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PART II—NONMETALS

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CONTENTS.

[The dates of publication of the separate chapters are given in parentheses.]

ILLUSTRATIONS.

INSERT.

MINERAL RESOURCES OF THE UNITED STATES, 1921—PART II.

FUEL BRIQUETS.[1]

By W. F. McKenney.

PRODUCTION.

The production of fuel briquets, like that of bituminous coal, declined sharply—30 per cent—in 1921.

Fuel briquets produced in the United States in 1920 and 1921.[a]

	1920		1921	
	Net tons.	Value.	Net tons.	Value.
Eastern States	258,621	$1,691,504	143,534	$1,047,906
Central States	212,176	1,959,196	169,726	1,574,487
Pacific Coast States	96,395	973,131	85,689	1,009,908
	567,192	4,623,831	398,949	3,632,301

[a] List of producers shown on page 4.

On January 1, 1921, coal consumers had in stock piles and bins about 46 million tons of soft coal. With the general slackening of industry that began early in January the demand for coal declined and prices receded from the high levels reached in 1920, and the manufacturers of briquets had difficulty in meeting an increased competition with coal.

The production of briquets in the Eastern States decreased 45 per cent, even though the price of anthracite, with which briquets compete in that district, declined little if any during the year. In the Central States the output was 20 per cent less than in 1920, and in the Pacific Coast States, where there is but little competition with coal, the output was 11 per cent less. The production in Wisconsin was more than twice that in any other State, and the production of Wisconsin and Pennsylvania together was nearly 55 per cent of the total.

Fuel briquets produced in the United States in 1916–1921.

Year.	Net tons.	Value.	Year.	Net tons.	Value.
1916	295,155	$1,445,662	1919	295,734	$2,301,054
1917	406,856	2,233,888	1920	567,192	4,623,831
1918	477,235	3,212,793	1921	398,949	3,632,301

[1] The tables in this report were compiled by Miss J. M. Corse, of the United States Geological Survey, who has compiled the statistics of fuel briquets since 1911.

VALUE.

The total value of the briquets produced in 1921 decreased 21 per cent in comparison with 1920. The average value per ton, however, increased from $8.15 to $9.10, making a total increase since 1916 of $4.20, or 86 per cent.

As the average value per ton is based on sales, many of which are much above or below the average, it is not always an accurate index of the trend of prices. Thus in 1920 the inclusion of a relatively large proportion of the low-cost Pennsylvania product tended to

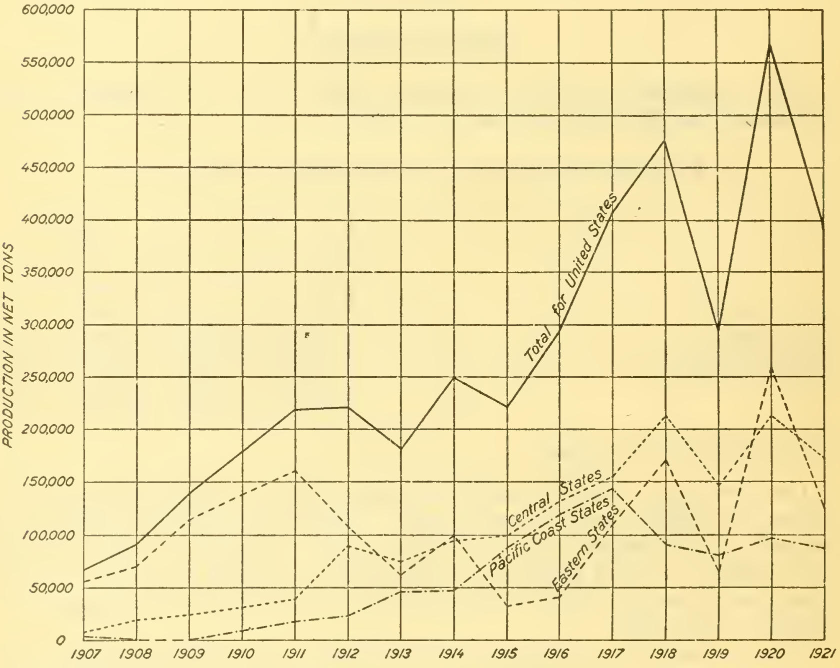

FIGURE 1.—Fuel briquets produced in the Eastern, Central, and Pacific Coast States and in the United States, 1907–1921.

depress the average value per ton, and in 1921 the inclusion of a much larger proportion of high-cost briquets tended to raise it. A better idea of the trend in prices of briquets may be gained from the following table, which shows the average value per ton at plants in Pennsylvania and the Central States.

Average value per ton f. o. b. plant of briquets produced in Pennsylvania and the Central States, 1911–1921.

Year.	Pennsylvania.	Central States.	Year.	Pennsylvania.	Central States.
1911	$2.37	$4.34	1917	$3.15	$6.81
1912	2.68	4.47	1918	4.11	8.17
1913	2.65	4.92	1919	4.17	8.47
1914	2.48	4.83	1920	5.60	9.23
1915	2.90	4.26	1921	6.14	9.28
1916	3.83	4.73			

The higher prices obtained for some briquets do not necessarily indicate superior products, for the prices fixed at the plants are determined by considering, among other things, the cost of the raw fuel used and the price of competing coal.

In 1921 the average value was as high as $15.86 a ton at some plants, but in Pennsylvania it was only $6.14. In the Central States it was $9.28, against $4.34 in 1911, an increase of 114 per cent in 10 years. In Pennsylvania the increase during the same period was 159 per cent.

RAW MATERIAL AND BINDERS.

An interesting development in 1921 was the operation of a plant by the Clinchfield Carbocoal Corporation, at South Clinchfield, Va., for briquetting high-grade bituminous coal partly carbonized at a comparatively low temperature in an oven of special type. This process results in the recovery of valuable by-products, among which is coal-tar pitch that may be utilized as a binder for the briquets.

With one exception, all plants that reported in 1920 were operated in 1921, and one new plant began operations. Of the 15 plants that reported, 7 used anthracite culm as the fuel constituent, 2 semianthracite, 1 a mixture of anthracite culm and bituminous slack, 1 semibituminous slack, 1 a mixture of bituminous slack and subbituminous coal, 2 carbon residue from the manufacture of oil gas, and 1 bituminous coal first subjected to low-temperature carbonization. The total quantity of raw fuel used was 398,241 tons, of which 48 per cent was anthracite and semianthracite; 31 per cent semibituminous slack, bituminous slack, and coke; and 21 per cent subbituminous coal and oil-gas residue.

From this quantity of raw fuel 398,949 tons of briquets were produced, a gain in weight of 708 tons. The loss due to the practice of screening out the larger sizes at some plants and also to the fact that moisture is expelled during the process was more than offset by the binder that remained in the finished briquets.

Raw fuels used in making briquets in the United States, 1919–1921, in net tons.

Fuel.	1919	1920	1921
Anthracite culm and fine sizes and semianthracite	118,595	356,877	190,964
Semibituminous and bituminous slack and coke	[a] 97,387	[a] 125,506	121,925
Lignite, subbituminous coal, and oil-gas residue	80,383	89,656	[b] 85,352
	296,365	572,039	398,241

[a] Includes no coke. [b] Includes no brown lignite.

The binders used in 1921 were the same as in preceding years. Of the plants in operation, 2 used no binder, 4 asphaltic pitch, 2 coal-tar pitch, 1 a mixture of asphaltic and coal-tar pitch, 1 mixed pitches, 1 sulphite liquor, 1 asphaltic oil and cornstarch, and 3 patent binders.

Asphaltic pitch and coal-tar pitch, alone or in compounds, remained the standard binders and were used in about 61 per cent of the total output—a smaller part than in 1920.

Briquets produced in the United States in 1921, by type of binder used, in net tons.

Asphaltic pitch	131,986
Asphaltic pitch and coal-tar pitch, coal-tar pitch, or asphaltic oil and cornstarch	122,492
Sulphite liquor, mixed pitches, patent binder, or no binder	144,471

BRIQUETTING PLANTS IN THE UNITED STATES.

The plant of the Johnson Fuel Co., at Scranton, N. Dak., was idle throughout the year, but all other plants that reported in 1920 were active in 1921. The plant of the Clinchfield Carbocoal Corporation, at South Clinchfield, Va., came into operation for the first time.

Briquetting plants operated in the United States in 1921.

Group and State.	Name and address of operator.	Location of plant.	Date put in operation.	Raw fuel used.
Eastern States:				
New Jersey	Burnrite Coal Briquette Co., 543 New Jersey Avenue, Newark, N. J.	Newark	1920	Anthracite.
Do	Fuel Briquet Co., 520 Brunswick Avenue, Trenton, N. J.	Trenton	1918	Do.
New York	General Briquetting Co., 25 Broad Street, New York, N. Y.	New York	1920	Do.
Pennsylvania	American Briquet Co., Drexel Building, Philadelphia, Pa.	Lykens	1920	Do.
Do	Anthracite Briquette Co., Sunbury, Pa.	Sunbury	1919	Do.
Do	Lehigh Coal & Navigation Co., 437 Chestnut Street, Philadelphia, Pa.	Lansford	1909	Do.
Do	Scranton Anthracite Briquette Co., Dickson City, Pa.	Dickson City	1907	Do.
Virginia	Clinchfield Carbocoal Corporation	South Clinchfield.	1921	Coke made from high-grade bituminous coal.
Do	Delparen Anthracite Briquette Co., Parrott, Va.	Parrott	1915	Virginia semianthracite.
Central States:				
Missouri	Standard Briquet Fuel Co., 319 North Fourth Street, St. Louis, Mo.	Kansas City	1909	Arkansas semianthracite.
Wisconsin	Berwind Fuel Co., 122 South Michigan Avenue, Chicago, Ill.	Superior	1912	Semibituminous slack.
Do	Stott Briquet Co., Merchants' National Bank Building, St. Paul, Minn.	do	1909	Anthracite fines and bituminous slack.
Pacific Coast States:				
California	Los Angeles Gas & Electric Corp., 645 South Hill Street, Los Angeles, Calif.	Los Angeles	1905	Carbon (petroleum residue).
Oregon	Portland Gas & Coke Co., Gasco Building, Portland, Oreg.	Portland	1913	Do.
Washington	Pacific Coast Coal Co., 612 L. C. Smith Building, Seattle, Wash.	Renton	1914	Bituminous slack and subbituminous coal.

WORLD'S PRODUCTION OF FUEL BRIQUETS.

The date when the first fuel briquets were manufactured is largely a matter of conjecture. The Mashek Engineering Co. of New York City, in its fifth annual catalog, states that "Reference has been found in English literature to the manufacture of 'cole balls' in Germany during 1594." According to the same source of information, it was not until about 1890 that briquets were made and marketed commercially in the United States.

How small a part of the world's output of briquets is contributed by the United States is shown in the following table prepared by W. I. Whiteside, of the Geological Survey. In round numbers the total production in 1913 was 38,400,000 metric tons, of which the United States produced 165,000 tons, or 0.43 per cent. The briquetting industry has been developed chiefly in countries where a large part of the available coal is of low grade and unsuitable for use in its raw state. In Germany 45 per cent of the coal output in 1921 was lignite, and in that year Germany produced nearly 34 million metric tons of briquets. Most of the figures shown in this table have been obtained from official sources, but some have been taken from trade publications and are subject to revision on receipt of more accurate or complete data.

World's production of fuel briquets, 1913–1921.

[In metric tons of 2,204.622 pounds. For more complete data see U. S. Geol. Survey Mineral Resources, 1921, pt. 1, pp. 513–564.]

Country.	1913	1914	1915	1916	1917
Austria:					
Coal	196,000	194,000	205,000	196,000	138,000
Lignite	242,000	231,000	252,000	225,000	169,000
Belgium	2,609,000	1,800,000	1,490,000	1,936,000	982,000
Czechoslovakia:					
Coal	(c)	(c)	(c)	(c)	(c)
Lignite	(c)	(c)	(c)	(c)	(c)
France	3,673,000	(a)	(a)	(a)	(a)
Germany:					
Coal [e]	[d] 6,993,000	[d] 6,194,000	[d] 6,583,000	[d] 6,299,000	[d] 5,338,000
Lignite	21,498,000	21,098,000	22,750,000	23,484,000	22,048,000
Hungary	117,000	110,000	132,000	(a)	24,000
Netherlands	159,000	166,000	227,000	293,000	388,000
Russia	(a)	(a)	390,000	310,000	154,000
Spain	486,000	558,000	555,000	556,000	499,000
United Kingdom	2,249,000	1,870,000	1,725,000	1,884,000	1,774,000
United States	165,000	227,000	201,000	268,000	369,000

Country.	1918	1919	1920	1921
Austria:				
Coal	(a)	(b)	(b)	(b)
Lignite	(a)	(b)	(b)	(b)
Belgium	1,141,000	2,548,000	2,846,000	2,646,000
Czechoslovakia:				
Coal	(c)	75,000	71,000	(a)
Lignite	(c)	154,000	164,000	(a)
France	(a)	(da)	[d] 2,058,000	[d] 2,848,000
Germany:				
Coal [e]	[d] 5,339,000	4,008,000	4,972,000	[f] 5,688,000
Lignite	23,111,000	19,716,000	24,282,000	28,243,000
Hungary	(a)	(a)	(a)	(a)
Netherlands	504,000	584,000	634,000	(a)
Russia	16,000	(a)	(a)	(a)
Spain	410,000	587,000	742,000	(a)
United Kingdom	1,885,000	2,094,000	2,474,000	(a)
United States	433,000	268,000	515,000	362,000

[a] No data available.
[b] See under Czechoslovakia.
[c] See under Austria.
[d] Includes Lorraine.
[e] Includes Saar district.
[f] Exclusive of Saar district, for which figures are not yet available.

GRAPHITE.

By L. M. Beach.

PRODUCTION.

NATURAL GRAPHITE.

The sales of domestic graphite in 1921 showed a decrease of 74 per cent in quantity and 85 per cent in value in comparison with 1920. This large decrease in both quantity and value indicates the worst condition in the graphite industry shown by the records of the United States Geological Survey. Overproduction in preceding years was the main cause of this situation. Manufacturers were overstocked with crucibles and with raw material, both foreign and domestic, and large stocks of domestic flake graphite were on hand at the mines.

Domestic natural graphite sold, 1915–1921.

Year.	Amorphous.		Crystalline.		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1915	1,181	$12,856	[illegible]	[illegible]	[illegible]	[illegible]
1916	2,622	26,723	[illegible]	[illegible]	[illegible]	[illegible]
1917	8,301	75,491	[illegible]	1,094,[illegible]	[illegible]	[illegible]
1918	6,580	68,435	[illegible]	1,454,798	[illegible]	[illegible]
1919	2,579	47,716	4,[illegible]	[illegible]	[illegible]	[illegible]
1920	4,594	49,738	4,[illegible]	[illegible]	[illegible]	[illegible]
1921	1,842	20,850	596	75,864	2,437	96,724

Number of operators reporting production of graphite, 1918–1921.

State.	1918	1919	1920	1921
Alabama	25	[illegible]	7	2
California	2	2	1	1
Colorado	1	1	1	1
Montana	1		1	
Nevada	1	1	1	1
New York	5	2	[illegible]	1
Pennsylvania	4	3	1	
Rhode Island	1	1	2	1
Texas	2	1	1	1
	42	21	17	8

CRYSTALLINE GRAPHITE.

The sales of crystalline graphite in 1921 showed a decrease of 88 per cent in quantity and 87 per cent in value, as compared with 1920. This graphite was produced by only five firms operating in four States and, therefore, State totals may not be published. New York was the leading producer, Texas ranked second, and California third. Alabama, which held first place for years in the production of domestic flake, ranked fourth in 1921, with only two companies reporting sales.

Eight of the 13 firms that reported sales in 1920 stated that their mines were idle in 1921. The active firms were as follows:

Flaketown Graphite Co., Mountain Creek, Ala.
Superior Flake Graphite Co., Chicago, Ill. (operating in Alabama).
California Graphite Co., Los Angeles, Calif.
Joseph Dixon Crucible Co., Jersey City, N. J. (operating in New York).
Southwestern Graphite Co., Boston, Mass. (operating in Texas).

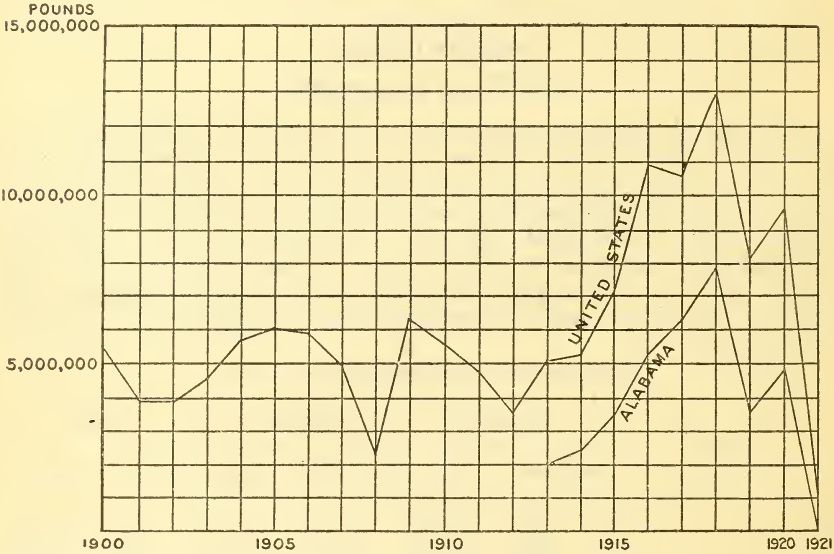

FIGURE 2.—Diagram showing production of crystalline graphite in the United States, 1900–1921, and in Alabama, 1913–1921.

In 1921 the imports of crystalline graphite decreased 75 per cent in comparison with 1920; this corresponds closely with the decrease of 88 per cent in domestic production.

Crystalline graphite imported into and produced in the United States, 1917–1921.

	1917	1918	1919	1920	1921
Short tons.					
Imports:					
Ceylon	24,575	9,029	9,451	9,204	2,311
Madagascar	4,393	970	10,016	4,710	1,078
Other countries	3,494	3,314	1,505	2,200	687
	32,462	13,313	20,972	16,114	4,076
Domestic production	5,292	6,431	4,043	4,816	595
Total available supply	37,754	19,744	25,015	20,930	4,671
Percentage represented by domestic production	14.0	32.6	16.2	23.0	12.7
Value.					
Imports:					
Ceylon	$7,179,208	$2,397,735	$1,530,281	$1,077,290	$199,440
Madagascar	1,057,081	265,338	1,205,350	286,383	67,509
Other countries	353,481	270,136	102,390	159,517	48,035
	8,589,770	2,933,209	2,838,021	1,523,190	314,984
Domestic production	1,094,398	1,454,799	731,141	576,444	75,664
Total available supply	9,684,168	4,388,008	3,569,162	2,099,634	390,648
Percentage represented by domestic production	11.3	33.2	20.5	27.5	19.4

AMORPHOUS GRAPHITE.

In 1921 the amorphous graphite sold decreased 61 per cent in quantity and 58 per cent in value in comparison with 1920. Rhode Island, Nevada, and Colorado furnished the supply in 1921. The Graphite Mines Corporation, New York, N. Y., operated in Rhode Island. The Carson Black Lead Co., Oakland, Calif., reported a production from its mine at Carson, Nev., and the Graphite Corporation of Milwaukee, Wis., operated at Pitkin, Colo.

The average value per ton of amorphous graphite sold by producers in 1921 was $11.32, which was 72 cents more than the average in 1920. This increase in value, however, does not indicate that the price of amorphous graphite was higher in 1921 than in 1920, for it was due to much larger sales of graphite which has regularly brought higher prices, and to much smaller sales of graphite of low value.

MANUFACTURED GRAPHITE.

Graphite is manufactured by the Acheson Graphite Co. at Niagara Falls, N. Y. The figures given below, published by permission of this company, represent only the manufactured graphite that comes into competition with natural graphite.

Graphite manufactured by the Acheson Graphite Co., 1917–1921.

Year	Pounds.	Year	Pounds.
1917	10,474,649	1920	7,399,749
1918	9,182,272	1921	5,888,000
1919	8,163,177		

IMPORTS AND EXPORTS.[1]

The reports of the Bureau of Foreign and Domestic Commerce as to imports show only the country shipping the goods, which is not always the country of origin. For example, the graphite entered in the bureau's statements as imported from France probably originated in Madagascar, and that imported from Great Britain should probably be credited to Ceylon and possibly in part to Madagascar. The shipments from Japan probably consisted of graphite from Chosen. The imports from Canada slightly exceed the Canadian production, and it is assumed that this excess represents reshipments of graphite previously imported into Canada. Imports of more doubtful origin are included under "Other countries."

[1] The figures showing imports and exports were compiled by J. A. Dorsey, of the United States Geological Survey, from the records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Graphite imported into the United States, 1915–1921.

[General imports.]

Country of origin.	1915	1916	1917	1918	1919	1920	1921
Short tons.							
Ceylon	14,491	26,232	24,575	9,029	9,451	9,204	2,311
Madagascar	1,468	1,631	4,393	970	10,016	4,710	1,078
Canada	2,995	4,127	3,476	3,084	1,504	2,170	687
Brazil		1	18	45			
Mexico	1,680	5,331	7,570	5,600	5,506	3,659	3,404
Chosen (Korea)	2,373	5,375	2,462	568	126	810	646
Italy	27	151	115	17	22	137	47
Austria						58	
Germany						30	
Other countries	41	169		185	1	317	10
	23,075	43,017	42,609	19,498	26,626	21,095	8,183
Value.							
Ceylon	$1,826,238	$6,356,532	$7,179,208	$2,397,735	$1,530,281	$1,077,290	$199,440
Madagascar	184,067	241,863	1,057,081	265,338	1,205,350	286,383	67,509
Canada	116,407	314,177	349,034	236,226	102,163	157,015	48,035
Brazil		75	4,380	7,351			
Mexico	75,000	238,000	285,568	134,183	135,464	131,832	120,153
Chosen (Korea)	35,292	103,619	83,558	24,455	3,948	29,936	15,145
Italy	994	4,133	3,092	628	663	5,072	1,019
Austria						1,195	
Germany						2,502	
Other countries	3,165	21,484	67	26,559	227	20,087	775
	2,241,163	7,279,883	8,961,988	3,092,475	2,978,096	1,711,312	452,076

Graphite imported for consumption in the United States, 1912–1921.

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1912	25,643	$1,709,337	1917	42,577	$8,961,988
1913	28,879	2,109,791	1918	19,498	3,092,475
1914	21,990	1,398,209	1919	26,626	2,978,096
1915	23,075	2,241,163	1920	21,095	1,711,312
1916	42,930	7,279,883	1921	8,183	452,076

The quantity of graphite annually exported from the United States is very small. In 1921 there was an increase of 52 per cent in the quantity of unmanufactured graphite exported, but the value decreased from 9 cents to 5 cents a pound. The manufactured graphite exported showed an increase of 11 per cent in value.

The exports of lead pencils and pencil leads are not included in the tables showing articles of manufactured graphite, but are given in a separate table. The value of the pencils and leads exported in 1921 was 46 per cent less than the corresponding value in 1920.

Graphite exported from the United States, 1917–1921.

Year.	Unmanufactured graphite.		Manufactures of graphite.
	Pounds.	Value.	
1917	5,146,816	$349,563	$891,687
1918	1,907,719	121,555	731,518
1919	1,258,040	90,185	788,755
1920	1,213,616	112,771	610,261
1921	1,841,578	95,998	679,359

Value of pencils and pencil leads exported from the United States, 1920–21.

Country.	1920	1921	Country.	1920	1921
France	$61,734	$86,708	China	$101,591	$102,669
Italy	6,462	....	British India	161,140	8,988
Spain	44,122	22,732	Straits Settlements	20,262	3,161
England	1,074,783	400,736	Dutch East Indies	15,021	2,911
Canada	611,608	502,774	Japan	129,655	140,470
Mexico	160,204	210,371	Australia	88,974	65,774
Cuba	271,949	78,015	New Zealand	14,457	12,696
Argentina	291,062	68,878	Philippine Islands	138,637	67,646
Brazil	153,353	38,507	British South Africa	14,686	8,831
Chile	55,167	18,844	Other countries	289,894	188,405
Colombia	58,582	10,303			
Peru	43,326	21,436		3,849,221	2,074,508
Uruguay	42,552	13,653			

PRICES.

In 1921 the price of domestic flake graphite ranged from 2 to 13 cents a pound; in 1920 from 1.75 to 13 cents. The average price of domestic flake at the mines was 6.4 cents in 1921, which was 0.5 cent more than in 1920. This slight increase in price was due to the facts that the only producer in a certain State in 1921 obtains a little higher price than other producers and that the others dropped out of business in 1920.

The accompanying table is based on information furnished by importers prior to 1920. The figures for 1920 and 1921 were furnished by Mr. Charles Pettinos, of New York. Part of a letter written by Mr. Pettinos to the United States Geological Survey is quoted below:

> The trade was virtually at a standstill for the year, and less plumbago was shipped from Ceylon during the year than in any similar period for the last 20 years. Virtually no mining was done because not only was there no demand but also because any such selling prices as the above would have meant a heavy loss to the miner.
>
> The plumbago on hand in Ceylon at the beginning of 1921 was held by a number of people, some of whom were weak financially. As the year progressed it all finally found its way into the hands of dealers who could afford to sit tight and wait for a better market, and that is what they are doing. A few lots were sent over here on consignment, but in comparatively small quantities. The holders know that plumbago can not possibly be produced at the prices they have paid for what they have, and therefore they are holding it for a higher market, and they will get it as soon as trade picks up.
>
> There was a slight variation in nominal quoted prices during the year, due to the rise and fall in sterling exchange; the lowest prices were naturally being quoted when sterling was lowest, which was in the late summer and early fall. Since then sterling has gone, as you know, from $3.50 to about $4.40, which, on the basis of so many sterling per ton, would considerably increase the price to-day in dollars and cents.
>
> The users here still have stocks on hand and are operating to a small extent only. They will come into the market gradually during this year, I think, and they may find they will have to pay more than to-day's quotations for their plumbago.
>
> There is a good deal of plumbago still in Ceylon ready for shipment and quite a little in London and here in the States. All of this must be absorbed before mining operations can be resumed to any extent. Furthermore, they will not be resumed unless a decent profit can be realized on the freshly mined product. Good lump in 1913 and 1914 was selling at around 8 to 9 cents c. i. f. New York, leaving very little profit, and it can not be produced to-day as cheaply as it was then.
>
> The situation on Madagascar flake graphite is much the same thing. No mining is going on, and the industry in Madagascar is dead. There are large stocks in Madagascar, France, England, and America. It will be absorbed much more slowly than the Ceylon stocks, and it may be several years before there is any activity in that direction.

Average prices of Ceylon graphite c. i. f. New York, 1914–1921.

[Cents per pound.]

Year.	Lump.		Chip.		Dust.		Remarks.
	First grade.	Second grade.	First grade.	Second grade.	First grade.	Second grade.	
1914........	6½– 9½	7½– 8½	7¼– 7¾	6½– 7	4¾– 5¼	3½– 4	Low, first half; high, second half.
1915........	9⅝–20	8 –14	7 –14	6½–12	7½–9½	6½– 9½	Do.
1916........	20 –28	14 –21	13½–20	11½–17	9½–12	9½–10	Do.
1917........	28 –32	21 –23	20 –23	17 –19	11 –13	10 –12	High level maintained throughout the year.
1918........	28½–15¼	22 –14	21½–12½	18½–11	12 –10½	10 – 9	High, first half; low, second half.
1919........	14 –15¼	12 –13	10 –11	8 – 9	6¾– 7½	5 – 6	Low throughout the year.
1920........	14 – 9	11 – 7	10 – 7	7½– 5½	7 – 5	5 – 3½	High, first half; low, second half.
1921........	5½– 6	4½– 5	4½– 5	3½– 4	3¼– 3¾	2 – 2½	Low throughout the year.

PEAT.

By K. W. Cottrell.

The peat industry in the United States reflected the general business depression in 1921. In common with all other raw fertilizer materials peat suffered by reason of the decrease in the selling price of agricultural products, which, combined with the high freight rates, prevented farmers from purchasing fertilizer. Many of the operators were idle during the whole year; others operated but a few months.

The quantity of peat produced in the United States in 1921 decreased 42,798 short tons, or 58 per cent; the value decreased $661,613, or 72 per cent. Peat used in the manufacture of fertilizer decreased 33,812 tons, or 53 per cent, in quantity and $522,589, or 68 per cent, in value. Peat used in the manufacture of stock food decreased 93 per cent in quantity and 96 per cent in value. A small quantity of peat fuel was reported for 1921.

Peat produced in the United States, 1916–1921.

Year.	Number of plants reporting.	Short tons.	Value.	Average price.
1916	13	52,506	$369,104	$7.03
1917	18	97,363	709,900	7.29
1918	25	107,261	1,047,243	9.76
1919	15	69,197	705,532	10.20
1920	18	73,204	921,732	12.59
1921	21	30,406	260,119	8.55

The 21 plants reporting production in 1921 were distributed as follows: New Jersey 4, New York 4, California 3, Illinois 2, and Florida, Georgia, Massachusetts, Michigan, Minnesota, New Hampshire, North Carolina, and Wisconsin 1 each. California was the largest producer, with an output of 12,672 short tons, valued at $117,580. New Jersey ranked second, with an output of 12,051 tons, valued at $94,269. Illinois ranked third, but the State total may not be published, as there were only two producers.

The quantity of peat moss or litter imported in 1921, according to the Bureau of Foreign and Domestic Commerce, was 3,450 tons, an increase of 688 tons, or 25 per cent, over 1920. The price per ton, however, fell from $13.11 to $6.60. No exports of crude peat or peat products were reported for 1921.

The consumption of peat and peat moss (production plus imports) was 33,856 tons, valued at $282,873, in 1921, against 75,966 tons, valued at $957,933, in 1920.

Peat and peat moss used in the manufacture of peat products in the United States in 1920 and 1921.

Kind of product.	Production.		Imports.		Consumption.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1920.						
Fertilizer and fertilizer ingredient	63,272	$773,635			63,272	$773,635
Stock food	[a] 9,182	[a] 143,047			[a] 9,182	[a] 143,047
Fuel	750	5,050			750	5,050
Moss	([a])	([a])	2,762	$36,201	[a] 2,762	[a] 36,201
	73,204	921,732	2,762	36,201	75,966	957,933
1921.						
Fertilizer and fertilizer ingredient	29,460	251,046			29,460	251,046
Stock food	[b] 946	[b] 9,073			[b] 946	[b] 9,073
Fuel	([b])	([b])			([b])	([b])
Moss	([b])	([b])	3,450	22,754	[b] 3,450	[b] 22,754
	30,406	260,119	3,450	22,754	33,856	282,873

[a] Small production of moss and stable litter included under "Stock food."
[b] Small production of fuel, moss, and stable litter included under "Stock food."

The following individuals and companies reported to the Geological Survey that they produced crude peat or peat products in the United States in 1921:

Alphano Humus Co., Whitehall Building, New York, N. Y.
Appleton Peat Products Co., Appleton, Wis.
Blaine, J. H., Hopewell Junction, N. Y.
Chapman, I. S., & Co. (Inc.), 937 Third Street, San Bernardino, Calif.
Craig, William H., Fishkill, N. Y.
Day, James H., 35 South Street, Milford, N. H.
Hennepin Atomized Fuel Co., 406 Tribune Annex, Minneapolis, Minn.
Humus Natural Manure Co., 1964 Broadway, New York, N. Y.
Hyper-Humus Co., Newton, N. J.
International Products Co., 132 Boylston Street, Boston, Mass.
McElhone, Asa, Fishkill, N. Y.
Manito Chemical Co., Peoria, Ill.
Marcrum, J. G., Netcong, N. J.
National Humus & Chemical Co., Chassell, Mich.
Pacific Humus Co., 205 Central Building, Pasadena, Calif.
Phos-Pho Germ Manufacturing Corporation, New Bern, N. C.
Ranson, Robert, St. Augustine, Fla.
Riverside Orange Co. (Ltd.), Arlington Heights, Riverside, Calif.
Sims, Alfred F., Sag Harbor, N. Y.
Southern Humus Co., Smyrna, Ga.
Wiedmer Chemical Co., Pierce Building, St. Louis, Mo.

ABRASIVE MATERIALS.

By L. M. Beach and A. T. Coons.

The statistics in this chapter relate to natural and artificial abrasives used for grinding, polishing, and other abrasive operations. Those for quartz and feldspar are excluded because they can not be precisely separated according to uses, being used also otherwise than as abrasives, and they are therefore considered in other chapters.

NATURAL ABRASIVES PRODUCED IN THE UNITED STATES.

Natural abrasives were produced in 1921 in 26 States, which are listed below:

Alabama	Millstones.
Arkansas	Oilstones.
California	Diatomaceous (infusorial) earth, grinding pebbles, and pumice.
Connecticut	Diatomaceous (infusorial) earth.
Illinois	Tripoli.
Indiana	Oilstones and rubbing stones.
Kansas	Pumice.
Kentucky	Hones.
Maryland	Diatomaceous earth.
Michigan	Grindstones.
Minnesota	Grinding pebbles and tube-mill lining.
Missouri	Tripoli.
Nebraska	Pumice.
Nevada	Diatomaceous (infusorial) earth and grinding pebbles.
New Hampshire	Garnet, millstones, and scythestones.
New York	Diatomaceous (infusorial) earth, emery, garnet, and millstones.
North Carolina	Millstones.
Ohio	Grindstones, pulpstones, oilstones and rubbing stones, and scythestones.
Oklahoma	Tripoli.
Oregon	Diatomaceous (infusorial) earth.
Pennsylvania	Rottenstone.
Utah	Diatomaceous (infusorial) earth.
Vermont	Scythestones.
Virginia	Diatomaceous (infusorial) earth, emery, and millstones.
Washington	Diatomaceous (infusorial) earth.
West Virginia	Grindstones and pulpstones.

Natural abrasives produced and sold in the United States, 1919–1921.[a]

Abrasive.	1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Millstones	(b)	$66,972	(b)	$63,325	(b)	$24,524
Grindstones and pulpstones	46,865	1,336,015	53,484	1,707,004	26,340	1,227,322
Oilstones and scythestones	1,463	235,943	1,144	231,747	831	173,025
Emery	2,601	23,203	2,327	21,685	305	2,250
Garnet	4,944	310,131	5,476	434,425	3,048	260,687
Abrasive quartz and feldspar	(c)	(c)	(c)	(c)	(c)	(c)
Diatomaceous (infusorial) earth and tripoli[d]	66,934	713,501	102,155	1,649,370	67,474	895,629
Pumice	36,051	116,835	41,838	114,433	37,108	158,540
Grinding pebbles and tube-mill lining	9,448	85,302	10,924	77,823	989	14,637
	....	2,887,902	....	4,299,812	....	2,756,614

[a] More detailed information on abrasive materials will be found in Mineral Resources for 1914 and 1917.
[b] Figures not available, as product was not reported by weight.
[c] See chapters on feldspar and silica.
[d] Includes rottenstone and for 1921 an estimate for part of the diatomaceous earth.

Value of millstones produced and sold in the United States, 1919–1921.

State.	1919	1920	1921
Alabama	(a)	(a)	(a)
Maryland	....	(a)	....
New Hampshire	....	....	(a)
New York	$10,155	$13,331	$14,672
North Carolina	29,025	14,226	(a)
Pennsylvania	(a)		
Virginia	(a)	34,676	(a)
Undistributed	27,792	1,092	9,852
	66,972	63,325	24,524

[a] Included under "Undistributed."

Grindstones and pulpstones produced and sold in the United States, 1919–1921.

Year.	Grindstones.			Pulpstones.		
	State.	Short tons.	Value.	State.	Pieces.	Value.
1919	Michigan, Ohio, and West Virginia.	40,755	$993,959	Ohio and West Virginia.	2,450	$342,056
1920	.....do	44,832	1,239,990	.....do	2,321	467,014
1921	.....do	16,310	477,259	.....do	2,941	750,063

Tripoli produced and sold in the United States, 1920–21.

State.	1920			1921		
	Short tons.	Value.		Short tons.	Value.	
		Crude (estimated).	As sold (crude and finished).		Crude (estimated).	As sold (crude and finished).
Illinois	24,458	$66,509	$360,651	7,765	$27,333	$125,352
Missouri, Oklahoma, and Pennsylvania	15,775	97,567	209,026	4,575	26,559	87,661
	40,233	164,076	569,677	12,340	53,892	213,013

Diatomaceous earth produced and sold in the United States, 1918–1921.

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1918	[a] 2,965	[a] $24,947	1920	61,922	$1,079,693
1919	42,642	531,960	1921	[b] 55,134	[b] 682,616

[a] Exclusive of considerable production upon which the Survey is not at liberty to report.
[b] Partly estimated.

CONSUMPTION.

Value of all abrasive materials[a] consumed in the United States, 1918–1921.

	1918	1919	1920	1921
Natural abrasives	$2,864,332	$2,887,902	$4,299,812	$2,756,614
Artificial abrasives [b]	7,682,597	7,465,849	7,492,164	1,996,147
Imports	1,187,632	2,237,077	4,425,409	1,177,400
	11,734,561	12,590,828	16,217,385	5,930,161
Exports	6,056,242	6,138,366	7,025,621	3,320,590
Apparent consumption	5,678,319	6,452,462	9,191,764	2,609,571

[a] Exclusive of feldspar and various forms of quartz. See chapters on feldspar and silica.
[b] Figures for 1918, 1919, and 1920, have been revised to include amounts heretofore not available for publication. Values for 1918 to 1921 include those of artificial abrasives produced in Canada. These materials are largely consumed in the United States, but the figures are not duplicated under "Imports."

IMPORTS AND EXPORTS.

Value of abrasive materials imported for consumption in the United States, 1918–1921.

Material.	1918	1919	1920	1921
Millstones and burrstones	$20,017	$26,356	$20,954	$13,556
Grindstones and pulpstones	27,361	50,551	77,046	81,880
Hones, oilstones, and whetstones	6,075	12,199	56,416	35,761
Emery and corundum	614,167	595,203	617,187	393,454
Diatomaceous earth, tripoli, and rottenstone	11,128	12,545	16,323	13,203
Pumice	33,014	119,781	249,995	173,201
Diamond dust and bort	475,870	1,420,442	3,387,488	466,345
	1,187,632	2,237,077	4,425,409	1,177,400

Value of burrstones and millstones imported for consumption in the United States, 1918–1921.

Year.	Rough.	Made into millstones.	Total.	Year.	Rough.	Made into millstones.	Total.
1918	$17,570	$2,447	$20,017	1920	$9,007	$11,947	$20,954
1919	8,996	17,360	26,356	1921	3,075	10,481	13,556

Emery and corundum imported for consumption in the United States, 1919–1921.

Year.	Grains.		Ore and rock.		Other manufactures.	Total value.
	Pounds.	Value.	Long tons.	Value.		
1919	547,349	$32,128	11,401	$522,036	$41,039	$595,203
1920	1,766,554	85,966	8,226	519,839	11,382	617,187
1921	1,504,971	82,771	6,169	281,931	28,752	393,454

Value of general imports of pebbles and flint into the United States, 1919–1921.

Country.	1919	1920	1921
Belgium	$34,783	$65,097	$23,404
Canada	1,742	430	1,510
Denmark	95,254	131,028	36,924
France	117,691	131,950	54,248
Germany		9,528	53
Mexico		30	
Netherlands		567	
Scotland			18
Sweden	626		
	250,096	338,630	116,157

Value of domestic abrasive materials exported from the United States, 1919–1921.

Material.	1919	1920	1921
Grindstones	$297,068	$424,322	$281,976
Abrasive wheels, emery, and other	3,032,067	2,791,128	1,318,804
All other	2,809,231	3,810,171	1,719,810
	6,138,366	7,025,621	3,320,590

ARTIFICIAL ABRASIVES.

The artificial abrasives here considered are of three kinds—(1) metallic abrasives, manufactured by the Pittsburgh Crushed Steel Co., Pittsburgh, Pa., and the Globe Iron-Crush & Shot Co., Mansfield, Ohio; (2) silicon carbides, manufactured by the Carborundum Co. at Niagara Falls, N. Y., the Norton Co. at Chippewa, Ontario, and the Exolon Co. at Thorold, Ontario, and Blasdell, N. Y.; (3) aluminum oxides, manufactured by the Norton Co. at Niagara Falls, N. Y., and Chippewa, Ontario, the Carborundum Co. at Niagara Falls, N. Y., Niagara Falls, Ontario, and Shawinigan Falls, Quebec, the Exolon Co. at Blasdell, N. Y., and Thorold, Ontario, the General Abrasives Co. (Inc.) at Niagara Falls, N. Y., and the National Abrasive Co. at Hamilton, Ontario.

Artificial abrasives produced and sold in the United States and Canada, 1918–1921.[a]

Year.	Pounds.	Value.	Year.	Pounds.	Value.
1918	101,826,000	$7,682,597	1920	84,874,000	$7,492,164
1919	101,036,000	7,465,849	1921	26,398,000	1,996,147

[a] Revised figures, 1918–1920.

SILICA.

By L. M. Beach.

PRODUCTION.

Silica of the kinds considered in this report is used in the manufacture of wood filler, pottery, paints, and scouring soaps, as a polisher, as foundry mold wash, in metallurgic and chemical processes, and for cosmetics and dentifrices.

Silica sold for pottery, paints, fillers, polishers, abrasives, and other uses in the United States, 1919–1921.

Material.	1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Quartz (vein quartz, pegmatite, and quartzite)	63,332	$373,571	68,190	$320,350	11,252	$84,957
Sand and sandstone [a]	47,277	288,890	158,395	1,183,014	105,887	802,450
Tripoli (ground and otherwise prepared)	24,292	181,541	40,233	569,677	12,340	213,013
Diatomaceous earth	42,642	531,960	61,922	1,079,693	[b] 55,134	[b] 682,616
	177,543	1,375,962	328,740	3,152,734	184,613	1,783,036

[a] Includes only finely ground material. Figures probably incomplete.
[b] Partly estimated.

Quartz sold in the United States, 1917–1921.

Year.	Crude.		Ground.		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1917	126,575	$120,856	16,098	$197,213	142,673	$318,069
1918	61,008	121,888	10,732	137,442	71,740	259,330
1919	51,774	135,187	11,558	238,384	63,332	373,571
1920	59,423	142,397	8,767	177,953	68,190	320,350
1921	8,570	39,660	2,682	45,297	11,252	84,957

The sales of quartz from pegmatite dikes, veins, and quartzite in 1921 showed a decrease of 83 per cent in quantity in comparison with 1920. The prices of crude quartz in 1921 ranged from $1 to $7.50 a ton and averaged $4.63. Prices of ground quartz ranged from $11 to $39 and averaged $16.89. Production was reported in California, Connecticut, Maryland, Michigan, New York, North Carolina, Pennsylvania, Washington, and Wisconsin.

A considerable quantity of quartzite used for furnace flux has been included in these figures for several years, but in 1921 practically none was sold for this purpose.

IMPORTS.

The Bureau of Foreign and Domestic Commerce records imports of "flint, flints, and flint stones, unground," from several countries. These imports are partly flint pebbles for use in grinding mills and partly material for uses such as are listed in this report. The figures can not be accurately separated.

Value of pebbles and flint imported for consumption in the United States, 1917–1921.

1917	$197,156	1920	$338,630
1918	127,808	1921	116,157
1919	250,096		

FULLER'S EARTH.[1]

By Jefferson Middleton.

GENERAL CONDITIONS.

The great activity in the fuller's earth industry that began in 1915 and continued until late in 1920 was checked in 1921 by the depression in the petroleum industry, the output of fuller's earth declining 18 per cent and the value 21 per cent in 1921 as compared with 1920. The demand for fuller's earth increased late in 1921, however, and the outlook for 1922 is so good that some new deposits in Georgia and Pennsylvania may be developed. Notwithstanding the considerable decrease in both output and value, the output in 1921 was the largest recorded, except that in 1919 and in 1920, and was nearly three times as large as that in 1913. The imports decreased in even greater proportion than the production—49 per cent in quantity and 46 per cent in value.

OCCURRENCE.

Fuller's earth has been reported in Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New York, Pennsylvania, South Carolina, South Dakota, Texas, Utah, Virginia ,and Washington, but in 1921 it was produced only in Alabama, Arkansas, Florida, Georgia, Massachusetts, and Texas.

PRODUCTION.

Fuller's earth produced and marketed in the United States, 1916–1921.

Year.	Operators reporting sales.	Short tons.	Value at mines.	Average price.
1916	10	67,822	$706,951	$10.42
1917	11	72,567	772,087	10.64
1918	14	84,468	1,146,354	13.57
1919	10	106,145	1,998,829	18.83
1920	12	128,487	2,506,189	19.51
1921	12	105,609	1,973,848	18.69

The small number of producers makes it impossible to publish totals for some States without disclosing individual operations. All the production came from the Southern States, except that of one

[1] The statistical data of this report have been prepared by Miss Katrine W. Cottrell.

operator in Massachusetts. Florida was the leading producing State, as it has been since the beginning of the industry, and reported 57,268 tons, valued at $1,109,823, or 54 per cent of the total output and 56 per cent of the total value. Georgia was second and Texas third in both output and value. These three States reported 99 per cent of the output and value for 1921.

IMPORTS.

The imports of fuller's earth, which had been gradually increasing for many years prior to the World War, naturally fell off during the war but increased in 1919 and 1920. In 1921, however, they decreased materially and reached the lowest quantity since 1900, and were only 39 per cent as great as those of the record year, 1914. The value, however, showed no such decrease, owing to the increase in prices received for the earth. Of the imported earth, 95 per cent was wrought or manufactured.

Fuller's earth imported and entered for consumption in the United States, 1917–1921.

Year.	Unwrought or unmanufactured.			Wrought or manufactured.			Total.		
	Short tons.	Value.	Average price.	Short tons.	Value.	Average price.	Short tons.	Value.	Average price.
1917	1,441	$11,718	$8.13	15,553	$164,699	$10.58	16,994	$176,417	$10.38
1918	900	10,502	11.67	11,707	155,033	13.24	12,607	165,535	13.13
1919	373	4,301	11.53	13,500	185,410	13.73	13,873	189,711	13.67
1920	1,738	19,793	11.38	17,497	202,100	11.55	19,235	221,893	11.54
1921	483	6,172	12.78	9,261	113,243	12.23	9,744	119,415	12.26

SLATE.

By G. F. Loughlin and A. T. Coons.

GENERAL CONDITIONS.

The sales of slate declined in 1921, but the proportion of the decline was not so marked as that in many other industries. As more than 90 per cent of the total slate sold enters into construction work, slate should have been favored by the demand which resulted from the resumption of building after the curtailment caused by the war, but this advantage was offset by strikes in the building trades in 1921, especially during the spring and summer. The other principal obstacle to the restoration of prosperity in the industry was the high freight rates, which were especially adverse to shipments to distant markets. On the other hand quarry labor was easily obtained, though skilled slate workers were scarce, and wages at many quarries were reduced 10 to 30 per cent during the last part of the year. Although the average values for the year of all products except billiard-table tops, school slates, grave covers and vaults, and slate granules were somewhat higher than in 1920, they declined 10 to 25 per cent at the end of the year. The market improved during the fall and winter, and the outlook for 1922 is promising.

The sales of mill stock as a whole declined. The increase in the demand for blackboards, billiard-table tops, and grave vaults and and covers was more than offset by a decrease in the demand for electrical and structural slate.

The sales of electrical slate, which increased 50 per cent in 1920, were more affected by the depression than those of other varieties. They decreased 40 per cent in 1921, and such demand as there was came early in the year and was mainly for large switchboards. The exports of electrical appliances, however, were greater in 1921 than in 1920. The marked decline in domestic demand was not surprising in view of the general stagnation in manufacturing industries, but the expected increase in the development and utilization of electric power promises a good future for electrical slate. During the year the Structural Service Bureau, 1701 Walnut Street, Philadelphia, Pa., issued detailed specifications for electrical slate based on an extensive series of tests on slate from Pennsylvania conducted under the direction of Prof. M. O. Fuller,[1] of Lehigh University.

[1] Fuller, M. O., Tests of physical and electrical properties of slate, 34 pp., Fritz Eng. Lab., Lehigh Univ., 1921.

In a discussion of these tests at a conference in Washington, D. C., called by the Structural Service Bureau and attended by representatives of interested Government bureaus, the United States Chamber of Commerce, and producers' associations, it was shown that the quality of slate for electrical use was mainly affected by moisture, carbon, and iron. Slate that had been seasoned for three months gave satisfactory results, whereas the same slate if used when newly quarried was relatively inferior. Fuller's tests showed that seasoning or air drying for three months increased the ohmic resistance of slate from 100 to more than 300 per cent. It was also demonstrated that the highly carbonaceous "ribbons" in slate from Pennsylvania presented much less resistance to conduction than the normal slate. Iron compounds, either the magnetic oxide (magnetite) or nonmagnetic oxides and silicates, were insignificant in comparison with the carbonaceous "ribbons," as the minute grains of these minerals were too thinly and uniformly distributed to affect the resistance. The iron compounds and the finely disseminated carbon become serious factors only when very high resistance is required. Fuller's tests show that a resistance of 400,000 ohms is a safe working value for the slate tested and allows a factor of safety of 9 for properly seasoned slate.

Efforts are also being made to standardize switchboards. This practice will allow producers to carry a sufficient stock of seasoned standard sizes, whereas now they can not prepare the stock until orders are received and are frequently obliged to ship the slate before it has seasoned.

The sales of structural slate, which increased in 1920 over 1919, decreased markedly in 1921 and were exceeded in quantity by those of both blackboards and school slates. The value of standardization, proposed in 1920, in improving the production and sales of structural slate could hardly be demonstrated in a year of depression.

Slate for blackboards and bulletin boards showed the greatest increase in sales in 1921, and demand for it was reported to exceed the supply. As less than 5 per cent of this slate was exported in 1921, the increased demand indicates some acceleration in the completion of schools in this country.

The sales of school slates, which were mainly exported, decreased in quantity and average value in 1921, after a striking increase in 1920. The recorded values of the total sales and the exports (pp. 26 and 30) differ because the total sales represent unfinished slate at the quarry and the exports represent finished slate in cases at the port of export.

The sales of slate for billiard-table tops were second to those of blackboards in percentage of increase in 1921. Nearly 15 per cent of this product was exported, chiefly to Canada. Most of this product and all of the blackboard and school slate came from Pennsylvania.

The decrease in the sales of roofing slate requires little comment. Nearly all of this product is sold for domestic consumption, and, to judge from the small increase in average value, the trade was not benefited as a whole by decrease in costs of operation, although some producers reported decreases in selling prices of 50 cents to $1 per square.

The sales of crushed slate, which assumed importance in 1916 and increased in output yearly through 1920, decreased in 1921 at a somewhat greater rate than those of roofing slate. About 95 per cent of the crushed slate was made into granules for surfacing prepared roofing. The remainder was slate "flour" used as a filler. Crushed slate was sold in 1921 from quarries in Vermont, New York, Pennsylvania, Tennessee, and Georgia, and preparations for producing it in 1922 were being made in Alabama, Maryland, Virginia, and Utah. Of the total quantity of slate granules sold in 1921, more than 65 per cent were of green slate, 30 per cent of red slate, and less than 5 per cent of gray or blue slate. Besides slate granules, "greenstone" granules were produced in New Jersey, Pennsylvania, Michigan, Minnesota, and California, and their sales in 1921 amounted to 54,393 short tons, valued at $343,735, a gain of more than 14,000 tons compared with 1920. The greenstone was chiefly altered diabase but included some serpentine in Pennsylvania.

Some interesting investigations were made by the Bureau of Mines in 1921 [2] on the uses of slate "flour," which are still in the experimental stage. Although the material is satisfactory for some uses, preparation of a more uniform and more finely pulverized product, at least 95 per cent of which will pass a 300-mesh screen, is necessary before slate flour can compete with certain other materials in products requiring extremely fine-grained fillers.

These investigations, together with the activities of newly formed slate-trade associations in Pennsylvania, marked progress which had been sadly lacking in the slate industry as a whole. The need of a general organization was particularly apparent during the war, and early in 1922, at the suggestion of the National Federation of Construction Industries, the National Slate Manufacturers' Association was formed. The efforts of this association in improvement of quarry methods with reduction of waste, improvement of handling of slate after it leaves the quarry, and development of by-products should regain for roofing slate much of the trade that it has lost and should accelerate the expansion of other branches of the slate industry.

PRODUCTION.

The first of the following tables showing sales of slate by uses differs in arrangement from tables for former years, as slate for blackboards, bulletin boards, and school slates is herein included under "Mill stock," leaving only granules, "flour," and a small quantity of slate sold for flagging, tombstones, and unspecified uses under "Other uses."

Slate sold in the United States, 1917–1921, by uses.

Year.	Roofing slate.			Mill stock.			Other uses.[b]	Total.
	Squares (100 sq. ft.).	Value.[a]	Average value.	Square feet.	Value.[a]	Average value.		
1917	703,667	$3,411,740	$4.85	10,663,000	$1,799,917	$0.17	$538,309	$5,749,966
1918	379,817	2,219,131	5.84	7,204,000	1,853,603	.26	768,386	4,841,120
1919	454,337	3,085,957	6.79	7,466,000	1,782,793	.24	1,161,898	6,030,648
1920	396,230	3,524,658	8.90	9,910,000	3,147,281	.32	2,054,503	8,726,442
1921	348,085	3,197,745	9.19	8,970,000	2,719,723	.30	1,404,538	7,322,006
Percentage of increase or decrease	−12.2	−9.3	+3.3	−9.5	−13.6	−6.3	−31.6	−16.1

[a] F. o. b. at point of shipment. [b] Chiefly slate granules.

[2] Bowles, Oliver, The utilization of waste slate as a filler: Bur. Mines Repts. Inv. No. 2283, September, 1921.

In approximating the tonnage for the different slate products given in the following table a specific gravity of 2.75 has been used as the basis of calculation, and a thickness corresponding to an average for each product. The total quantity and value given for each use are the totals of the reports of the quarrymen (not the selling agents), and the value f. o. b. quarry or nearest point of shipment is given. It has been suggested that some of the mill stock finds its ultimate use for purposes other than reported by the quarrymen, but the Survey has no means of verifying this suggestion.

Roofing slate, mill stock,[a] and slate granules sold in the United States in 1920 and 1921, by uses.

Use.	1920			1921				
	Quantity.	Value.	Average value.	Quantity.	Value.	Average value.	Percentage of increase or decrease. Quantity.	Percentage of increase or decrease. Value.
Roofing..............squares..	396,230	$3,524,658	$8.90	348,085	$3,197,745	$9.19	−12.2	−9.3
Approximate equivalent in short tons................	134,000	....	......	117,500	....	......	......	......
Electrical.........square feet..	1,950,397	1,491,769	.76	1,173,653	927,951	.79	−39.8	−37.8
Approximate equivalent in short tons................	10,700	....	......	8,400	....	......	......	......
Structural and sanitary, square feet.........................	2,593,563	916,216	.35	1,706,321	642,532	.38	−34.2	−29.9
Approximate equivalent in short tons................	19,500	....	......	12,300	....	......	......	......
Grave vaults and covers, square feet.........................	477,239	130,795	.27	552,592	121,967	.22	+15.8	−6.7
Approximate equivalent in short tons................	6,800	....	......	8,000	....	......	......	......
Blackboards and bulletin boards..........square feet..	2,254,876	385,480	.17	3,154,201	791,241	.25	+39.9	+105.3
Approximate equivalent in short tons................	16,200	....	......	22,600	....	......	......	......
Billiard table tops .square feet..	344,258	140,032	.41	462,920	179,862	.39	+34.5	+28.4
Approximate equivalent in short tons................	2,500	....	......	3,300	....	......	......	......
School slates............pieces..	4,302,390	82,989	[b]19.29	3,591,376	56,170	[b]15.64	−16.5	−32.3
Approximate equivalent in square feet...............	2,290,000	....	......	1,921,000	....	......	......	......
Approximate equivalent in short tons................	4,000	....	......	2,500	....	......	......	......
Granules...........short tons..	268,516	2,044,942	7.62	231,770	1,397,886	6.03	−13.7	−31.6
Other [c]. short tons (estimated)..	6,500	9,561	......	5,130	6,652	......	......	......
Total (quantities approximate, in short tons)....	468,700	8,726,442	......	411,500	7,322,006	......	−12.2	−16.1

[a] In 1920 the total mill stock sold, including school slates, was approximately 9,910,000 square feet, valued at $3,147,281; in 1921 it was approximately 8,970,000 square feet, valued at $2,719,723.
[b] Average value per thousand pieces.
[c] Includes small quantity of slate sold for flagging, tombstones, and other uses not specified.

Slate sold in the United States in 1921, by States and uses.

State.	Operators.	Roofing slate.			Structural and sanitary.		Electrical.		Other uses. [a]	Total.
		Squares (100 sq. ft.).	Value.	Average value.	Square feet.	Value.	Square feet.	Value.		
Georgia	1	....	....	....	....	....	....	....	([b])	([b])
Maine	3	3,633	$47,916	$13.19	....	....	417,723	$358,547	$2,840	$409,303
Maryland	2	([b])	([b])	10.84	....	....	....	....	([b])	([b])
New Jersey	1	([b])	([b])	11.00	....	....	....	....	....	([b])
New York	15	4,100	59,106	14.42	....	....	....	....	457,850	516,956
Pennsylvania	47	202,605	1,565,109	7.72	1,646,483	$600,753	337,186	216,271	1,213,253	3,595,386
Tennessee	1	....	....	....	....	....	....	....	([b])	([b])
Vermont	32	115,019	1,286,529	11.19	59,838	41,779	418,744	353,133	665,537	2,346,978
Virginia	4	20,318	212,943	10.48	....	....	....	....	....	212,943
Undistributed [b]	......	2,410	26,142	....	....	....	....	....	214,298	240,440
	106	348,085	3,197,745	9.19	1,706,321	642,532	1,173,653	927,951	2,553,778	7,322,006
Total, 1920	99	396,230	3,524,658	8.90	2,593,563	916,216	1,950,397	1,491,769	2,793,799	8,726,442

[a] For details see table of sales on page 26.

[b] Undistributed includes Georgia, Maryland, New Jersey, and Tennessee.

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Slate sold in Pennsylvania in 1921, by counties and uses.

County.	Operators.	Roofing slate.			Mill stock.								Other.[b]	Total.
		Squares (100 sq. ft.).	Value.	Average value.	Structural and sanitary.[a]		Electrical.		Blackboards and bulletin boards.		School slates.			
					Square feet.	Value.	Square feet.	Value.	Square feet.	Value.	Number.	Value.		
Berks and Lancaster	3	....	....	....	....	....	....	....	....	....	....	....	$101,694	$101,694
Lehigh	11	21,711	$157,826	$7.27	49,767	$18,150	196,462	$103,120	604,743	$109,616	2,694,019	$42,591	....	431,303
Northampton	33	180,894	1,407,283	7.78	2,139,313	702,312	140,724	113,151	2,549,458	681,625	897,357	13,579	144,439	3,062,389
	47	202,605	1,565,109	7.72	2,189,080	720,462	337,186	216,271	3,154,201	791,241	3,591,376	56,170	246,133	3,595,386
Total, 1920	44	220,366	1,746,026	7.92	3,009,549	1,005,400	638,557	441,726	2,251,646	384,131	4,302,390	82,989	189,995	3,850,267

[a] Includes slate for grave covers and vaults.

[b] In 1920 includes 266,258 square feet of billiard-table material, valued at $108,033, and 10,879 short tons of granules and "flour," valued at $79,221, and in 1921, 371,550 square feet of billiard-table material, valued at $142,205, and 15,680 short tons of granules and "flour," valued at $101,694.

IMPORTS AND EXPORTS.[1]

Value of slate imported for consumption in the United States, 1916–1921.

1916	$2,200	1919	$691
1917	1,024	1920	4,512
1918	321	1921	2,923

Value of roofing slate exported from the United States, 1920 and 1921, by countries.

Country.	1920	1921	Country.	1920	1921
Canada	$91,992	$74,546	Brazil	$293	
Mexico	1,951	2,029	Colombia	454	
Honduras	8	4	Peru	350	
Nicaragua	19	16	Venezuela		$145
West Indies:			England	10,329	3,575
Cuba	5,858		Ireland		11,887
Jamaica	2,510	100	New Zealand	6,047	
Trinidad and Tobago	1,485	332	Australia		39
Virgin Islands of the United States		80	British South Africa		3,777
Panama	609	3,700	China	40	1,400
Argentina	160			122,105	101,630

The following figures for exports of slate other than roofing were collected by the United States Geological Survey from shippers of the products named.

[1] The figures of imports and exports were compiled by J. A. Dorsey, of the United States Geological Survey, from the records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Slate other than roofing exported from the United States in 1921, by destination.

Destination.	Electrical.		Structural.		Blackboards.		Billiard tables.		School slates.		Total.
	Square feet.	Value.	Square feet.	Value.	Square feet.	Value.	Square feet.	Value.	Cases.[a]	Value.	
Canada	12,497	$13,370	904	$365	154,095	$52,016	61,106	$31,882	1,991	$24,672	$122,305
Mexico	3,280	3,047							388	4,858	7,905
Central America	630	590					860	343			933
West Indies	6,868	6,512	1,709	945	1,456	582	806	322	85	979	9,340
South America	7,448	6,930					1,288	521	2,587	30,832	38,283
Europe	3,181	2,960					39	16	2,966	33,024	36,000
Africa	1,980	1,841							3,632	41,707	43,548
Oceania	4,298	4,000					4,068	2,602	3,621	40,988	47,590
Asia	15,027	13,980							2,193	24,323	38,303
Undistributed	250	275									275
	55,459	53,505	2,613	1,310	155,551	52,598	68,167	35,686	17,463	201,383	344,482

[a] Cases weigh from 130 to 165 pounds each; average is 135 pounds.

STRONTIUM.[1]

By George W. Stose.

STRONTIUM ORE.

PRODUCTION.

No strontium ore was mined in the United States in 1921, nor has any been mined since 1918, when a small quantity of ore was produced from deposits in Barstow County, Calif. Deposits in Arizona, Texas, and Washington have been worked on a small scale in the past.

IMPORTS.

The quantity of strontium ore imported can not be determined accurately, because a record of this commodity is not kept by the customs officers at ports of entry. It has been estimated that about 2,000 short tons of ore is required in normal years by the industries of this country, most of which has been imported. In 1920 the imported ore used in domestic manufactures was considerably more than 2,000 tons, and in 1921 it was apparently less than 600 tons. This reduction was probably due both to an over supply of chemicals manufactured in 1920 and to a diminution in demand in 1921.

PRICES.

The price of strontium ore in the United States is determined by the value of the imported product delivered at the ports of entry. The price paid for strontium ores in 1919 as reported by manufacturers of strontium chemicals was about $22.76 a short ton. Figures for later years are not available, but the price of celestite was probably much lower in 1920. The price obtainable for domestic strontium ore also depends on the price that the manufactured compounds command. The plants that made strontium nitrate from ore in 1921 obtained an average of 13½ cents a pound for their product, whereas in 1920 the average price was 18 cents. Because of the high freight rates from the Western States, where the domestic deposits of strontium ore occur, the net price to the miner has been insufficient to make the mining of domestic ore profitable.

STRONTIUM CHEMICALS.

Most of the strontium chemicals manufactured in the United States in 1921 were made from strontium ore imported from England. The production of chemicals not made from ore is not included in this report. Three plants were in operation during the year, one each in Missouri, New Jersey, and Pennsylvania. The largest producer of strontium chemicals was the E. I. du Pont de Nemours & Co., at Paulsboro, N. J. Strontium nitrate was the chief strontium chemical produced and was made in all three plants.

[1] The statistical data in this report were prepared by Mrs. E. R. Phillips, of the United States Geological Survey.

Other strontium chemicals produced were bromide, salicylate, carbonate, and hydroxide. The strontium chemicals produced and marketed by these plants amounted to 847,368 short tons, or only about one-sixth the quantity marketed in 1920. The value of the output in 1921 was $118,655.

Strontium chemicals manufactured from domestic and imported crude ore in the United States and marketed in 1916–1921, in pounds.

1916	2,006,000	1919	2,191,409
1917	2,499,676	1920	4,713,015
1918	4,927,000	1921	847,368

IMPORTS.[2]

More than 1,000,000 pounds of strontium carbonate and oxide was imported in 1921, which is nearly as much as was imported in 1919 and about three-fourths the quantity imported in 1920.

Strontium carbonate and strontium oxide [a] imported for consumption in the United States, 1895–1921.

Year.	Pounds.	Value.	Year.	Pounds.	Value.
1895-1913 (yearly average)	([b])	$447	1918 January-June	([b])	$2,103
1914	([b])	1,016	1918 July-December	185,920	356
1915	([b])	6,411	1919	1,225,952	3,380
1916	([b])	11,049	1920	1,659,083	15,479
1917	([b])	23,216	1921	1,212,758	4,393

[a] "Oxide of strontium, protoxide of strontium, and strontianite or mineral carbonate of strontium" imported for consumption in the United States, compiled from the records of the Bureau of Foreign and Domestic Commerce.
[b] Figures for quantity not available prior to July, 1918.

USES AND MARKET.

Strontium compounds are used chiefly in the manufacture of signal lights, fireworks, and medicines. Strontium nitrate, which is by far the chief compound made in domestic plants, is used in the production of red pyrotechnical fire and lights, flares, fuses, signal shells, and signal lights. Strontium chemicals are now made chiefly in the Atlantic States and a small quantity in Missouri. The demand for domestic ore is therefore largely confined to the Eastern States, where it must compete in price and quality with ore imported from foreign countries, chiefly England. Since the resumption of the importation of ore in 1919 the mining of domestic ore has ceased because of the low price and high freight rate.

DEPOSITS OF STRONTIUM ORE IN THE UNITED STATES.

The known workable deposits of strontium ore in this country are in Arizona, California, Texas, Utah, and Washington. Other deposits of doubtful value occur in several other of the Western States and in a few States east of Mississippi River. These have been briefly described in Mineral Resources for 1916, 1918, and 1919. Renewed interest in deposits in Ohio has recently been shown, and they may prove to be of some commercial value.

[2] Compiled by J. A. Dorsey, of the United States Geological Survey, from the records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

CARBON BLACK PRODUCED FROM NATURAL GAS.

By E. G. Sievers.

PRODUCTION.

The carbon-black industry showed marked progress in 1921, the total output being 16 per cent greater than in 1920. The table below, which shows the output by States, is based on reports from the operators, but as several operators failed to submit reports their production had to be estimated.

Carbon black produced from natural gas in the United States in 1921.

State.	Number of plants.	Pounds.	Value.	Average value (cents).	Average yield per M cubic feet (pounds).	Gas used (M cubic feet).
Louisiana	13	31,003,615	$2,949,428	9.5	0.97	32,071,778
West Virginia	21	25,073,000	2,204,400	8.8	1.6	15,476,000
Kentucky	2	2,697,075	215,822	8.0	1.8	1,518,763
Oklahoma Pennsylvania Montana	3	573,225	38,707	6.8	.9	629,492
Wyoming	2	419,400	37,521	8.9	.5	869,000
Total, 1921	41	59,766,315	5,445,878	9.1	1.2	50,565,033
Total, 1920	35	51,321,892	4,032,286	7.9	1.3	40,598,978
Total, 1919	36	52,056,941	3,816,040	7.3	1.0	49,896,235

FEATURES OF THE INDUSTRY.

The outstanding features of the industry were an increase of 67 per cent in production in Louisiana, which became for the first time the leading State, and a decrease of 6 per cent in West Virginia as compared with 1920. The leading State in the earlier days of the industry was Pennsylvania, but later West Virginia was for a long time the greatest producer. Then, as the supplies of natural gas in the eastern fields declined and new fields were developed in Louisiana, the carbon-black industry migrated to the territory where the supply of gas was large and cheap. In Oklahoma, where production had ceased in 1920, one plant was operated in 1921.

When abundant supplies of natural gas were developed in Wyoming that State attracted the carbon-black industry and became a large producer, but legislation there has dealt a severe blow to the industry, as is clearly shown by the marked drop in production.

PRICES.

Owing to the depression in the rubber industry early in 1921 the price of carbon black declined to about 8 cents a pound, and some was sold for even less. By July 1 the price advanced, and by the end of the year it reached 11 cents a pound. This rapid return to better conditions in 1921 has probably used up most of the product in storage, and prices have risen accordingly, reaching, at the time of the writing of this report, 15 cents a pound.

YIELD OF CARBON BLACK.

The average yield of carbon black per thousand cubic feet of gas consumed was slightly lower in 1921 than in 1920, although the efficiency of some of the plants has been materially increased. The yield in 1921 ranged from 0.2 to 3.5 pounds, and the maximum was 1.5 pounds higher than the maximum in 1920. The highest average yield of carbon black in any State in 1921, 1.8 pounds, was obtained in Kentucky, which was followed closely by West Virginia, as shown in the preceding table. Both States increased the yield over 1920. The yield for Louisiana decreased slightly.

Number of plants in the United States showing different yields of carbon black, 1919–1921.

Yield per M cubic feet of gas.	1921						1920	1919
	Louisiana.	West Virginia.	Kentucky.	Wyoming.	Oklahoma, Pennsylvania, Montana.	Total.		
Less than 1 pound	2	2	....	1	1	6	6	6
1 to 1.2 pounds	9	3	....	1	1	15	15	17
1.3 to 1.6 pounds	1	9	....	....	1	10	6	11
1.7 to 2 pounds	....	4	2	....	....	6	8	2
2.1 to 2.5 pounds	....	2	....	....	....	2	....	....
2.6 to 3 pounds	....	1	....	....	....	1	....	....
3 to 3.5 pounds	1	....	....	....	....	1	....	....
	13	21	2	2	3	41	[a] 35	36

[a] Revised figures.

Analyses of natural gas from several States made by the Bureau of Mines show that the gas of Wyoming yields the largest quantity of carbon black per thousand cubic feet of gas consumed, although the record of production shows that in 1921 it did not. The high percentage of methane in the gas of Louisiana reduces the yield of carbon black, because methane contains only about half as much carbon as ethane. The natural gas of West Virginia carries a fairly large proportion of ethane and gives a correspondingly high yield of carbon black.

DEVELOPMENT OF PLANTS AND FIELDS.

Six more plants were operated in 1921 than in 1920. West Virginia operated two more plants, and Kentucky and Wyoming each added one plant. Louisiana, which should naturally show the greatest activity, operated only two more plants in 1921 than in 1920.

Owing to attempts at restrictive legislation the construction work done on carbon-black plants in the Monroe field, La., in 1921 consisted chiefly in completing plants that were started in 1920. Although some operators in that field report a higher yield in 1921 than in 1920 there has been little improvement in the average efficiency of the plants. At the end of 1920 the Monroe field contained about 75 completed natural-gas wells, whose daily potential capacity, according to the operators' reports, was about 650,000,000 cubic feet. Of these wells only 46 were being used, and these produced about 90,000,000 cubic feet of gas daily, including that furnished to the city of Monroe. During 1921 six or seven wells were completed, increasing the available daily potential capacity to 750,000,000 cubic feet. Only 51 wells, which had a capacity of 100,000,000 cubic feet of gas a day, were being used at the end of the year

The channel process of producing carbon black appears to be the one most commonly used. Reports to the United States Geological Survey for 1921 show that 11 plants used the channel process, 3 the disk process, and 1 the plate process. The processes used by the remaining plants were not reported by the operators.

CAPACITY OF PLANTS.

Of the 41 plants that operated in 1921, only 8 were working at maximum capacity, and 5 of these were in Louisiana, where the supply of gas exceeds the demand. The restriction of operation at full capacity to a small number of plants in the country at large is due chiefly to a lack of gas.

The range in daily consumption of gas and production at the plants and their maximum capacity in 1921, as reported by the operators, is as follows:

Gas used:		
Maximum	M cubic feet	30,000
Minimum	do	346
Carbon black produced:		
Maximum	pounds	32,000
Minimum	do	327
Maximum capacity:		
Gas	M cubic feet	30,000
Carbon black	pounds	32,000

These figures are not complete, because some of the operators failed to submit this information in their reports, but they indicate the variation in production at different plants.

During 1921 there were 35 plants in operation every day; the remaining 6 were operated only part of the time. This continuous activity of most of the plants probably accounts for the marked increase in the output.

USES.

Printer's ink.—Although carbon black is used for many purposes, it is especially adapted to use in the manufacture of printer's ink, which, according to the opinions of those who are engaged in the industry, consumes from 20 to 25 per cent of the total output.[1]

The rubber industry.—The rubber industry, which is now the largest consumer of carbon black, used 30 to 35 per cent of the output in 1921. Carbon black increases the resiliency and toughness of rubber and it gives to rubber tires, in which most of the carbon black employed in the rubber industry is used, a better grip on the road.

[1] For detailed statement on the uses of carbon black for printer's ink see Mineral Resources for 1920.

and thus increases their mileage and traction, reducing the cost of motor transportation, now in itself an economic problem. According to a prominent carbon-black jobber,[2] rubber tires compounded with carbon black weigh about 20 per cent less than those compounded with zinc oxide, thus not only saving transportation charges but materially lessening road shock both to the car and to the tire itself. Moreover, the opaque carbon particles prolong the life of the rubber by cutting off the strong rays of light, which are detrimental to it.

The combination of better quality and less cost has caused the increased use of carbon black in the rubber industry. Rubber manufacturers maintain that a dollar invested in high-grade carbon black will produce nearly twice as much wearing power, resistance to cutting, nonskidding power, and durability as a dollar invested in any other material that can be used.

Paints and varnishes.—The paint trade uses about 10 per cent of the total output of carbon black, whose great covering power and tinting strength has made it especially useful in varnishes and enamels.

Miscellaneous uses.—Carbon black is used also in the manufacture of stove and shoe polish, phonograph records, black leather, bookbinders' board, buttons, carbon and other black and gray papers, typewriter ribbons, carriage cloth, celluloid, electric insulators, cement colors, crayons, drawing and marking inks, artificial stone, and black tile. These uses consume about 10 per cent of the annual output.

EXPORTS.

The usefulness of carbon black is realized abroad, for between 15 and 20 per cent of the annual output is exported to be used for purposes similar to those for which it is employed in this country.

ECONOMIC ASPECTS OF THE INDUSTRY.

The carbon-black industry is a great aid in the development of new gas fields. This industry can easily succeed in areas that are sparsely populated and far from markets and that present other unfavorable conditions. Its one requirement is a sufficient supply of natural gas; in fact, an isolated area where there is such a supply is an ideal location for a carbon-black plant, because there is no domestic demand for the gas. The best illustration of the aid that can be given by the carbon-black industry in the development of new and remote natural-gas fields is furnished by the Monroe field, in Louisiana. About five years ago only a few wells had been drilled in that field, in an unsuccessful search for oil. The field is remote from large cities and communities, in a region where there is little demand for the gas for domestic use, and it has therefore been eagerly exploited by the carbon-black industry.

LEGISLATIVE RESTRICTIONS.

To protect its oil and gas fields Louisiana has through the State legislature taken broad measures for the control or elimination of the carbon-black industry. The Department of Conservation of that

[2] Smith, C. H., Entrance of carbon black into rubber manufacture: Rubber Review, January, 1922.

State requires that the gasoline in natural gas shall be extracted from it before it is burned in the carbon-black plants, and most of the carbon-black plants in that State are therefore operated in conjunction with gasoline plants. The gas used in the carbon-black plants in the northwestern part of the Monroe field is too low in gasoline vapors to warrant their extraction. In West Virginia and Wyoming also the gasoline is recovered from some of the gas that enters the carbon-black plants.

As natural gas has preeminent value as a domestic fuel, much has been done to conserve it for that use. The drastic legislation against the carbon-black industry caused by the attempt to conserve natural gas has forced the industry out of some States entirely and has retarded its expansion. Texas has passed a law that prohibits the manufacture of carbon black from natural gas except under a special permit granted by the State Railroad Commissioners after due hearing. In 1919 the legislature of Wyoming passed a law prohibiting the erection in that State of a carbon-black plant within 10 miles of any incorporated city or town that uses natural gas, and the United States Supreme Court has held that this law is constitutional. Montana also has passed laws regulating the manufacture of carbon-black.

FLUORSPAR AND CRYOLITE.

By Hubert W. Davis.

FLUORSPAR.[1]

The stagnation in the fluorspar industry in 1921 was due principally to the curtailment of operations in the industries that consume fluorspar but also to the fact that the aggregate stocks in the hands of users on January 1, 1921, were the largest that had ever accumulated —sufficient to meet normal requirements for six months. The total shipments in 1921 were the lowest recorded since 1908.

FLUORSPAR MINED AND SHIPPED.

The shipments of fluorspar from domestic mines in 1921 decreased 81 per cent in quantity and 85 per cent in value as compared with those in 1920. The general average price per ton f. o. b. mines or shipping points for all grades in 1921 was $20.71, a decrease of $4.55 a ton from 1920. The highest average price in 1921 was reported from Illinois and the lowest from Colorado.

The exact quantity of crude fluorspar mined can not be ascertained, because at most of the smaller mines only the cleaned material is weighed, but the total quantity mined in 1921 was about 74,000 short tons, a decrease of 73 per cent from 1920. The total quantity of merchantable fluorspar recovered by mining and milling in 1921 showed a decrease of 70 per cent from 1920.

Merchantable fluorspar recovered in 1920 and 1921, by States.

State.	1920		1921	
	Short tons.	Percentage.	Short tons.	Percentage.
Illinois	124,953	62.05	24,904	41.57
Kentucky	53,756	26.70	24,467	40.84
Colorado	12,702	6.31	4,103	6.85
New Mexico	8,679	4.31	4,914	8.20
New Hampshire	202	.10	685	1.14
Arizona	180	.09	525	.88
Utah	268	.13	315	.52
Nevada	632	.31		
	201,372	100.00	59,913	100.00

Such details of the shipment of fluorspar from 1918 to 1921 by States as may be published without revealing statistics of individual producers, except by permission, are given in the following table:

[1] A discussion of the character and occurrence of fluorspar, the history of its development, and notes on the essential features of a commercial deposit are given in Mineral Resources for 1920, and notes on fluorspar deposits in foreign countries are given in Mineral Resources for 1919.

Domestic fluorspar sold, 1918–1921.

State.	Gravel.			Lump.			Ground.			Total.		
	Short tons.	Value.	Average price.	Short tons.	Value.	Average price.	Short tons.	Value.	Average price.	Short tons.	Value.	Average price.
1918												
Arizona	....	....	....	364	$5,537	$15.21	....	....	....	364	$5,537	$15.21
Colorado	32,680	$287,620	$8.80	5,795	129,160	22.29	....	....	....	38,475	416,780	10.83
Illinois	122,721	2,565,394	20.90	9,518	260,948	27.42	8,752	$273,203	$31.22	132,798	2,887,099	21.74
Kentucky	79,411	1,856,739	23.38							87,604	2,069,185	23.62
New Mexico	b 1,309	b 25,507	19.49	b 3,267	b 61,373	18.79	....	....	....	3,437	64,348	18.72
Other States a										1,139	22,532	19.78
	b 236,121	b 4,735,260	20.05	b 18,944	b 457,018	24.12	8,752	273,203	31.22	263,817	5,465,481	20.72
1919												
Illinois	81,026	1,962,934	24.23	4,246	133,993	31.56	10,373	446,224	43.02	92,729	2,430,361	26.21
Kentucky	29,470	770,381	26.14							32,386	883,171	27.27
Colorado										9,687	150,739	15.56
New Mexico	b 12,088	b 184,044	15.23	b 1,087	b 27,998	25.76	....	....	....	2,346	37,643	16.05
Other States a										1,142	23,660	20.72
	b 122,584	b 2,917,359	23.80	b 5,333	b 161,991	30.38	10,373	446,224	43.02	138,290	3,525,574	25.49
1920												
Illinois	103,486	2,396,322	23.16	8,332	381,171	36.27	8,481	537,151	43.32	120,299	3,096,767	25.74
Kentucky	39,997	1,029,195	25.73	2,178			3,916			46,091	1,246,942	27.05
Nevada	530			....			2			532		
New Hampshire	b 202	b 13,332	17.61	(b)	b 8,608	20.30	....	....	....	202	22,070	18.66
Utah	....			268			....	....	....	268		
Arizona	25			156			....	....	....	181		
Colorado	10,076	157,768	14.96	2,776	195,000	22.52	....	....	....	12,852	251,308	19.55
New Mexico	470			5,883			....	....	....	6,353	101,460	15.97
	b 154,786	b 3,596,617	23.24	b 19,593	b 584,779	29.85	12,399	537,151	43.32	186,778	4,718,547	25.26
1921												
Colorado	3,143	39,907	12.70	....	....	....	....	....	....	3,143	39,907	12.70
Illinois	8,208	146,746	17.88	1,099			3,170			12,477	315,767	25.31
Kentucky	11,714	185,451	15.83	1,689	80,838	21.39	1,863	235,981	40.00	15,266	294,513	19.29
New Mexico	1,650	21,450	13.00	991			866			3,507	60,186	17.16
New Hampshire	b 567	b 13,721	24.20	(b)	(b)	....	....	....	....	567	13,721	24.20
	25,282	b 407,275	16.11	b 3,779	b 80,838	21.39	5,899	235,981	40.00	34,960	724,094	20.71

a 1918: New Hampshire, Utah and Washington; 1919: Arizona, Nevada, New Hampshire, and Utah.

b Some lump spar is included with gravel.

FLUORSPAR INDUSTRY, BY STATES.

Arizona.—On account of the low price of fluorspar in 1921 the producers in Arizona were unable to compete profitably for the small quantity that was required by western consumers. A little fluorspar was mined, but no shipments were reported.

Colorado.—Operations were curtailed at both Wagon Wheel Gap and Jamestown, Colo., the Lehman mill, at Jamestown, being closed about February 1 and the mine at Wagon Wheel Gap May 1.

Illinois.—The concentrating mill of the Rosiclare Lead & Fluorspar Mining Co. was redesigned and rebuilt in order to improve mill practice on the ores. The additions made include a large machine to dewater the mill feed and separate the siliceous slimes, a larger and more complete screening and sizing system to assist the jigs in making cleaner separation, and tables to handle the fine sand spar, heretofore handled on jigs. Provision has also been made for handling spar middlings and re-treating them in order to keep down the tailing losses and to produce a better grade of gravel from the jigs.

At the Eichorn mine, near Rosiclare, the shaft was sunk to a depth of 200 feet, and crosscuts were made to the vein at the 100-foot and 200-foot levels. Drifts are being run at the 200-foot level, and some flourspar has been taken out. Work on a small milling plant has been begun.

Construction and development work at the Hillside mine and mill, near Rosiclare, was continued throughout the year, and it is expected that this modern plant will be put in operation in 1922.

Exploration work was done at two openings on the property of the Spar Mountain Mining Co., near Cave-in-Rock.

The Cave-in-Rock Fluorspar Co. abandoned its property near Cave-in-Rock. This company acquired the Baldwin mine, near Elizabethtown, in Pope County, sunk a shaft, and installed a crusher and log washer. A small quantity of flourspar was mined and shipped in 1921.

Kentucky.—The shipments from Kentucky exceeded those of Illinois for the first time since 1904.

The Ohio-Kentucky Fluorspar & Lead Corporation has taken over the Klondyke and Royal mines, near Smithland. It is reported that the Klondyke mine is now fully developed and has a 10-foot vein at the 160-foot level and that an up-to-date 100-ton mill is to be built during 1922. The shaft at the Royal mine, which has not been fully developed, is said to be about 400 feet deep. A mill having a daily capacity of 250 tons is planned.

The Tabb and Wheeler mines, near Mexico, Ky., were acquired late in 1921 from the West Kentucky Ore Co. by the Kentucky Fluorspar Co. At the Tabb mine two new shafts were sunk which show an average of 6 feet of high-grade fluorspar at a depth of 70 feet, at which 200 feet of drifting has been done. Two new shafts were sunk to a depth of 70 feet at the Wheeler mine. No. 2 shaft on the extension of the Yandell vein was sunk to a depth of 90 feet by the Kentucky Fluorspar Co., and a large body of acid-grade fluorspar was reported to have been encountered.

The Lucille mine of the Gugenheim Mining Co. at Marion, the only mine, except the Haffaw, in western Kentucky with railroad connection, exhausted its No. 3 shaft, which was sunk late in 1920 to reach a pocket containing about 5,000 tons of fluorspar. This company will continue to operate its mill at Marion and will draw its supply from mines near Mexico.

The Crystal Fluorspar Co. did considerable development work at its property near Sheridan and reports having opened a vein of high-grade fluorspar.

It is reported that many small operators abandoned the western Kentucky field entirely during 1921, leaving their workings to fill with water and the shafts to cave in, thus losing all development work done during the last few years.

The Heyward Minerals Co., which has mines in the central Kentucky district, operated during the first quarter of 1921, suspended work for six months, and resumed operations in October.

Nevada.—The Continental Fluorspar Co. suspended hoisting at its mine near Beatty, Nev., but expected to resume operations early in 1922. A washing and grinding plant consisting of engines, crusher, tables, grinders, and dryers was installed.

New Hampshire.—New Hampshire was the only producing State that showed an increase in shipments in 1921. The output was obtained from the Pierce and Stoddard mines, in Cheshire County.

New Mexico.—The new mill of the Great Eagle Fluorspar Co., in Grant County, N. Mex., was completed and put in operation, and a small quantity of ground fluorspar was shipped. Another new mill, that of the Ore Production Co., near Rincon, was also put in operation. At the Tortuga mine of the American Fluorspar Co., near Mesilla Park, Dona Ana County, a jig has been added to the mill, which now has a capacity of 15 tons of ground fluorspar every 24 hours, and a considerable quantity of ground fluorspar was shipped during the year. It is reported that a vein of fluorspar carrying 97 to 98 per cent of calcium fluoride was opened at the Tortuga mine.

From the middle of 1920 until October, 1921, the Hibbs Ore Co. exploited, developed, and experimentally treated ores of about 10 mines in the fluorspar field of New Mexico. It is reported that a new dry process was developed whereby any grade of crystalline ore could be treated so as to yield more than 90 per cent of its fluorspar content and produce a 90 per cent grade, at a cost of about $1.25 a ton.

Utah.—A small quantity of fluorspar was mined by the Fluorite Mines Co., near Clive, Utah, but no shipments were made, as the consumers who draw their supplies from this mine had sufficient material on hand for their requirements. A description of the fluorspar deposit near Clive is given on pages 48–49.

TOTAL OUTPUT.

The historical table that follows gives the production and value of fluorspar so far as recorded by the Geological Survey.

Fluorspar produced [a] in the United States, 1880–1921.

Year.	Illinois.		Kentucky.		Other States.		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1880–1901							178,117	$1,067,655
1902	18,360	$121,550	29,030	$143,410	628	$6,872	48,018	271,832
1903	11,413	57,620	30,835	153,960	275	2,037	42,523	213,617
1904	17,205	122,172	19,096	111,499	151	1,084	36,452	234,755
1905	33,275	220,206	22,694	132,362	1,416	9,920	57,385	362,488
1906	28,268	160,623	[b] 12,528	[b] 83,402	([b])	([b])	40,796	244,025
1907	25,128	141,971	21,058	133,971	3,300	11,400	49,486	287,342
1908	31,727	172,838	6,323	48,642	735	4,518	38,785	225,998
1909	41,852	232,251	7,800	53,233	1,090	6,263	50,742	291,747
1910	47,302	277,764	17,003	124,574	5,122	27,858	69,427	430,196
1911	68,817	481,635	12,403	96,574	5,828	33,238	87,048	611,447
1912	103,937	695,467	10,473	61,186	2,135	12,510	116,545	769,163
1913	85,854	550,815	19,622	113,903	10,104	71,568	115,580	736,286
1914	73,811	426,063	19,077	128,986	2,228	14,992	95,116	570,041
1915	116,340	624,040	19,219	129,873	1,382	10,562	136,941	764,475
1916	126,369	746,150	19,698	123,596	9,668	52,908	155,735	922,654
1917	156,676	1,373,333	43,639	697,566	18,513	216,823	218,828	2,287,722
1918	132,798	2,887,099	87,604	2,069,185	43,415	509,197	263,817	5,465,481
1919	92,729	2,430,361	32,386	883,171	13,175	212,042	138,290	3,525,574
1920	120,299	3,096,767	46,091	1,246,942	20,388	374,838	186,778	4,718,547
1921	12,477	315,767	15,266	294,513	7,217	113,814	34,960	724,094
							2,161,369	24,725,139

[a] Beginning with 1906 figures represent shipments from mines.
[b] Small quantity from Colorado and Tennessee included with Kentucky.

Figure 3 shows graphically the course of the production of fluorspar in the United States from 1883 to 1921. The quantities beginning in 1906 represent shipments from mines. For convenience in comparison the imports, beginning with the first full year for which records are available, 1910, are shown on the same diagram.

STOCKS OF FLUORSPAR.

According to the reports of producers the total quantity of fluorspar in stock at the mines or at shipping points at the end of 1921 amounted to 58,659 short tons, an increase of 40 per cent over the stock at the end of 1920, and the largest ever accumulated by producers. As the quantity of fluorspar in stock piles is of necessity partly estimated, there are variations in the mine reports from year to year which prevent an absolute balance between the quantity mined and the quantity shipped and stocks on hand. Data on consumers' stocks are noted under consumption (pp. 46–47).

Stocks of fluorspar at mines or shipping points in 1920 and 1921, by States, in short tons.

State.	1920	1921
Arizona	174	549
Colorado	1,400	3,160
Illinois	18,615	29,404
Kentucky	16,355	22,338
Nevada	250	250
New Hampshire		118
New Mexico	4,790	2,640
Washington	200	200
	41,784	58,659

IMPORTS AND EXPORTS.[2]

The imports of fluorspar into the United States in 1921 showed a decrease of 75 per cent in quantity and 74 per cent in value, compared with 1920. The value at the foreign ports averaged \$11.13 a ton.

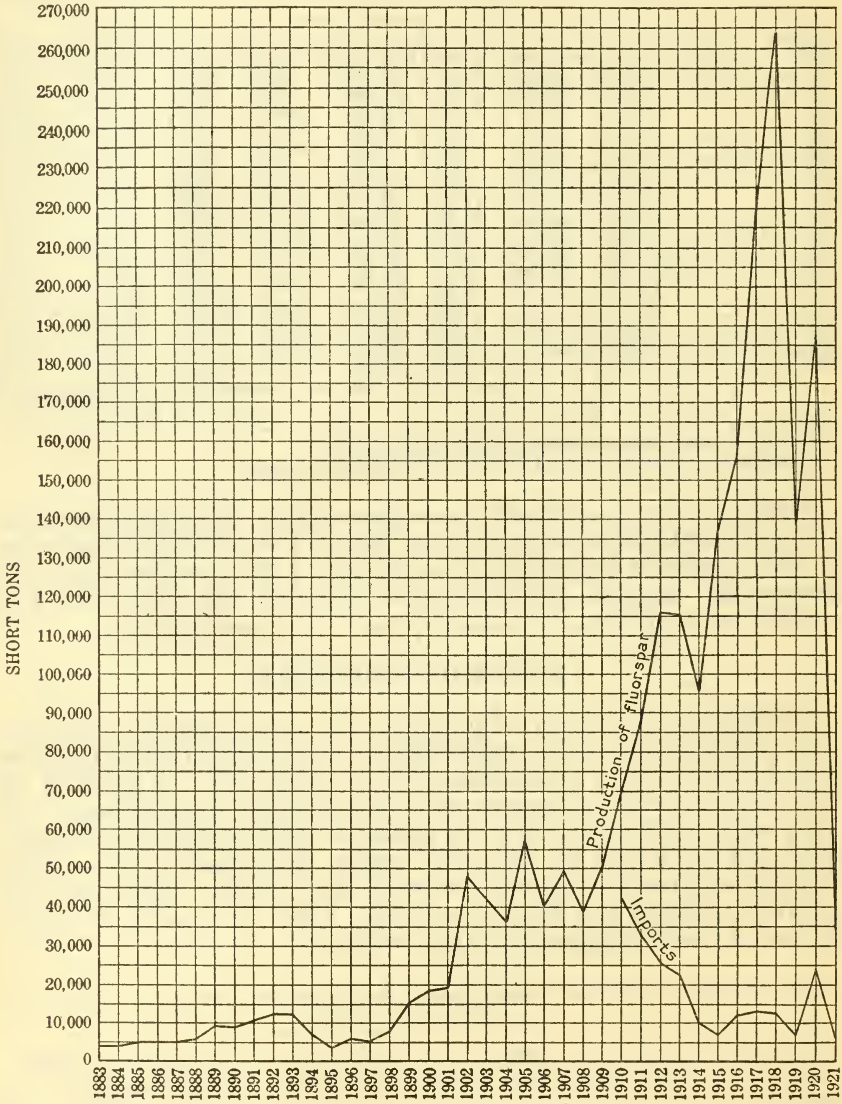

FIGURE 3.—Diagram showing production of fluorspar in the United States, 1883–1921, and imports, 1910–1921.

The imports were equivalent to about 25 per cent of the domestic shipments of gravel fluorspar, as compared with about 16 per cent in 1920.

[2] The statistics of imports were compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce.

According to the values reported, including the duty of $1.34 a short ton ($1.50 a long ton) but excluding the ocean freight charges, the average cost of imported English fluorspar to the consumer was $8.66 a ton in 1921, compared with $16.11 for domestic merchantable gravel at the mine or mill.

The distances that domestic fluorspar must be transported from mines to steel plants in the Lehigh and Susquehanna valleys of Pennsylvania are generally much greater than the distances that English fluorspar must be carried from the ports of entry to these plants, so that an advantage in price on account of a saving in railway freight charges may be enjoyed by users of the imported material. Unless ocean freight rates are moderate, however, foreign fluorspar

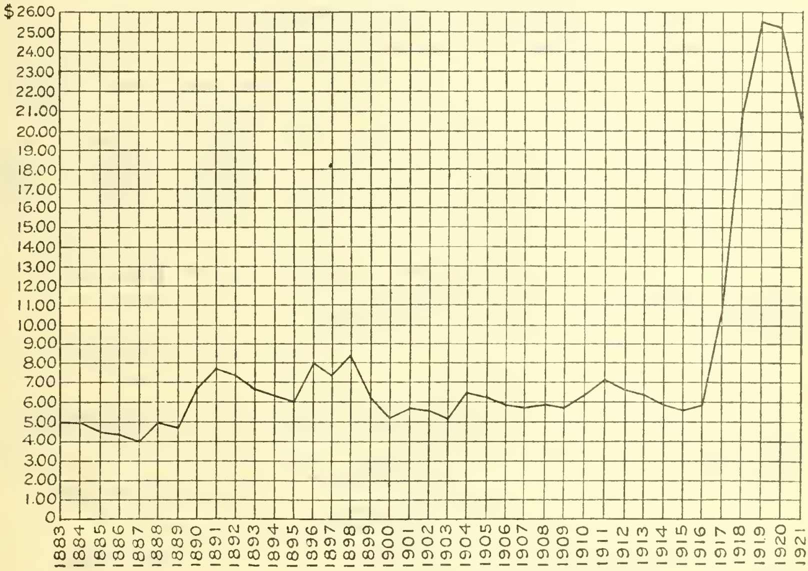

FIGURE 4.—Curve showing average prices per ton of fluorspar at the mines in the United States, 1883–1921.

is not in a position to enjoy much advantage in American markets, for the reason that the foreign material is not generally of so high a grade as the mechanically treated domestic product, and as fluorspar is of value chiefly according to its purity, purchasers should find that the purer American fluorspar is more efficient and consequently cheaper in the end.

As shown by the accompanying diagram (fig. 5) and table, the greater part of the fluorspar imported in 1921 was brought from Canada, and probably most of it was shipped to steel plants at Indiana Harbor, Ind. The greater part of the English fluorspar was probably taken by steel plants at Sparrows Point, Md., and Coatesville and Steelton, Pa.

Fluorspar imported into the United States, by countries, in 1920 and 1921.

Country.	1920			1921		
	Short tons.	Value.	Average value.	Short tons.	Value.	Average value.
England	17,096	$144,142	$8.43	1,644	$12,031	$7.32
Canada	7,068	110,532	15.64	4,370	52,855	12.09
Germany	407	9,450	23.22	215	4,420	20.56
British South Africa	30	1,080	36.00			
Australia	11	426	38.73			
	24,612	265,630	10.79	6,229	69,306	11.13

Fluorspar imported and entered for consumption, 1917–1921.

Year.	Short tons.	Value	Average value.
1917	13,616	$114,598	$8.42
1918	12,572	169,364	13.47
1919	6,943	107,631	15.50
1920	24,612	265,630	10.79
1921	6,229	69,306	11.13

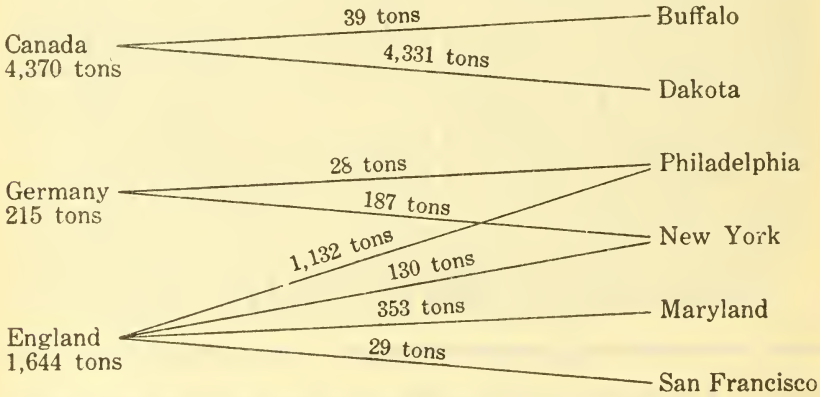

FIGURE 5.—Source and district of entry of fluorspar imported into the United States in 1921.

No fluorspar was reported to have been exported from the United States in 1921. The exports in 1920, as reported to the United States Geological Survey by the producers of fluorspar, amounted to 2,764 short tons, valued at $65,475, or $23.69 a ton. The exported fluorspar, most of which was gravel, went to Canada.

CONSUMPTION.

The market for the bulk of the fluorspar sold in the United States depends on the condition of the steel industry, and the demand fluctuates with the production of basic open-hearth steel. Most of the domestic gravel and some of the lump fluorspar, together with probably most of the imported fluorspar, are consumed as flux in basic open-hearth steel furnaces and to a smaller extent in other metallurgic operations. From 1916 to 1920 the sales of gravel have constituted between 83 and 89 per cent of the total shipments of domestic fluorspar, but in 1921 these sales constituted only 72 per cent of the total. Fluorspar is also used as a flux in iron blast furnaces, iron foundries, and gold, silver, copper, and lead smelters; it is used also in the manufacture of glass, of enameled and sanitary ware, of sodium fluoride used as a wood preservative, and of hydrofluoric acid; in the electrolytic refining of antimony and lead; in the production of aluminum; and in other minor applications.

Information furnished by steel manufacturers who produce about two-thirds of the output of basic open-hearth steel shows that the consumption of fluorspar per ton of steel produced in 1921 ranged from 4.8 to 18.6 pounds and averaged 8.2 pounds. These steel companies reported a consumption of 45,631 short tons of fluorspar in 1921, which, on the assumption that the remaining companies consumed a like proportion, would indicate a total consumption of about 68,400 tons for all open-hearth plants, compared with about 117,000 tons in 1920. This group of steel manufacturers also reported stocks of fluorspar on January 1, 1922, amounting to 19,755 short tons, which would indicate total stocks approximating 30,000 tons at all steel plants, as compared with about 66,600 tons in 1920. These reports, therefore, show that the greater part of the flourspar consumed in 1921 was withdrawn from consumers' stocks.

The shipments of domestic fluorspar plus the imports minus the exports should give from year to year an index to the quantity available for consumption and indicate its relative increase or decrease. The total quantity of all grades of fluorspar available for consumption in 1921 was 41,189 short tons, a decrease of 80 per cent compared with 1920. The general relation between the total supply of fluorspar and the output of open-hearth steel may be noted by comparison of the following tables:

Fluorspar available for consumption, 1917–1921, in short tons.

Year.	Sales of domestic spar.	Imports for consumption.	Exports.	Available for consumption.
1917	218,828	13,616	(a)	232,444
1918	263,817	12,572	(a)	276,389
1919	138,290	6,943	(a)	145,233
1920	186,778	24,612	b 2,764	208,626
1921	34,960	6,229	....	41,189

a Not available.
b Reported by producers; none recorded by Bureau of Foreign and Domestic Commerce.

Open-hearth steel produced in 1917–1921, in long tons.

[From reports of the American Iron and Steel Institute.]

Year.	Basic.	Acid.	Total.
1917	32,087,507	2,061,386	34,148,893
1918	32,476,571	1,982,820	34,459,391
1919	25,719,312	1,229,382	26,948,694
1920	31,375,723	1,296,172	32,671,895
1921	15,042,564	507,238	15,549,802

SHIPMENTS, BY USES.

The large dependence of the fluorspar industry on the steel industry is clearly shown by the fact that by far the greater part of the fluorspar shipped is taken by steel manufacturers. There is considerable variation in the average price per ton of the fluorspar shipped to the several industries. The high price of fluorspar for hydrofluoric acid and glass and enamel ware is due to the high quality demanded.

Fluorspar shipped in 1920 and 1921, by uses.

Use.	1920				1921			
	Quantity.		Value.	Average price.	Quantity.		Value.	Average price.
	Percentage.	Short tons.			Percentage.	Short tons.		
Steel	81.01	151,311	$3,393,246	$22.43	73.09	25,553	$407,230	$15.94
Glass and enamel ware	5.76	10,756	474,483	44.11	16.02	5,599	224,137	40.03
Hydrofluoric acid (including fluorspar used in manfacture of aluminum)	10.44	19,498	718,744	36.86	5.24	1,833	52,455	28.62
Miscellaneous	1.31	2,449	66,599	27.19	5.65	1,975	40,272	20.39
	98.52	184,014	4,653,072	25.29	100.00	34,960	724,094	20.71
Exported to Canada	1.48	2,764	65,475	23.69				
	100.00	186,778	4,718,547	25.26	100.00	34,960	724,094	20.71

A FLUORSPAR DEPOSIT IN UTAH.

By Victor C. Heikes.

A deposit of fluorite, the only one in Utah from which the mineral has been shipped in commercial quantity, is at the north end of the Wild Cat Mountains, in Tooele County, 20 miles southwest of Clive, a station 74 miles west of Salt Lake City on the Western Pacific Railroad. This deposit gives promise of supplying the needs of the steel works near Salt Lake City and the chemical works on the Pacific coast that require a pure product.

The Wild Cat Mountains appear to be made up of sedimentary rocks of Pennsylvanian age cut by a few small dikes of basalt. Only the northern part of the mountains, however, was closely examined. The oldest rock exposed is a thick-bedded blue limestone, interstratified with a few thin beds of shale. This limestone, which is traversed by some veinlets of white calcite, contains the fluorspar deposits so far developed. Overlying this rock is about 450 feet of thin-bedded black limestone, followed by about 700 feet of thick-bedded gray and blue limestones, full of veinlets of white calcite. Interbedded with these limestones are a few thin beds of siliceous shale. Above the gray and blue limestones is 350 feet of thin-bedded siliceous and shaly limestones, weathering to a light reddish color, above which, forming the crest of the ridge, is quartzite. The few small dikes seen range from a few inches to 4 feet in width and run roughly parallel with the fissures that contain the fluorspar deposits. These dikes are exposed only for short distances.

The beds of the Wild Cat Mountains strike northeast and dip southeast. The angle of dip at the mine is 35°, but the average dip for the range as a whole is probably considerably less. The only faulting observed was along the fissures that contain the ore deposits. The walls of these fissures in places are slickensided and polished, but the fissures contain little gouge or breccia, and the displacement along them was apparently slight.

On top of the ridge at its north end is a zone of vertical sheeting, which strikes about north. This zone contains pyrite and chalcopyrite, and rock from it is said to assay from 1 to 6 ounces of silver to the ton.

The principal ore deposits are replacement veins in limestone. They carry silver, copper, fluorite, and in places a little lead, barite, and quartz. The veins strike northeast and dip steeply to the northwest. The width of the veins ranges from a few inches to several feet. The vein walls are broken by numerous fractures. Where the fracturing is strong the limestone has been most extensively replaced, and in such places the vein may have a workable width of 15 feet or more.

Generally the limestone near the ore is bleached and silicified. The greatest rock alteration occurs alongside the basaltic dikes, where the limestone for a thickness of several feet is highly silicified and carries finely disseminated pyrite and chalcopyrite, with seams of fluorite and barite. Such material assays from 2 to 6 ounces of silver and $2.40 in gold to the ton. Samples of fresh dike rocks have assayed from 0.6 to 1.3 ounces of silver.

The mine workings are shallow and consist of trenches, short tunnels, and inclined shafts. The main opening, at the hoist, is an inclined shaft about 55 feet deep. Sinking was in progress at the time of visit, and the hoisting was done with a small gasoline engine.

The material so far mined and shipped has consisted of fluorite and oxidized silver-copper ores. These products are separated by hand sorting and screening. The silver-copper ore is distributed through the fluorite and limestone as small veinlets, or as the filling of interstitial spaces. The silver-copper ore constitutes about one-fifth of the total material mined. The copper minerals in this ore are principally malachite, azurite, a little chalcocite, and some cuprite. The silver invariably occurs with the copper, both as a native silver and as cerargyrite.

Analyses of carload lots of fluorspar shipped from these deposits to Salt Lake City and San Francisco show the following percentages:

Analyses of fluorspar from Wild Cat Mountains, Utah.

CaF_2.	$CaCO_3$.	SiO_2.	CaF_2.	$CaCO_3$.	SiO_2.
97.23	1.36	0.48	85.46	11.10	2.4
87.26	6.50	3.90	88.36	8.43	2.1
88.30	5.25	4.1	89.42	5.92	2.83
89.10	6.44	3.07	86.14	9.60	3.16
89.15	6.55	3.05	88.65	5.56	3.62

The average content of a carload lot of silver-copper ore, according to the smelter's settlement sheet, was as follows: Gold, $0.015; silver, 43.6 ounces; copper, 3.7 per cent; silica, 33.6 per cent; lime, 34.95 per cent; sulphur, 0.8 per cent; iron, 1 per cent; zinc, 0.2 per cent.

FLUORSPAR IN CANADA.

The shipments of fluorspar in Canada in 1921 amounted to 5,519 short tons, valued at $136,267, as compared with 11,235 short tons, valued at $240,446, in 1920, a decrease of 51 per cent in quantity and 43 per cent in value.[3]

The Rock Candy group, near Grand Forks, in British Columbia, contributed 98 per cent of the output, and the greater part of it was exported to the United States.

The imports of fluorspar into Canada in 1921 amounted to 3,867 short tons, valued at $43,752, and the exports were 4,625 tons, valued at $51,470.

PRODUCTION IN PRINCIPAL COUNTRIES.

Fluorspar produced in principal countries, 1913, 1915, and 1917–1921, in metric tons.

[For more complete data see U. S. Geol. Survey Mineral Resources, 1921, pt. 1, pp. 513-564.]

Country.	1913	1915	1917	1918	1919	1920	1921
United States	104,853	124,230	198,519	239,333	125,454	169,441	31,715
Canada			3,855	6,679	4,593	10,192	5,007
Great Britain	54,522	33,653	65,912	54,357	37,452	55,561	(a)
Spain	351	370	250	350	280	416	(a)
France	7,524	(a)	(a)	(a)	4,894	(a)	(a)
Italy			800	876	900	810	1,600
Norway		180		155	(a)	(a)	(a)
Australia:							
New South Wales		424	1,631	2,315	2,046	1,945	(a)
Queensland			72			613	(a)
Victoria				102	319	13	(a)
Bavaria	(a)	1,500	6,470	6,011	6,396	6,272	(a)
Saxony	3,260	3,045	1,410	2,332	2,906	(a)	(a)

a Figures not yet available.

CRYOLITE.

Cryolite occurs in commercial quantities only in Greenland, at Ivigtut. It is mined and shipped in two grades, white and black. The white cryolite, which is nearly pure except for a mixture of pyrite, galena, and siderite, is shipped to Copenhagen; the black cryolite, which contains a large quantity of fluorite, is shipped to the Pennsylvania Salt Manufacturing Co., at Philadelphia, Pa.

Cryolite is essential for the production of aluminum, the fused mineral being used as the bath for the electrolysis of alumina to the metal. It is used also in the manufacture of opaque white glass, in enameling ironware, and as a flux in the manufacture of white portland cement.

Cryolite shipped from Greenland and imported into the United States, 1917–1921.

Year.	Total shipped (long tons).[a]	Imports into United States.[b]		
		Long tons.	Value.	Average value.
1917	9,482	4,383	$218,500	$49.86
1918	9,955	1,950	97,500	50.00
1919	6,265	2,131	106,956	50.19
1920	(c)	3,864	193,638	50.11
1921	(c)	3,460	295,186	85.31

a The mineral industry of the British Empire and foreign countries: Aluminum and bauxite: Imperial Mineral Resources Bureau (London), 1921.
b Bureau of Foreign and Domestic Commerce.
c Not available.

3 Preliminary report of the mineral production of Canada during the calendar year 1921, Canada Dept. Mines, Mines Branch, 1922.

POTASH.[1]

By M. R. Nourse.

INTRODUCTION.

The general business depression, the peculiarly disorganized condition of the fertilizer business, the high freight rates, and the low price of foreign potash are given by former producers of domestic potash as the cause for the small production in 1921.

At the end of 1920 many of the domestic producers of potash had closed their plants, as the fertilizer market, owing to the financial inability of the farmer to purchase, was almost at a standstill. The price of potassium chloride (80 per cent muriate) in the New York market in 1921 ranged from \$1.85 a unit of K_2O in January to 70 cents a unit in the later part of the year. On September 28, 34 of the American fertilizer manufacturers entered into a contract,[2] terminating April 20, 1922, with the German Kali Syndicate, whereby the fertilizer manufacturers agreed to purchase from the syndicate at least 75 per cent of their entire purchases of potash salts during the life of the contract, this 75 per cent to aggregate not less than 35,680 short tons of actual potash (K_2O), the contract price ex vessel Atlantic port to be \$35.75 a ton in bulk on a basis of 80 per cent KCl and \$37 a ton in bags of 200 pounds. The contract also provided that if a manufacturer should purchase all his potash salts from the syndicate the prices should be reduced to \$34.75 a short ton in bulk and \$36 a ton in bags, with discounts of 1 to 10 per cent according to the amount purchased. It further provided that the syndicate should have opportunity to reduce its prices in the event that potash salts were offered to contracting manufacturers at lower net prices than those named in the contract. On November 17, 1921, the fertilizer manufacturers entered into contract[3] with the French potash producers for the remaining 25 per cent of their estimated requirements.

The question of a protective tariff on potash has been agitated throughout the year, hearings having been held before committees of the House [4] and Senate.[5]

[1] Since 1910 a chapter on potash has appeared annually in Part II, Mineral Resources of the United States. Extensive bibliographies and lists of United States patents covering processes for the extraction of potash from silicate rocks have formed a part of most of these chapters, in addition to which the chapter for 1910 contained a brief account of the German potash deposits, the chapter for 1915 gave simple tests for potash, those for 1916 and 1917 included detailed descriptions of the sources of potash in this country and brief statements concerning efforts to produce potash from other sources, and the chapter for 1918 included statistics of production and descriptions of refined potassium salts.

[2] Hearings before the Committee on Finance, United States Senate, on the proposed tariff act of 1921 (H. R. 7456), pp. 4731–4737.

[3] Idem, pp. 4768–4777.

[4] Tariff information, 1921. Hearings on the general tariff revision before the Committee on Ways and Means, House of Representatives; Potash, pp. 19, 30, 40, 43, 98, 217, 335–347, 359, 3188, 3567, 3992, 4013, 4373, 1921.

[5] Hearings before the Committee on Finance, United States Senate, on the proposed tariff act of 1921 (H. R. 7456); Potash, pp. 4716–4857, 1922.

The United States Potash Producers Association continued to issue a bimonthly leaflet in the interest of the domestic potash industry.

Perhaps the most vital development in 1921 in connection with a possibly permanent domestic potash industry was the discovery in western Texas of samples of salt containing unusual percentages of potash in the drillings from wells that were being sunk for oil, a brief statement concerning which will be found on pages 54–55 of this report.

PRODUCTION AND SALES.

In 1921 only 25,485 short tons of crude material containing an average of 39.9 per cent of K_2O was produced in the United States by 18 companies operating 20 plants. The sources of this material are stated in the table. No production was reported from alunite, silicate rocks, kelp, or wool washings. The only companies that reported continuous operation of their potash plants throughout the year produced their material as a by-product in the manufacture of cement, steel, and alcohol; other companies reported activities for periods ranging from 1 to 11¾ months.

The crude material sold was valued at the point of shipment at an average of $1.01 a unit (20 pounds of K_2O).

A number of companies that produced potash in 1920 but not in 1921 reported sales or stocks on hand, or both. Several of the companies that produced potash in 1921 were unable to dispose of their product. The number of plants reporting sales and stocks on hand at the end of the year is therefore given in the following table in addition to the number of producing plants.

Potash produced and sold in the United States in 1921, by sources.

Source.	Production.				Sales.[a]				Stocks on hand Dec. 31, 1921.[a]		
	Number of plants.	Crude potash (short tons).	Available content of K_2O. Short tons.	Available content of K_2O. Percentage of total.	Number of plants.	Crude potash (short tons).	Available content of K_2O (short tons).	Value f. o. b. plant.	Number of plants.	Crude potash (short tons).	Available content of K_2O (short tons).
Mineral:											
Natural brines....	7	11,907	6,057	59.6	6	6,376	3,078	$281,630	9	18,763	8,194
Dust from cement mills............	3	3,366	1,037	10.2	[b] 4	256	82	12,923	[b] 4	3,745	1,259
Dust from blast furnaces........	5	1,257	106	1.0	4	580	50	5,018	5	1,200	115
	15	16,530	7,200	70.8	14	7,212	3,210	299,571	18	23,708	9,568
Organic: Molasses distillery waste, Steffens water from beet-sugar refineries, and wood ashes.....	5	8,955	2,971	29.2	9	3,125	1,198	148,288	12	9,217	3,057
	20	25,485	10,171	100.0	23	10,337	4,408	447,859	30	32,925	12,625

[a] Sales were made and stocks reported on hand by a number of companies that did not report production in 1921.
[b] Includes alunite.

Potash produced and sold in the United States, 1915–1921.

Year.	Number of plants.		Production.		Sales.[a]		
	Total.	Exclusive of producers of wood-ash potash.	Crude potash (short tons).	Available content of K_2O (short tons).	Crude potash (short tons).	Available content of K_2O (short tons).	Value f. o. b. plant.
1915	[b] 5	5	4,374	1,090	4,374	1,090	$342,000
1916	70	25	35,739	9,720	35,739	9,720	4,242,730
1917	95	46	126,961	32,573	126,961	32,573	13,980,577
1918	128	77	207,686	54,803	140,343	38,580	15,839,618
1919	102	67	116,634	32,474	166,063	45,728	11,271,269
1920	66	49	166,834	48,077	139,963	41,444	7,463,026
1921	20	19	25,485	10,171	10,337	4,408	447,859

[a] Production and sales were practically the same from 1915 to 1917, and no distinction was made between them.
[b] Although no production was reported from wood ashes it is probable that an appreciable quantity of potash was produced from that source in 1915.

Domestic potash produced and sold in the United States in 1920 and 1921, classified according to material marketed.

Material marketed.	Crude potash (short tons).	Available content of K_2O.		
		Per cent.	Short tons.	Percentage of total.
1920.				
Crude mixed salts	94,601	10–48	25,033	60.4
High-grade chloride	22,126	45.5–58	11,926	28.8
Sulphate	4,988	33–45	2,352	5.7
Low-grade chloride	8,630	15–32	1,388	3.4
Dust from cement mills and blast furnaces	9,249	2.27–12	521	1.2
First sorts	276	60	150	.5
Caustic	93	80	74	
	139,963		41,444	100.0
1921.				
Crude mixed salts	4,432	25–42	1,517	34.4
High-grade chloride	5,028	50–58.7	2,741	62.2
Dust from cement mills and blast furnaces	657	1.8–11.2	52	1.2
All other [a]	220	29–51	98	2.2
	10,337		4,408	100.0

[a] Includes sulphate, low-grade chloride, and crude caustic.

In only two States was potash produced in 1921 in more than two plants. Production from the other States may not be noted separately, as the information received is of a confidential nature.

Potash produced in the United States in 1921, by States.

	Number of plants.	Crude potash (short tons).	Available content of K_2O.	
			Short tons.	Percentage of total.
California	6	13,075	6,187	61
Pennsylvania	5	1,257	106	1
Other States [a]	9	11,153	3,878	38
	20	25,485	10,171	100

[a] Includes two plants in Nebraska, two in Utah, and one each in Indiana, Maryland, New York, Tennessee, and Wisconsin.

GOVERNMENT ACTIVITIES.

UNITED STATES GEOLOGICAL SURVEY.

Active efforts by the United States Geological Survey in 1921 to discover new sources of raw potash materials were confined mainly to the "Red Beds" region of Texas and neighboring States. The field laboratory was maintained in the early part of the year at Cliffside, Potter County, Tex., by cooperative agreement between the Bureau of Economic Geology and Technology of the University of Texas and the United States Geological Survey. Later headquarters for this work were moved to Big Spring, Howard County. In September the Texas bureau was obliged to withdraw because of lack of funds. D. D. Christner, joint field agent, was in charge until November, when the work was turned over to H. W. Hoots, of the United States Geological Survey.

The search for potash salts in this region by the organizations mentioned has been conducted for a number of years and resulted in 1921 in obtaining from widely scattered wells being drilled for oil samples of salt containing unusual percentages of potassium. From information available concerning the formations from which these samples came it seems not unreasonable to believe that there are present in western Texas and southeastern New Mexico potash salts of commercial quality, workable thickness, and perhaps great extent.

The "Red Beds" region of central Kansas, western Oklahoma, eastern New Mexico, and northwestern Texas contains the largest known salt field of the world. The geologic record is similar to that of the potash fields of western Europe, and it has long been believed by interested geologists that this region must contain potash salts in crystalline deposits, associated with the known beds of rock salt, anhydrite, and gypsum. Data as to the most promising samples analyzed by the Geological Survey are given in the following table:

Location, depth, and content of samples from wells in "Red Beds" region analyzed for potash.

Name and owner of well.	Location.	Depth of sample (feet).	K_2O in sample.	Dissolved from 1 gram of dry rock by 100 cubic centimeters of water.	
				Total salts.	K_2O.
			Per cent.	*Per cent.*	*Per cent.*
Bryant well, States Oil Corporation.	9 miles south of Midland, Midland County.	2,405-2,411	6.00	67.30	8.94
Burns well, LaMesa Oil Co.	16 miles east of LaMesa, Dawson County.	1,864-1,865	10.82	....	....
River well, A. Pitts Oil Co.	On Pecos River 8 miles east of Barstow, Ward County.	1,600-1,610	9.03	62.74	14.40
Do	do	1,610-1,614	5.60	66.54	8.42
Do	do	1,645	4.23	40.32	10.50
Do	do	1,695-1,700	6.29	55.42	11.35
Do	do	1,875	5.65	53.60	10.54
Means well No. 1, Pinal Dome Oil Corporation.	Northeastern Loving County, 20 miles west of the southeast corner of New Mexico.	990-995	11.21	69.60	16.1
Do	do	1,740-1,745	9.00	76.40	11.78
Do	do	1,825-1,830	8.74	63.70	13.72
Do	do	2,005-2,010	3.41	27.00	12.60
McDowell well No. 4	Glasscock County	1,035-1,050	10.67	....	15.22
St. Rita well No. 1, Texon Oil & Land Co.	Southwest corner of Reagan County.	1,175-1,182	5.63	62.60	8.99
Do	do	1,283-1,293	7.88	84.20	9.38
Do	do	1,316-1,325	8.29	76.90	10.78

The region in which these wells were drilled has been briefly outlined in a recent press statement,[6] as follows:

Starting from the Means well, which is close to the New Mexico-Texas line, in Loving County, about 20 miles west of the southeast corner of New Mexico, the boundary of the area in which potash in notable richness has been found in the "Red Beds" runs southward for 30 miles to well No. 1 or the river well of the Pitts Oil Co., about 8 miles east of Barstow, thence east by northeast 130 miles to the McDowell well, in northern Glasscock County, and thence north by northwest 50 miles to the Burns well, in Dawson County, from which it returns in a west by southwest direction to the starting point.

As the wells were drilled for oil and the easily soluble salts were of secondary consequence to the drillers, the samples have been accompanied by scant data relative to conditions in the wells when they were taken. It is therefore impossible to say whether the samples analyzed represent beds several feet thick or only a few inches. Core drilling will have to be done in order to determine this matter.

More detailed information concerning this work will be found in papers listed in the bibliography (p. 59), under "United States Geological Survey."

BUREAU OF MINES.

The experiment station of the Bureau of Mines at Salt Lake City continued its research work on the extraction of potash from low-grade alunite. A study of the methods of mining potash in Europe is in progress, the results of which will later be prepared for publication.

BUREAU OF SOILS.

No appropriation for the completion, operation, and maintenance of the experimental kelp potash plant of the Bureau of Soils at Summerland, Calif., was made by Congress for 1921. The plant was therefore sold in March, 1922.

EXPORTS AND IMPORTS.[7]

A comparatively small quantity of potash materials, including refined potassium salts, is exported from the United States, but information concerning these exports is meager. The available data on exports for 1920 and 1921 are shown in the following table:

Potassium salts exported from the United States in 1920 and 1921.

Salt.	1920		1921	
	Short tons.	Value.	Short tons.	Value.
Chlorate	1,410	$445,243	188	$49,709
All other	....	3,116,772	....	286,284
	....	3,562,015	....	335,993

The imports of potash materials in 1921 are shown in the following table. For the five years prior to 1914 the United States imported annually from Germany an average of about 250,000 short tons of potash (K_2O), or more than three times the total imports for 1921.

[6] Steiger, George, Extension of possible potash area in west Texas (U. S. Geol. Survey press notice, Feb. 8, 1922).

[7] Figures on imports and exports in this report were compiled by J. A. Dorsey, of the U. S. Geological Survey, from the records of the Bureau of Foreign and Domestic Commerce.

Potash materials imported and entered for consumption in the United States, 1913, 1920, and 1921.[a]

Material.	Approximate K_2O content (per cent).	1913				1920				1921			
		Short tons.	Available content of K_2O.		Value.	Short tons.	Available content of K_2O.		Value.	Short tons.	Available content of K_2O.		Value.
			Short tons.	Per centage of total.			Short tons.	Percentage of total.			Short tons.	Percentage of total.	
Kainite	12.4	521,176	64,626	23.9	$2,201,730	416,661	51,666	23.0	$8,212,621	77,365	9,593	12.2	$1,453,854
Manure salts	20.0	250,529	50,106	18.5	2,245,509	348,837	69,767	31.0	10,625,717	43,286	8,657	11.0	792,601
Muriate	50.0	237,630	118,815	43.8	7,075,745	136,194	68,097	30.3	12,703,858	79,642	39,821	50.6	4,777,726
Sulphate	48.6	44,349	21,554	8.0	1,677,429	17,006	8,265	3.7	2,343,431	12,459	6,055	7.7	719,183
Total [b]		1,053,684	255,101	94.2	13,200,413	918,698	197,795	88.0	33,885,627	212,752	64,126	81.5	7,743,364
Bicarbonate	46.0	223	103		20,968	194	89		93,565	197	91	.1	33,352
Bitartrate (argol)	20.0	14,499	2,900	1.1	2,779,180	17,779	3,556	1.6	4,452,428	8,089	1,618	2.1	1,189,902
Bitartrate (cream of tartar)	25.0	75	19		28,314	109	27		83,903	669	167	.2	306,674
Carbonate, crude	61.0	4,858	2,963	1.1	272,973	8,452	5,156	2.3	510,700	2,024	1,235	1.6	191,265
Carbonate, crude or black salts	50.0	344	172	.1	17,852	7,356	3,678	1.7	417,797	1,665	833	1.1	76,091
Carbonate, refined	67.0	6,145	4,117	1.5	393,284	882	591	.2	290,354	70	47	.1	14,952
Caustic	80.0	4,324	3,459	1.3	342,056	856	685	.3	451,274	5,455	4,364	5.5	487,182
Chlorate	38.0	596	226	.1	64,468	742	282	.1	162,417	2,771	1,053	1.3	246,191
Chromate and bichromate	40.0	9	4		1,819	2	1		2,690	37	14		6,772
Cyanide	70.0	735	514	.2	216,844	7,224	5,056	2.3	1,088,247	1,886	1,320	1.7	319,683
Ferricyanide (red prussiate)	42.0	34	14		12,035	51	21		64,686	13	5		4,878
Ferrocyanide (yellow prussiate)	44.0	1,706	751	.3	388,379	381	17		105,962	224	99	.1	91,447
Iodide	28.0					3	1		14,872				580
Nitrate (saltpeter), crude	40.0	4,826	193	.1	261,078	18,816	7,526	3.4	1,599,346	8,297	3,319	4.2	590,200
Nitrate (saltpeter), refined	46.0	203	93		22,602	631	290	.1	107,154	670	308	.4	45,548
Permanganate	29.0	273	79		38,188	27	8		29,748	192	56	.1	72,232
Rochelle salt	22.0	54	12		13,412	59	13		29,013	194	43		62,141
Total [c]		38,904	15,619	5.8	4,873,452	63,564	26,997	12.0	9,504,156	32,453	14,572	18.5	3,739,090
Grand total		1,092,588	270,720	100.0	18,073,865	982,262	224,792	100.0	43,389,783	245,205	78,698	100.0	11,482,454

[a] The figures in this table were compiled from the records of the Bureau of Foreign and Domestic Commerce, United States Department of Commerce, by recalculation to short tons and to actual potash (K_2O) and by giving the totals for calendar years instead of fiscal years. The tons are calculated to the nearest even unit, and the values are those given in the original records, so that the value given for a high-priced commodity received in small quantity may not be strictly applicable to the quantity given. For instance 2,705 pounds of cyanide received in 1916 is reported as 1 ton, but the value given is that of the actual quantity received. Furthermore the values are those placed on the commodities by the shippers and represent the values at point of shipment and do not agree with market quotations in this country.

[b] Used principally in fertilizers.

[c] Used principally in chemical industries.

The first four salts listed in the foregoing table are used principally in fertilizers and are produced chiefly in France and Germany; the other materials listed are manufactured potassium salts, more or less refined, and are used in chemical industries.

The figures in the following table have been compiled and recalculated from the records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Potash (K_2O) imported for consumption in the United States, 1913–1921, in short tons.

1913	270, 720	1918	7, 957
1914	207, 089	1919	39, 619
1915	48, 867	1920	224, 792
1916	7, 885	1921	78, 698
1917	8, 100		

Until 1915 practically all the potash brought into this country came from Germany; from 1916 until 1920 it came from many different countries; in 1921 it came principally from Germany, France, and Belgium, though that from Belgium and also that from Canada doubtless originated in Germany and France. Unfortunately there is no authentic information at hand concerning the original source of these shipments.

Potash imported into the United States in 1921, in short tons. [a]

[The figures in parentheses in the column headings indicate percentage of K_2O.]

Country.	Manure salts (20).	Kainite (12.4).	Muriate (50).	Sulphate (48.6).	Bitartrate argols or wine lees (20).	Carbonate of, including crude or black salts (50, 61, 67).	Cyanide (70).	Hydrate (80).	Nitrate of, or saltpeter, crude (40).	All other (50).	Total. Short tons.	Total. Value.
Belgium	5,036	19,783	10,281	387		1,629		39		197	37,352	$1,511,761
Czechoslovakia						22		604		95	721	77,252
Denmark								17		137	154	34,981
Finland										618	618	44,147
France	14,494	37,904	29,561		1,949	478				7	84,393	4,135,766
Germany	23,731	19,678	36,001	8,277	11	1,405	38	4,420		2,808	96,369	2,885,787
Greece					130						130	12,288
Italy					1,744						1,744	295,225
Netherlands			299			77		223		119	718	69,785
Portugal					623						623	91,221
Spain					1,726						1,726	235,458
Sweden			22					2		21	45	6,428
Switzerland				91	1			104		6	202	24,730
England	25		67			39		46		40	217	21,607
Canada			3,411	3,642	6	98	1,848		223		9,228	839,337
Mexico	(b)											10
Argentina					481					4	485	75,814
Chile					84				6,096		6,180	339,170
China				62	3						65	3,066
British India									1,978		1,978	243,362
Dutch East Indies						5					5	2,642
Hongkong						6					6	1,420
Japan										12	12	3,506
British South Africa					5						5	845
French Africa					1,281						1,281	127,538
	43,286	77,365	79,642	12,459	8,044	3,759	1,886	5,455	8,297	4,064	244,257	11,086,146
Content of potash (K_2O)	8,657	9,593	39,821	6,055	1,609	2,115	1,320	4,364	3,319	2,032	78,885	

[a] The figures in this table were compiled from the records of the Bureau of Foreign and Domestic Commerce, United States Department of Commerce, by recalculation to short tons and to the actual potash (K_2O) and by giving the totals by the calendar year instead of the fiscal year. The tons are calculated to the nearest even unit. The data represent general imports and include both imports for immediate consumption and those going to warehouses, which may or may not be entered for consumption during the year. They differ slightly from the figures in the preceding table of imports, which represents imports for consumption.

[b] Less than 1 ton.

The total output of the German mines in 1921 was 921,186 metric tons of actual potash (K_2O), of which 768,565 metric tons was consumed in Germany and 152,621 metric tons exported.[8] The total output of the French mines in 1921 was 903,134 metric tons of crude material containing 146,355 metric tons of potash (K_2O).[9]

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RECENT PATENTS.

The following United States patents covering the extraction of potash from silicate rocks were issued:

1345077, June 29, 1920, DeLuce, R. Potash-bearing materials are mixed with a large amount of lime and passed into a pressure tank with superheated steam and heated to 200° to 250° to produce a fertilizer.

1366569, Jan. 25, 1921, Kreiss, A. L. Fertilizer material is prepared by leaching the product obtained by calcining a mixture of suitable proportions of phosphate rock, potash-bearing silicate, and either or all of the following: Sodium sulphate, potassium carbonate, sodium carbonate, and potassium sulphate.

1377601, May 10, 1921, Ravner, Oystein. Rocks or mineral containing potassium are heated with ashes of marine plants until a soluble compound of potassium is formed.

1378485, May 17, 1921, Rankin, H. D. Magnetite, feldspar, or similar material which is resistant to solvents is heated with just sufficient sulphuric acid to wet the material thoroughly in a closed vessel to a temperature sufficient to boil the acid in order to dissolve or solubilize the constituents of the material.

1379914, May 31, 1921, Glaeser, Walter. A powdered amorphous silicate is mixed with calcium chloride and a chlorine-conveying substance and heated out of contact with the atmosphere to above 800°.

1382037, June 21, 1921, Welch, H. V. A process of obtaining potassium compound from suspended matter of kiln flue gases by treatment with water to obtain a saturated solution, then heating the resulting sludge to cause the solution of insoluble potassium compound and separating the resulting solution from the remaining insolubles.

1386486, Aug. 2, 1921, Allingham, J. Finely divided potash-bearing rock is mixed with common salt and sulphur and heated in a reducing atmosphere in a furnace; the mass is then lixiviated with water, and potassium chloride is recovered by crystallization.

1388276, Aug. 23, 1921, McKirahan, S. Finely divided fluorspar is mixed with a noncalcic silicate, and the mixture is heated to volatilize the potassium as potassium chloride, which is recovered from the volatile product.

1399216, Dec. 6, 1921, Levitt, E. Potassium-bearing silicates are treated with a flux containing boron trioxide, powdered, mixed with water, and treated with a solution of sulphur dioxide, and the resulting compounds are recovered.

1402831, Jan. 10, 1922, Brown, C. M. Finely ground feldspar is subjected to the action of sulphurous gases in the presence of air in a heated atmosphere, which changes the potassium and aluminum compounds to sulphates. This product is leached with water and evaporated to recover the salts.

1402973, Jan. 10, 1922, Shoeld, M. Leucite or similar material is ground in a solution of common salt, the ingredients of the resulting sludge are proportioned by the addition of a solution of common salt, the sludge is subjected to sufficient heat and pressure to effect an interchange of the potassium of the mineral and the sodium of the solution, and the potassium chloride is then recovered from the liquor.

1409139, Mar. 7, 1922, Glaeser, Walter. Finely ground potassium-bearing silicates are mixed with sodium sulphate and lime, the mixture is heated to a temperature of about 800° C. in a closed chamber, and the soluble potassium sulphate is leached therefrom and crystallized.

PHOSPHATE ROCK.

By K. W. Cottrell.

SUMMARY.

The year 1921 was one of severe depression in the phosphate-rock industry. The sales of rock from the mines declined to about 2,000,000 long tons, which was less than has been sold in any other year since 1905, except 1915 and 1916, the period of extreme war restriction. The depression of 1921 is the more marked because the large output of phosphate rock in 1920 seemed to indicate complete recovery from the decline that began in 1914 and extended through 1919. Presumably overproduction in 1920 accounts for at least some of the falling off in 1921.

The sales of phosphate rock of all kinds from the mines in the United States in 1921 decreased neary 50 per cent in quantity and more than 50 per cent in value as compared with 1920. The quantity of rock mined decreased nearly 40 per cent for the United States as a whole, ceased entirely in South Carolina, and dropped off nearly 90 per cent in the Western States, nearly one-half in Tennessee and Kentucky, and more than one-third in Florida. The decrease affected all varieties of product but was larger in Florida hard and soft rock than in land pebble and larger in Tennessee blue rock than in brown rock. The exports of phosphate rock of all kinds also decreased, having been nearly one-third less than in 1920.

PRODUCTION.

Phosphate rock sold in the United States, 1911–1921.

Year.	Long tons.	Value f. o. b. mines.	Year.	Long tons.	Value f.o.b. mines.
1911	3,053,279	$11,900,693	1917	2,584,287	$7,771,084
1912	2,973,332	11,675,774	1918	2,490,760	8,214,463
1913	3,111,221	11,796,231	1919	2,271,983	11,591,268
1914	2,734,043	9,608,041	1920	4,103,982	25,079,572
1915	1,835,667	5,413,449	1921	2,064,025	12,270,070
1916	1,982,385	5,896,993			

Phosphate rock mined in 1920 and 1921, by States, in long tons.

State.	1920	1921	Percentage of decrease.
Florida	3,255,720	2,088,251	36
South Carolina	42,709		100
Tennessee and Kentucky	627,677	332,962	47
Western States	48,895	4,961	90
	3,975,001	2,426,174	39

Raw phosphate rock sold for direct application to the soil, 1914–1921.

	Long tons.		Long tons.
1914	48,317	1918	45,294
1915	50,468	1919	79,189
1916	70,233	1920	72,801
1917	75,861	1921	13,503

Phosphate rock mined and sold in the United States, 1920–21, by States.

State.	1920		1921	
	Long tons.	Value.	Long tons.	Value.
Florida:				
Hard rock	400,249	$4,525,191	175,774	$1,806,671
Soft rock	13,953	190,551	4,419	20,153
Land pebble	2,955,182	14,748,620	1,599,835	8,604,818
	3,369,384	19,464,362	1,780,028	10,431,642
South Carolina:				
Land rock	44,141	367,209		
Tennessee:				
Brown rock	[a] 556,177	4,425,761	[a] 252,543	1,666,358
Blue rock	78,671	518,234	25,163	146,198
	[a] 634,848	4,943,995	[a] 277,706	1,812,556
Western States [b]	55,609	304,006	6,291	25,872
	4,103,982	25,079,572	2,064,025	12,270,070

[a] Includes brown rock from Kentucky. [b] 1920: Idaho and Utah; 1921: Idaho and Montana.

World's production of phosphate rock, 1917–1920, in metric tons.

[For more complete data see U. S. Geol. Survey Mineral Resources, 1921, pt. 1, pp. 513–564.]

Country.	1917	1918	1919	1920
Algeria	[a] 234,825	[a] 198,539	276,040	502,614
Angaur Island	(b)	(b)	(b)	(b)
Belgium	138,300	61,700	90,970	133,040
Canada [b]	135	127	22	
Christmas Island	89,889	54,227	(b)	(b)
Dutch West Indies:				
Aruba	3,639			
Curacao			10,058	61,440
Egypt	115,732	31,147	29,364	114,813
France	(b)	(a)	103,869	(b)
French Guiana	(b)	(b)	(b)	(b)
Indo-China			7,050	13,200
Japan, including Rasa Island	122,000	191,722	122,868	(b)
Makatea Island	114,780		40,000	(b)
New Caledonia, Huon Island	6,004	7,925	5,729	(b)
New South Wales	2,032	305	585	156
New Zealand	5,131	5,080	4,064	
Norway [c]	1,832	4,562	(b)	(b)
Ocean and Nauru Islands	202,000	155,000	115,000	(b)
Portugal			300	1,775
Russia	(b)	(b)	(b)	(b)
South Australia	5,183	8,204	6,045	8,893
Spain	28,148	43,303	25,035	42,896
Tunis	576,000	862,494	1,075,214	1,075,180
Victoria	1,549	3,438	2,521	4,290
United States	2,625,636	2,530,612	2,308,448	4,169,851

[a] Exports. [b] Not available. [c] Apatite.

EXPORTS.[1]

Phosphate rock exported from the United States, 1919-1921.

Kind.	1919		1920		1921	
	Long tons.	Value.	Long tons.	Value.	Long tons.	Value.
Phosphate rock, ground or unground, not acidulated:						
High-grade rock	215,039	$2,261,852	344,896	$4,496,457	182,594	$2,592,541
Land pebble	128,860	904,308	693,355	5,593,814	544,425	4,627,875
All other	34,832	401,822	31,461	479,904	6,293	99,721
	378,731	3,567,982	1,069,712	10,570,175	733,312	7,320,137

Phosphate rock, ground or unground, not acidulated, exported from the United States, 1919–1921.

High-grade rock.

Country.	1919		1920		1921	
	Long tons.	Value.	Long tons.	Value.	Long tons.	Value.
Belgium	16,161	$161,610	55,645	$690,705	41,513	$622,695
Canada	752	14,195	2,226	39,442	6,559	89,262
Cuba	1,884	21,216				
Denmark	80,753	828,519	58,211	755,655		
England			8,306	124,587	5,042	78,166
Germany	28,062	300,782	104,433	1,407,445	91,880	1,293,893
Ireland			4,600	69,000		
Japan			4,292	35,076		
Netherlands	10,702	134,147	19,522	266,217	25,100	328,900
Norway	18,517	201,036	30,978	428,865	2,500	38,500
Poland and Danzig					10,000	141,125
Spain	18,527	200,255	24,480	312,845		
Sweden	37,106	375,048	32,203	366,620		
Switzerland	2,575	25,044				
	215,039	2,261,852	344,896	4,496,457	182,594	2,592,541

Land pebble.

Country.	1919		1920		1921	
	Long tons.	Value.	Long tons.	Value.	Long tons.	Value.
Belgium			26,788	$216,934	45,160	$389,695
Canada	1,202	$4,807	3,854	30,494	146	2,676
Cuba	8,449	32,857	34,208	262,204	7,055	43,101
Denmark	17,943	161,776	18,406	192,648	9,062	103,791
England	27,324	177,993	154,975	1,277,278	52,924	422,495
France					20,380	124,323
Germany			9,129	96,855	79,004	884,135
Honduras					3,596	16,182
Ireland	11,517	75,889	61,097	395,797	36,713	289,779
Italy					7,352	73,520
Japan			42,516	322,428	20,743	113,799
Netherlands	26,953	185,256	70,477	505,612	69,416	558,912
Norway			2,500	22,500		
Other British West Indies			3,675	25,100		
Portugal			8,305	55,381	24,545	260,315
Scotland	7,150	82,225	77,487	574,305	17,438	138,085
Spain	16,072	108,540	139,066	1,226,670	133,462	1,005,634
Sweden	12,250	74,965	40,872	389,608	17,429	200,433
	128,860	904,308	693,355	5,593,814	544,425	4,627,875

[1] Tables compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce.

Phosphate rock, ground or unground, not acidulated, exported from the United States, 1919–1921—Continued.

All other phosphate rock.

Country.	1919		1920		1921	
	Long tons.	Value.	Long tons.	Value.	Long tons.	Value.
Barbados	50	$1,375				
Belgium	5,554	55,540				
British Honduras	1	7				
Canada	5,303	70,958	12,955	$187,780	4,931	$72,023
China	1	6				
Costa Rica	250	1,450				
Cuba	4,156	74,181	8,134	160,824	1,197	23,635
Denmark	2,000	36,960				
England	1	2				
Germany			3,300	51,150		
Honduras	1	28			22	250
Ireland			2,500	14,250		
Jamaica	75	1,601				
Japan			1,382	12,737		
Mexico	2	70			110	2,975
Netherlands	3,500	59,500				
Newfoundland and Labrador			37	316	23	463
Norway	2,200	17,607				
Oceania:						
Australia			3	30		
New Zealand			1	10		
Other British					1	17
Other British West Indies	1	10	149	3,307	9	358
Spain			3,000	49,500		
Sweden	11,737	82,527				
	34,832	401,822	31,461	479,904	6,293	99,721

ASPHALT AND RELATED BITUMENS.

By K. W. Cottrell.

SUMMARY.

The sales of native asphalt and related bitumens in the United States in 1921 increased 49 per cent in quantity and 64 per cent in value over those in 1920. The sales of asphalt manufactured from domestic petroleum, however, decreased 11 per cent in quantity and 25 per cent in value and the sales of asphalt manufactured in the United States from Mexican petroleum decreased 13 per cent in quantity and 18 per cent in value.

The number of operators reporting the production of asphalt and related bitumens was 44, of whom 15 produced native asphaltic materials, 16 manufactured asphalt from petroleum of domestic origin exclusively, 10 from petroleum of Mexican origin, and 3 from both domestic and Mexican petroleum. The output of bituminous rock in 1921 (reported by 7 operators—2 each in California, Oklahoma, and Texas, and 1 in Kentucky) increased 115 per cent in quantity and 237 per cent in value over that in 1920. Gilsonite was reported from Uintah County, Utah; wurtzilite (elaterite) from Duchesne County, Utah; and grahamite from Pushmataha County, Okla.

Manufactured asphalt.—In the production of asphalt from domestic petroleum, California, with 8 operators reporting, ranked first, and Texas and Illinois, each with 4 operators reporting, ranked second and third, respectively, in both quantity and value.

Ozokerite.—The imports of ozokerite or other mineral waxes increased more than 100 per cent in quantity over those of 1920, but very little in value, owing to a drop in price from about 12 cents a pound in 1920 to about 6 cents in 1921.

Ichthyol.—The Meadows Chemical Corporation, 52 Vanderbilt Avenue, New York City, reports the manufacture of an ammonium ichthyolate, having practically no odor, from an oil distilled from the limestone at Burnet, Tex., and shipped to the laboratory at Durant, N. Y. The imports of ichthyol and ichthyol substitutes decreased in quantity from those of 1920, but increased in value.

Consumption.—It is impossible to arrive at an exact statement of the asphaltic material consumed in the United States, but if from the sum of the quantity produced from domestic deposits and manufactured from domestic and Mexican petroleum plus the quantity imported is taken the quantity exported the result reached is approximately correct.

PRODUCTION.

Native asphalt and related bitumens sold in the United States, 1916–1921.

[Value f. o. b. mine.]

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1916	98,477	$923,281	1919	88,281	$682,989
1917	81,604	773,424	1920	198,497	1,213,908
1918	60,034	780,808	1921	296,412	1,985,583

Native asphalt and related bitumens sold in the United States, 1916–1921, by States.

[Value f. o. b. mine.]

State.	1916		1917		1918	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
California	18,135	$45,102	6,009	$19,447	3,260	$12,516
Oklahoma	(a)	(a)	(a)	(a)	(a)	(a)
Utah	26,874	633,440	35,192	569,325	31,072	663,258
Other States [b]	53,468	244,739	40,403	184,652	25,702	105,034
	98,477	923,281	81,604	773,424	60,034	780,808
	1919		**1920**		**1921**	
California	[c] 3,614	$15,037	(a c)	(a c)	(a c)	(a c)
Oklahoma	[d] 4,323	18,187	[d] 7,522	$45,898	[d] 25,573	$87,587
Utah	[e] 33,992	406,610	[e] 63,522	659,176	[e] 10,371	190,808
Other States [b]	[f] 46,352	243,155	[c] 127,453	508,834	[c] 260,468	1,707,188
	88,281	682,989	198,497	1,213,908	296,412	1,985,583

[a] Included under "Other States."
[b] 1916 and 1917: Colorado, Kentucky, Oklahoma, and Texas; 1918: Kentucky, Oklahoma, and Texas; 1919: Illinois, Kentucky, and Texas; 1920 and 1921: California, Kentucky, and Texas.
[c] Bituminous rock.
[d] Bituminous rock and grahamite.
[e] Gilsonite and wurtzilite (elaterite).
[f] Bituminous rock, grahamite, and impsonite.

Asphalt manufactured in the United States from petroleum and sold at refineries, 1916–1921.

[Value f. o. b. refinery.]

Year.	From domestic petroleum.		From Mexican petroleum.	
	Short tons.	Value.	Short tons.	Value.
1916	688,334	$6,178,851	572,387	$6,018,851
1917	701,809	7,734,691	645,613	7,441,813
1918	604,723	8,796,541	597,697	9,417,818
1919	614,692	8,727,372	674,876	7,711,510
1920	700,496	11,985,457	1,045,779	14,272,862
1921	624,220	9,048,221	908,093	11,761,358

Asphalt and asphaltic material manufactured in the United States from petroleum and sold at refineries, 1921, by varieties.

[Value f. o. b. refinery.]

Product.	Solid and semisolid products of less than 200 penetration.		Semisolid and liquid products of more than 200 penetration.		Grand total.	
	Asphalt.		Flux.[a]			
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
From domestic petroleum:						
Paving[b]	201,087	$3,265,358	66,579	$589,697	267,666	$3,855,055
Roofing and waterproof[c]	184,460	2,866,761	19,412	272,472	203,872	3,139,233
Mineral rubber[d]	2,103	104,977			2,103	104,977
Other[e]	27,983	461,099	31,383	315,547	59,366	776,646
Road oil[f]			91,213	1,172,310	91,213	1,172,310
	415,633	6,698,195	208,587	2,350,026	624,220	9,048,221
From Mexican petroleum:						
Paving[b]	320,295	4,668,588	48,221	542,924	368,516	5,211,512
Roofing and waterproof[c]	235,679	2,944,128	95,627	940,540	331,306	3,884,668
Mineral rubber[d]	5,594	121,144			5,594	121,144
Other[e]	23,200	253,310	131,408	1,570,288	154,608	1,823,598
Road oil[f]			48,069	720,436	48,069	720,436
	584,768	7,987,170	323,325	3,774,188	908,093	11,761,358

[a] Flux: Liquid asphaltic material used in softening native asphalt or solid petroleum asphalt for paving, roofing, waterproofing, and other purposes.
[b] Paving asphalt: Refined native asphalt and asphaltic cement, fluxed and unfluxed, produced for direct use in the construction of sheet asphalt, asphaltic concrete, asphalt macadam, and asphalt block pavements, and also for use as joint filler in brick, block, and monolithic pavements.
[c] Roofing and waterproofing asphalt: Asphalt and asphaltic cement used in saturating, coating and cementing felt or other fabric and in the manufacture of asphalt shingles.
[d] Mineral rubber: Asphalt and asphaltic cement used by the rubber industry.
[e] Other solid and semisolid products: Asphalt and asphaltic cement used as dips and in the manufacture of insulating material, acid-resisting compounds, putty, mastic, and briquets and not included in the preceding definitions. Other liquid products: Petroleum asphalt used in the manufacture of saturant, paint, varnish, or other coating, exclusive of fuel oil and not included in the preceding definitions.
[f] Road oil: Residual asphaltic oil used for surface treatment.

Asphalt sold at mines and refineries in the United States, 1916–1921, by varieties.

[Value f. o. b. mine or refinery.]

Variety.	1916		1917		1918	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Petroleum asphalt[a]	688,334	$6,178,851	701,809	$7,734,691	604,723	$8,796,541
Bituminous rock	63,172	197,286	41,919	136,255	25,346	92,238
Gilsonite	26,870	629,640	35,049	532,989	30,848	606,639
Wurtzilite	4	3,800			(b)	(b)
Ozokerite			18	1,000	37	45,399
Other bituminous substances[c]	8,431	92,555	[b]4,618	[b]103,180	3,803	36,532
	786,811	7,102,132	783,413	8,508,115	664,757	9,577,349

Variety.	1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Petroleum asphalt[a]	614,692	$8,727,372	700,496	$11,985,457	624,220	$9,048,221
Bituminous rock	53,589	262,309	132,353	531,134	284,037	1,788,715
Gilsonite	(b)	(b)	56,204	548,776	10,066	178,224
Other bituminous substances[c]	34,692	420,680	9,940	133,998	2,309	18,644
	702,973	9,410,361	898,993	13,199,365	920,632	11,033,804

[a] From domestic petroleum only.
[b] Included under "Other bituminous substances."
[c] 1916: Grahamite; 1917: Grahamite and maltha; 1918, 1920, and 1921: Grahamite and wurtzilite (elaterite); 1919: Elaterite, gilsonite, grahamite, and impsonite.

IMPORTS AND EXPORTS.[1]

Native asphalt and bituminous rock imported into the United States, 1918–1921, by countries.

[General imports.]

Source.	1918		1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
North America:								
Canada	221	$4,112	38	$1,088	88	$2,832	18	$634
Mexico	12,968	96,125	6,566	31,587	15	66		
West Indies—								
British—								
Barbados	55	5,047	31	3,069	68	8,128	101	14,760
Trinidad and Tobago	58,791	327,091	51,062	350,431	100,783	892,545	75,305	754,503
Other British							896	4,200
Cuba	56	1,783	636	17,270	274	7,447	371	7,020
Dutch			(a)	10				
South America:								
Colombia			6	169	6	207	18	1,556
Venezuela	42,587	192,855	47,309	211,875	27,179	156,282	51,676	343,535
Europe:								
Belgium							2	30
Germany							140	1,889
Netherlands							2	25
United Kingdom—								
England	47	482						
Ireland					1	109		
Asia:								
Turkey in Asia							6	1,133
Oceania:								
Philippine Islands							(a)	5
	114,725	627,495	105,648	615,499	128,414	1,067,616	128,535	1,129,290

a Figures for quantity not available.

Ozokerite and other mineral waxes imported for consumption in the United States, 1916–1921.

Year.	Pounds.	Value.	Year.	Pounds.	Value.
1916	3,007,676	$196,185	1919	3,748,080	$454,840
1917	899,405	90,510	1920	4,272,341	499,758
1918	1,809,459	147,805	1921	8,548,542	546,054

Ichthyol and ichthyol substitutes imported for consumption in the United States, 1916–1921.

Year.	Pounds.	Value.	Year.	Pounds.	Value.
1916	116,738	$93,762	1919	30,976	$38,975
1917	58,397	36,232	1920	98,135	79,133
1918	65,752	39,452	1921	76,020	107,752

[1] Statistics of imports and exports compiled by J. A. Dorsey, of the U. S. Geological Survey, from records of the Bureau of Foreign and Domestic Commerce.

Asphalt exported from the United States, 1916–1921.

Year.	Unmanufactured.		Manufactures of.	Total.
	Short tons.	Value.		
1916	40,816	$759,769	$494,895	$1,254,664
1917	30,107	587,256	585,472	1,172,728
1918	22,108	577,654	577,936	1,155,590
1919	40,208	1,103,930	606,918	1,710,848
1920	51,706	1,356,116	842,074	2,198,190
1921	45,367	1,178,038	621,224	1,799,262

Asphalt exported from the United States in 1921, by countries.

Country.	Unmanufactured.		Manufactures of.
	Short tons.	Value.	
North America:			
Bermuda			$31
Canada	16,668	$307,615	151,439
Central America—			
Costa Rica			56
Guatemala	7	180	5
Honduras	1	60	398
Nicaragua	1	28	225
Panama	861	24,319	30,272
Salvador			27
Mexico	177	7,604	28,934
Newfoundland			650
West Indies—			
British—			
Jamaica			257
Trinidad and Tobago			34
Other British			40
Cuba	460	14,148	11,366
Dominican Republic	1	28	3,485
Dutch			132
French			46
Haiti			54
Virgin Islands of the United States			293
South America:			
Argentina	967	34,594	15,010
Brazil	1,781	69,716	56,948
Chile	220	5,887	10,227
Colombia	116	4,930	3,835
Ecuador	175	4,300	3,018
Peru	224	6,980	19,141
Uruguay	27	941	368
Venezuela	34	810	1,466
Europe:			
Belgium	473	12,087	29,864
Denmark	18	448	1,415
Finland			70
France	823	27,866	14,179
Germany	1,710	69,270	4,211
Greece	9	502	
Italy	6	390	1,041
Netherlands	250	10,876	85
Norway			1,752
Spain	905	29,814	47,508
Sweden	88	2,118	250
Switzerland	25	1,252	
United Kingdom—			
England	7,180	215,287	34,892
Ireland	93	2,459	
Scotland	897	18,837	20

Asphalt exported from the United States in 1921, by countries—Continued.

Country.	Unmanufactured.		Manufactures of.
	Short tons.	Value.	
Asia:			
China	794	$21,916	$19,467
East Indies—			
British—			
India	2,026	54,797	15,228
Straits Settlements	273	7,130	1,545
Other British	68	2,126	210
Dutch	375	13,716	2,606
French Indo-China			168
Hongkong	1,663	42,935	5,240
Japan	2,621	73,388	58,499
Kwantung, leased territory	95	2,443	640
Persia	39	1,124	38
Siam	2	93	668
Africa:			
Belgian Kongo			18
British—			
East			886
West			165
South	333	15,740	5,045
Canary Islands			74
Egypt			15
French			334
Portuguese	29	777	1,655
Oceania:			
British—			
Australia	1,735	43,494	24,518
New Zealand	895	18,719	2,148
Philippine Islands	222	6,294	9,013
	45,367	1,178,038	621,224

CONSUMPTION.

Asphaltic material consumed in the United States, 1916–1921, in short tons.

1916	1,467,657	1919	1,445,178
1917	1,587,284	1920	2,023,665
1918	1,356,009	1921	1,916,205

WORLD'S PRODUCTION.

Native asphalt, related bitumens, and bituminous rock produced in principal producing countries, 1913–1921, in metric tons.

[For more complete data see U. S. Geol. Survey Mineral Resources, 1921, pt. 1, pp. 513–564.]

Country.	1913	1914	1915	1916	1917	1918	1919	1920	1921
Austria-Hungary	6,051	5,931	2,197	a 151	(b)	(b)	(b)	(b)	(b)
Cuba (exports)	1,587	879	441	489	473	450	(b)	(b)	(b)
France	41,471	35,555	11,707	14,381	12,068	10,104	18,117	22,252	34,249
Germany	105,500	81,800	32,400	31,541	12,321	7,980	12,600	(b)	(b)
Italy	171,097	119,853	47,650	16,829	8,645	22,309	78,000	106,642	91,800
Japan	2,260	2,007	1,975	2,302	3,873	2,997	6,656	6,930	(b)
Mexico	(b)	(b)	388,318	(b)	(b)	(b)	(b)	(b)	(b)
Peru	(c)	(c)	(c)	12,080	8,131	14,915	14,033	17,162	(b)
Poland (Galicia)	1,353	(b)	(b)	(b)	(b)	(b)	299	368	(b)
Spain	d 5,582	5,765	4,521	7,316	1,817	3,692	4,564	4,222	(b)
Switzerland (exports)	50,368	32,848	17,222	20,506	14,764	1,788	8,888	(b)	(b)
Trinidad e	f 230,861	f 112,800	g 6,110	130,847	134,034	72,550	95,523	143,501	(b)
United States	84,008	72,473	68,720	89,336	74,030	54,462	80,087	180,074	268,899
Venezuela	h 85,170	h 45,305	h 28,983	h 44,611	h 49,360	46,453	45,936	23,452	(b)

a Austria only.
b Figures not yet available.
c Prior to 1916 figures combined with those for coal.
d Exclusive of 4,638 metric tons of bituminous rock.
e Includes small quantity of manjak produced in Barbados.
f Fiscal year, Apr. 1 to Mar. 31.
g 9 months, Apr. 1 to Dec. 31.
h Exports.

PRODUCERS.

The following operators reported to the United States Geological Survey that they produced asphaltic material from crude petroleum in the United States in 1921:

Asphaltum & Oil Refining Co., 2475 East Ninth Street, Los Angeles, Calif.
Atlantic Refining Co., 3144 Passyunk Avenue, Philadelphia, Pa.
Central Refining Co., Lawrenceville, Ill.
Craig Oil Co., Toledo, Ohio.
Freeport Gas Co., Freeport, Tex.
Gulf Refining Co., Frick Building Annex, Pittsburgh, Pa.
Indian Refining Co., 244 Madison Avenue, New York, N. Y.
King Refining Co., 255 Holbrook Building, San Francisco, Calif.
Magnolia Petroleum Co., Box 1667, Dallas, Tex.
Mexican Petroleum Corporation, Los Angeles, Calif.
Paraffine Co. (Inc.), 34 First Street, San Francisco, Calif.
Pioneer Asphalt Co., Lawrenceville, Ill.
Pioneer Paper Co., 251 South Los Angeles Street, Los Angeles, Calif.
Prudential Oil Corporation, 110 William Street, New York, N. Y.
Roseberg Oil Co., 923 Santa Fe Street, Los Angeles, Calif.
Seaside Oil Co., Summerland, Calif.
Sinclair Refining Co. of Louisiana, Houston, Tex.
Standard Asphalt & Refining Co., 208 South La Salle Street, Chicago, Ill.
Standard Oil Co. of California, 200 Bush Street, San Francisco, Calif.
Standard Oil Co. of Indiana, 910 South Michigan Avenue, Chicago, Ill. (plants in Illinois, Indiana, and Missouri).
Standard Oil Co. of Louisiana, Baton Rouge, La.
Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y.
Sun Co., Philadelphia, Pa.
Texas Co., Houston, Tex.
Union Oil Co. of California, Union Oil Building, Los Angeles, Calif.
United States Asphalt Refining Co., 90 West Street, New York, N. Y.
Warner Quinlan Asphalt Co., 79 Wall Street, New York, N. Y.

Native asphalt and related bitumens were produced commercially in this country in 1921 by the following operators:

American Asphalt Association, 918 Wainwright Building, St. Louis, Mo.
City Street Improvement Co., 604 Mission Street, San Francisco, Calif.
Continental Asphalt & Petroleum Co., Continental Building, Oklahoma, Okla.
Elaterite Varnish & Rubber Co., Los Angeles, Calif.
Fort Smith Asphalt Co., Fort Smith, Ark.
Gilson Asphaltum Co., 1900 Land Title Building, Philadelphia, Pa.
Kentucky Rock Asphalt Co., 712 Paul Jones Building, Louisville, Ky.
Meadows Chemical Corporation, 52 Vanderbilt Avenue, New York, N. Y.
Sattler & Stevens, Carpinteria, Calif.
Texas Rock Asphalt Co., San Antonio, Tex.
J. O. Tipton, Ada, Okla.
United States Elaterite Products Co., Salt Lake City, Utah.
Universal Gilsonite Asphalt Corporation, 831 Cooper Building, Denver, Colo.
Utah Gilsonite Co., Watson, Utah.
Uvalde Rock Asphalt Co., San Antonio, Tex.

MICA.

By B. H. Stoddard.

INTRODUCTION.

The mica industry in 1921 reflected the general depression of domestic business. The decrease in output, sales, and prices was marked and was not balanced by an increase in imports. Several mica companies, especially in the South, were idle the entire year, and one large company discontinued business.

For reasons of economy in Government printing, the reports on mica in 1920 and 1921 give little but statistical data. More detailed information may be found in the volumes of Mineral Resources for certain years, as follows:

1908: Mica in North Carolina, South Dakota, Colorado, and Georgia.
1912: Mica in the Northeastern, Southeastern, and Western States.
1913: General geology, mining, and treatment of mica.
1914: Mica in New Hampshire, North Carolina, and other Eastern States, South Dakota, New Mexico, Idaho, Colorado, and other Western States.
1918: Properties, forms, uses, substitutes, and future supplies of mica; foreign deposits; selected bibliography.

See also the papers by Douglas B. Sterrett in the following U. S. Geological Survey bulletins:

Mica deposits of South Dakota: Bull. 380, pp. 382–397, 1908.
Mica deposits of North Carolina: Bull. 430, pp. 593–638, 1910.
Mica in Idaho, New Mexico, and Colorado: Bull. 530, pp. 375–390, 1913.
Some deposits of mica in the United States: Bull. 580, pp. 65–125, 1915.

PRODUCTION.

Mica was produced in 1921 in eight States—North Carolina, New Hampshire, Virginia, New Mexico, Georgia, South Dakota, Colorado, and Wisconsin, named in order of total value of mica sold.

The uncut sheet mica sold in 1921 decreased 56 per cent in quantity and 78 per cent in value, and the scrap mica decreased 55 per cent in quantity and 66 per cent in value, as compared with 1920. The most notable decrease was shown by North Carolina, whose sales of uncut sheet mica dropped 79 per cent in quantity and 87 per cent in value. On the other hand, New Hampshire showed an increase in output of sheet mica of 73 per cent in quantity but a decrease of 25 per cent in value. The increase in quantity was due to the larger production of mica of small size, such as punch and washer mica, which had the effect of lowering the average price per pound of sheet mica sold in New Hampshire from 29 cents in 1920 to 13 cents in 1921. Scrap mica sold in New Hampshire amounted to 537 tons, valued at $10,613, as against 435 tons, valued at $12,877, in 1920.

The figures for sheet mica shown in the following table represent uncut sheet and punch mica. A very small quantity of splittings is also included as uncut sheet.

Mica sold in the United States, 1915–1921.

Year.	Sheet mica.		Scrap mica.		Total.	
	Pounds.	Value.	Short tons.	Value.	Short tons.	Value.
1915	553,821	$378,259	3,959	$50,510	4,236	$428,769
1916	865,863	524,485	4,433	69,906	4,866	594,391
1917	1,276,533	753,874	3,429	52,908	4,067	806,782
1918	1,644,200	731,810	2,292	33,130	3,114	764,940
1919	1,545,709	483,567	3,258	58,084	4,031	541,651
1920	[a] 1,683,480	[a] 546,972	5,723	167,017	[a] 6,565	[a] 713,989
1921	[a] 741,845	[a] 118,513	2,577	56,849	[a] 2,948	[a] 175,362

[a] The figures for sheet mica in 1920 and 1921 represent uncut sheet mica exclusively. In previous years the totals have included some cut sheet mica.

Mica sold by chief producing States, 1917–1921.

Year.	Sheet mica.			Scrap mica.		Total.	
	Pounds.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
New Hampshire:							
1917	472,519	236	$159,822	680	$9,229	916	$169,051
1918	376,900	188	106,200	530	7,040	718	113,240
1919	235,724	118	90,915	738	13,356	856	104,271
1920	284,862	142	83,811	435	12,877	577	96,688
1921	491,743	246	63,249	537	10,613	783	73,862
North Carolina:							
1917	643,476	322	543,207	2,180	34,134	2,502	577,341
1918	941,200	471	460,450	1,046	12,930	1,517	473,380
1919	1,021,306	511	331,498	1,639	32,338	2,150	363,836
1920	1,084,946	542	405,654	2,823	91,653	3,365	497,307
1921	230,532	115	51,851	1,353	30,496	1,468	82,347
Georgia:							
1917	30,534	15	12,141	26	1,400	41	13,541
1918	208,200	104	77,300	40	2,750	144	80,050
1919	47,018	24	19,682	51	778	75	20,460
1920	50,095	25	13,692	101	3,015	126	16,707
1921	12,730	6	2,640	75	1,700	81	4,340
Virginia:							
1917	68,558	34	22,831	253	2,709	287	25,540
1918	78,500	39	46,200	404	4,280	443	50,480
1919	(a)	(a)	(a)	578	7,811	(a)	(a)
1920	179,339	90	26,189	(a)	(a)	(a)	(a)
1921	(a)	(a)	(a)	(a)	(a)	(a)	(a)
South Dakota:							
1917	37,523	19	5,975	272	5,033	291	11,008
1918	(a)	(a)	(a)	(a)	(a)	(a)	(a)
1919	....	....	....	(a)	(a)	(a)	(a)
1920	....	....	....	(a)	(a)	(a)	(a)
1921	....	....	....	92	2,290	92	2,290
Alabama:							
1917	18,476	9	3,528	12	280	21	3,808
1918	11,800	6	3,150	....	....	6	3,150
1919	(a)	(a)	(a)	....	....	(a)	(a)
1920	81,458	41	16,401	222	5,234	263	21,635
1921	....	....	....	....	....	....	....

[a] The figures may not be given, as there were less than three operators.

In 1921 North Carolina produced 171,425 pounds of punch mica, valued at $10,964, and 59,107 pounds of mica larger than punch, valued at $40,887; Georgia produced 10,279 pounds of punch mica, valued at $697, and 2,451 pounds of mica larger than punch, valued at $1,943.

The following table is based on an aggregate of about 96 per cent of the total production of sheet mica. The figures include all qualities from clear to stained.

Uncut sheet mica sold in the United States in 1921, by sizes.

Size.	Pounds.	Percentage.	Percentage, with punch omitted.
Punch	665,880	93	....
$1\frac{1}{2}$ by 2 inches	10,368	2	22
2 by 2 inches	18,740	3	39
2 by 3 inches	9,878	1	21
3 by 3 inches	3,731	1	8
3 by 4 inches	2,072		4
Larger sizes	3,026		6
Splittings	(a)	(a)	(a)
	[b] 713,695	100	100

[a] A small quantity of splittings may not be shown, as there were less than three producers.
[b] This figure represents about 96 per cent of the total for the United States.

PRICES.

The prices of mica were lower in 1921 than in 1920 but remained fairly constant during the year. The decline in prices was apparently not a stimulus to the purchasers of mica, however, for there was a notable decrease in the quantity of mica sold. Several miners who produced mica in 1921 are holding their output for a more favorable market; others did no mining because of the lack of demand. According to reports received by the Geological Survey from producers and others, uncut sheet mica in 1921 was worth about half the price it brought in 1920. The average price per ton of scrap mica in 1921 was $22, as against $29 in 1920.

Total and average value[a] of domestic mica marketed in the United States, 1917-1921.

Year.	Total value.	Average value per short ton of all mica mined.	Average value per pound of sheet mica.
1917	$806,782	$198	$0.59
1918	764,940	246	.45
1919	541,651	134	.31
1920	713,989	109	.32
1921	175,362	59	.16

[a] Figures for 1917-1919 represent average value of cut and uncut mica as reported by producers. Figures for 1920 and 1921 represent the average value in terms of uncut sheet mica only.

The following table is based in part on statements received from the producers and purchasers.

Average prices per pound paid in the South for rough-trimmed sheet mica of good quality split and sorted to cut the sizes indicated, 1918–1921.

Size (in inches).	1918	1919	1920	1921
Punch	$0.07	$0.08	$0.10	$0.06
1½ by 2	.55	.55	.51	.35
2 by 2	.90	.95	.84	.55
2 by 3	1.30	1.35	1.25	1.00
3 by 3	1.75	1.85	2.04	1.40
3 by 4	2.05	2.15	2.37	2.00
3 by 5	2.45	2.55	2.95	2.50
4 by 6	3.45	3.50	3.85	3.00
6 by 6	3.90	(a)	4.00	3.50
6 by 8	6.00		5.00	5.00
8 by 10	8.00		7.00	(b)

a Prices exceedingly variable. b No information available.

CONSUMPTION.

The figures for imported mica do not give the cut sheet and splittings separately, and, moreover, as only the value of such mica is given, it has been necessary to estimate the quantity for the following table. The export figures represent the total mica exported and are also in part estimated.

Sheet mica consumed in the United States, 1919–1921, in short tons.

Year.	Production.[a]	Imports.		Exports (estimated).	Apparent consumption
		Sheet (unmanufactured).[b]	Splittings (estimated).		
1919	773	362	1,049	60	2,124
1920	842	649	1,584	150	2,925
1921	371	164	646	70	1,111

a Figures for 1920 and 1921 represent quantity of uncut sheet only; figures for 1919 include some cut sheet.
b Uncut trimmed sheets.

Value of sheet mica consumed in the United States, 1919–1921.

Year.	Production.[a]	Imports.		Exports.	Apparent consumption.
		Sheet (unmanufactured).[b]	Splittings (estimated).		
1919	$483,567	$726,532	$760,000	$109,348	$1,860,751
1920	546,972	1,177,943	1,939,000	316,169	3,347,746
1921	118,513	331,219	750,000	153,990	1,045,742

a Figures for 1920 and 1921 represent value of uncut sheet only; figures for 1919 include some cut sheet.
b Uncut trimmed sheets.

Mica splittings consumed in the United States, 1919–1921, in short tons.

Origin.	1919	1920	1921
India	608	1,077	533
Canada	437	506	108
United States	13	33	13
South America	4	1	5
	1,062	1,617	659

WORLD'S PRODUCTION.

World's production of mica, 1913–1921, in metric tons.

[For more complete data see U. S. Geol. Survey Mineral Resources, 1921, pt. 1, pp. 513–564.]

Country.[a]	1913	1914	1915	1916	1917	1918	1919	1920	1921
North America:									
United States (1)	5,599	3,636	3,843	4,414	3,690	2,825	3,657	5,956	2,674
Canada (2)	1,002	540	378	1,096	1,058	678	2,498	1,999	641
South America:									
Argentina (3)	6	$\frac{1}{4}$	......	6	63	172	52	(b)	(b)
Brazil (4)	10	15	51	54	96	162	154	68	(b)
Europe:									
Norway (exports) (5)	(b)	33	21	24	39	66	(b)	(b)	(b)
Spain (6)	......	......	......	......	......	8	7	5	(b)
Asia:									
Ceylon (7)	......	......	......	......	......	6	8	13	(b)
India (8)	2,325	2,058	1,379	2,205	2,078	2,778	2,326	(b)	(b)
Africa:									
Madagascar (9)	6	3	1	3	$\frac{1}{4}$	4	19	49	(b)
Nyassaland (10)	9	5	4	1	......	4	(b)	(b)	(b)
Rhodesia (11)	......	......	......	......	......	......	5	89	77
Tanganyika (12) (formerly German East Africa)	111	46	(b)	(b)	(b)	17	131	(b)	(b)
Union of South Africa, Transvaal (13)	(b)	(b)	2	12	4	5	3	1	(b)
Australia (14)	......	4	3	1	38	......	2	$\frac{1}{3}$	(b)

[a] Source of data:
1, 1913–1921, U. S. Geol. Survey.
2, 1913–1920, Canada Dept. Mines, Mines Branch; 1921, official preliminary.
3, 1913–1919, Estadística minera.
4, 1913, 1915–1918, Commercio exterior do Brasil; 1914, Imperial Mineral Resources Bureau; 1919–20, Commerce Repts.
5, 1914–1918, Imperial Mineral Resources Bureau.
6, 1918–1920, Estadística minera de España.
7, 1918, Imperial Mineral Resources Bureau; 1919–20, official figures furnished by American consul, Colombo, Ceylon.
8, 1913–1919, Records Geol. Survey of India.
9, 1913–1918, Rapport service des mines, Madagascar; 1919–20, Bull. Économique de Madagascar.
10, 1913–1918, Imperial Mineral Resources Bureau.
11, 1919, Rept. Secretary for Mines, southern Rhodesia; 1920, idem and Rhodesia Chamber of Mines; 1921, Min. Jour., London, Jan. 28, 1922.
12, 1913–14 and 1918–19, Imperial Mineral Resources Bureau.
13, 1915–1920, Secretary of Mines and Industries, Union of South Africa, Ann. Repts.
14, 1914–1916, Western Australia Mines Dept. Rept. (quantities for 1915 and 1916 estimated); 1917, Review of mining operations, Dept. Mines, South Australia; 1919, same as for 1914–1916 and Dept. Mines, Northern Territory; 1920, same as for 1914–1916.

[b] Figures not available.

The sheet mica from the United States, as reported, is about 91 per cent uncut sheet, 8 per cent cut sheet, and 1 per cent splittings. That from India is uncut sheet[1] and splittings; the proportions are not known, but it is estimated that about one-quarter is splittings. The Canadian mica is uncut sheet and splittings; the proportion of splittings to sheet is not known but is estimated to be much greater than that for India. For the other countries the mica reported is essentially trimmed sheet.

[1] Although the Madras square-trimmed mica is termed "cut mica" in import schedules, in reality it is uncut trimmed mica.

World's production of sheet mica, 1913–1921, in metric tons.

Year.	United States.	India.	Canada.[a]	Other countries.[b]	Total.	Percentage of total represented by production in United States.
1913	771	2,325	501	142	3,739	21
1914	253	2,058	270	106	2,687	9
1915	251	1,379	189	82	1,901	13
1916	393	2,205	548	101	3,247	12
1917	579	2,078	529	240	3,426	17
1918	746	2,778	339	444	4,307	17
1919	701	2,326	1,249	381	4,657	15
1920	764	(c)	1,000	225	(c)	(c)
1921	337	(c)	321	77	(c)	(c)

[a] Estimated as one-half of the total reported production of mica in Canada.
[b] The total reported production of mica for the other countries incomplete, as no figures of production are available for some of the countries. 1921 figures represent production of Rhodesia only.
[c] Figures not yet available.

IMPORTS AND EXPORTS.[2]

The imports of sheet mica in 1921, including cut mica, uncut mica, and splittings, showed the lowest value since 1916. Imports of mica were received from 16 countries.

Mica imported for consumption in the United States, 1918–1921.

Year.	Sheet.			Ground.		Total.
	Unmanufactured.[a]		Cut and splittings.[b]			
	Pounds.	Value.		Pounds.	Value.	
1918	741,429	$658,576	$880,906	11,587	$1,647	$1,541,129
1919	723,713	726,532	762,228	62	9	1,488,769
1920	1,298,537	1,177,943	2,011,434	....	....	3,189,377
1921	328,444	331,219	758,521	134,650	2,166	1,091,906

[a] Essentially uncut trimmed sheets.
[b] Includes the Madras square-shaped uncut sheets.

Mica was exported to 46 countries, but about 69 per cent of it went to Canada, Sweden, France, England, Belgium, and Japan, in the order named. The total value of the mica exported in 1921 was greater than in any previous year except 1920, being $153,990, as contrasted with $316,169 in 1920; $109,348 in 1919; $74,529 in 1918; $74,485 in 1917; and $78,671 in 1916.

[2] The statistical information on imports and exports has been compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce, United States Department of Commerce.

MAGNESITE.[1]

By Charles G. Yale.

PRODUCTION.

Reports received from producers show that much less crude domestic magnesite was sold in 1921 than in 1920. This marked reduction was caused by the entire cessation of work at the mines in Washington and partial idleness at those in California.

Crude magnesite sold or treated in the United States, 1914–1921.

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1914	11,293	$124,223	1918	231,605	$1,812,601
1915	30,499	274,491	1919	156,226	1,248,415
1916	154,974	1,393,693	1920	303,767	2,748,150
1917	316,838	2,899,818	1921	47,904	510,177

Magnesite, not purified, imported into the United States in 1920 and 1921.

[General imports.]

Country.	1920		1921	
	Short tons.	Value.	Short tons.	Value.
Australia	38	$417		
Austria		4	9,496	$125,329
Canada	6,751	184,060	427	15,195
Czechoslovakia	4,288	126,827	213	4,309
England	31	3,511	8	1,346
Germany	799	28,566	3,884	62,415
Greece	4,480	38,418	4,480	40,000
India, British			28	1,150
Italy	23,727	241,220	36,121	365,743
Mexico	560	6,300		
Netherlands	917	54,991	2,914	149,415
Scotland	213	13,720	90	7,482
Straits Settlements		4		
Turkey in Europe	3,952	70,540		
Venezuela	2,576	11,500	1,120	4,000
	48,332	780,078	58,781	776,384

In this table calcined and crude magnesite are not separated by countries. The quantity reported as shipped from Italy was doubtless produced at Trieste, Austria, and that received from Czechoslovakia was probably shipped from the former Hungarian mines near Tolsva and Nyustya.

[1] The figures for imports were compiled by J. A. Dorsey, of the Geological Survey, from records of the Bureau of Foreign and Domestic Commerce.

Magnesite imported for consumption in the United States, 1914–1921.

Year.	Crude.		Calcined, not purified.	
	Short tons.	Value.	Short tons.	Value.
1914	13,354	$54,677	121,817	$1,323,194
1915	49,764	255,140	26,574	232,071
1916	75,345	634,447	9,270	204,183
1917	30,277	232,105	3,966	232,601
1918	5,432	103,233	19,049	824,022
1919	6,381	103,311	9,471	270,721
1920	33,550	406,204	14,780	373,165
1921	51,993	525,452	6,788	250,932

Magnesium compounds imported for consumption in the United States in 1920 and 1921.

Material.	1920		1921	
	Pounds.	Value.	Pounds.	Value.
Calcined magnesia, purified	26,859	$9,093	35,182	$7,593
Carbonate, precipitated	14,930	1,512	18,514	2,061
Chloride	454,334	7,098	7,365,812	85,727
Sulphate (epsom salts)	1,803,769	66,944	12,519,778	88,153

DOMESTIC CONSUMPTION OF MAGNESITE.

Prior to the World War about 300,000 short tons of crude magnesite was annually consumed in the United States. About 10,000 tons was produced in this country, and the rest was imported. Both crude and calcined magnesite are imported, and 2 tons of crude will make 1 ton of calcined. In order to make all the figures in the following table comparable the quantity of calcined magnesite has been converted to its equivalent in crude magnesite and long tons have been converted to short tons.

Magnesite (expressed as crude) consumed in the United States, 1914–1921, in short tons.

Year.	Domestic production.	Imports.	Total.	Percentage of imports to total.
1914	11,293	256,988	268,281	96
1915	30,499	102,913	133,412	77
1916	154,974	93,885	248,859	38
1917	316,838	38,208	355,046	11
1918	231,605	43,530	275,135	16
1919	156,226	25,321	181,547	14
1920	303,767	63,110	366,877	17
1921	47,904	65,569	113,473	58

CONDITION OF THE MAGNESITE INDUSTRY.

CALIFORNIA.

GENERAL FEATURES.

Fewer magnesite mines were worked productively in California in 1921 than in 1920, and even those that were generally productive showed lessened output. The total output shows a decrease of 41 per cent and the value a decrease of 53 per cent in 1921 as compared with 1920. High freight rates to eastern markets and lack of demand caused general complaint among the producers, and some of the mines were worked only intermittently. The producers almost universally agree that the magnesite mines in California can not be worked at a profit in the face of large foreign imports unless a considerable duty shall be imposed on the material that is now coming in so freely from foreign countries, where cheap labor prevails. Most of the mines in California were closed entirely during the later months of the year, and the development of other deposits and the opening of new mines was stopped. In fact, the only two properties in the State that were operated in 1921 on a large scale were the Red Mountain mine, in Santa Clara County, and the mines of the Sierra Magnesite Co., in Tulare County. None of the others reported an output of more than 3,000 tons and most of them only a few hundred. All the producers report very unsatisfactory business during the year. Nearly all the California product is used as plastic material, but the few mines that produce a natural ferromagnesite suitable for making brick and other refractory products report small business, owing to conditions in the steel industry. The plastic products are especially needed for use in California, although some refractory brick can be made in the State for use in the smelting furnaces of plants in the country west of the Rocky Mountains. California magnesite can not compete with foreign magnesite in Atlantic ports with present freight rates and high cost of production, and even if it is shipped East by the Panama Canal the profit is doubtful.

Crude magnesite sold or treated in California in 1920–21.

County.	1920		County.	1921	
	Short tons.	Value.		Short tons.	Value.
Fresno	708	$6,850	Fresno and Napa	3,159	$33,643
Napa, San Benito, Sonoma	16,608	218,750	San Benito and Sonoma	3,579	38,116
Santa Clara	26,400	389,950	Santa Clara	25,800	274,770
Stanislaus	4,063	39,435	Stanislaus	3,378	35,976
Tulare	34,003	428,277	Tulare	11,988	127,672
	81,782	1,083,262		47,904	510,177

Crude magnesite produced in California, 1913–1921.

Year.	Producing mines.	Short tons.	Value.	Year.	Producing mines.	Short tons.	Value.
1913	1	9,632	$77,056	1918	30	84,077	$761,811
1914	6	11,293	124,223	1919	18	50,020	504,973
1915	16	30,499	274,491	1920	18	81,782	1,083,262
1916	45	154,259	1,388,331	1921	14	47,904	510,177
1917	65	211,663	2,116,630				

The average spot price per ton of California crude ore in 1921 was $10.65, as compared with $13.25 in 1920. Some mines obtained $11, some $9, others $7, $7.50, and $5, and one, with a rather large output, obtained only $3 a ton, because of the exceptionally long haul to a main-line railroad. The price of calcined material varied also, some that was suitable for making refractory brick bringing as high as $40 a ton.

Nearly all the magnesite produced in California in 1921 was calcined and ground before it was shipped to market, but some was marketed in its crude state. About $2\frac{1}{4}$ tons of crude ore make 1 ton of calcined magnesite. The price of both crude and calcined material differs in different counties, owing to differences in the conditions of mining and shipment. The larger operators generally obtain higher prices than the smaller ones, who must haul their output to main-line railroads by trucks.

REVIEW BY COUNTIES.

Alameda County.—The owners of the Cedar Mountain and Macdonald mines, near Livermore, report that their properties were idle in 1921, and that there was no production from Alameda County.

Fresno County.—The Andrew Ferguson property, at Piedra, was a producer, but finally had to give up contracts on account of imported material. The Tarpey deposit, also at Piedra, was idle, owing to litigation. The Sample, Ward, and Sinclair Bros. mines were unproductive, and the Vance, at Pine Flats, has been abandoned.

Napa County.—The White Rock mine, at Pope Valley, was operated part of the year by Frank R. Sweasy. All the refractory product was calcined in upright kilns, but the owner reports business dull, owing to decrease in the steel industry. The Grant, at Soda Valley, and the Soda Creek, at Chiles Valley, were idle.

Placer County.—The Sullivan mine, at Alta, and the Little Bear, at Towle, were both idle during the year.

Riverside County.—The Magnesco Refractory Products mine, at Winchester, was idle the entire year. There was no output from Riverside County.

San Benito County.—The Sampson magnesite mine, which has reverted from a lease to its owner, R. H. Moore, had all its ore calcined at the kilns near New Idria, and the product was hauled by truck to the main-line railroad and shipped east. The undeveloped Sampson Peak claims of Hugo Fischl were unproductive.

San Bernardino County.—The Cliffside Magnesite Co., at Yermo, was not productive during the year, A new deposit of magnesite 12 miles east of Cima, covered by several separate claims, has been opened by G. W. Elder and Clement B. Stone, of San Diego. Some sample shipments were made, but none on a commercial scale. The deposit is from $4\frac{1}{2}$ to 5 feet wide, and has been opened for a distance of 500 feet and in a crosscut in a tunnel 125 feet below the surface. The owners have acquired by lease the kilns and plant of the old International Magnesite Co., at Chula Vista, on San Diego Bay, and it is the intention to calcine the material at that point and ship it by sea to the Atlantic coast. The material found in this deposit is exceptionally white and pure.

Santa Clara County.—The most productive mine in Santa Clara County—and in the State—in 1921 was that of the Western Magnesite Development Co., operated under lease by C. S. Maltby. This large property is on Red Mountain, on the east side of San Francisco Bay, near the point of junction of the four counties of Santa Clara, Alameda, San Joaquin, and Stanislaus. It has been described in detail in previous reports of the Mineral Resources of the United States and in Bulletins 355 and 540. The property is equipped with an extensive calcining plant, and only calcined material is shipped. Small quantities of ore were also shipped from the Madrone mines, of the Bay Cities Water Co., and the Platner, on the west side of San Francisco Bay. The Coyote and Jackson mines were not worked in 1921.

Sonoma County.—A small quantity of ore was shipped by lessees from the old Turton mine (Refractory Magnesite Co.), but most of the year the mine was idle, as were the Guerneville Farms and Hardin mines.

Stanislaus County.—The W. K. Minerals Co. operated the Red Mountain mine, on Red Mountain, in 1921 and shipped the ore to Patterson. The Plastic Magnesite Co., at Ingomar, in the valley, was also a producer. The Bald Eagle, Quinto, and Manzanito mines, near Gustine, were all idle.

Tulare County.—A company that commenced its activities in October, 1920, and became operative as the Sierra Magnesite Co., January 1, 1921, has purchased or leased a number of formerly independent magnesite mines and calcining plants near Porterville and thereabouts, among them that of the old Tulare Mining Co., for many years the largest producer in the State. This new company has thus become the most productive in Tulare County. The Merryman and Rocky Hill mines, at Exeter; the Schrei, at Lindsay; and the Wilson, at Strathmore, were all producers in a small way in 1921. Among the idle mines reporting were the Blue Crystal, at Lindsay, the De Moulin, at Porterville, and the Dinuba, or Cone, at Dinuba. A number of small mines in this county are unable to operate productively by reason of lack of capital to erect calcining plants.

Tuolumne County.—The Sims Creek and Stratton mines, near Chinese, were not operated in 1921, but since the end of the year a plastic flooring company of San Francisco is buying its magnesite supplies from them.

PRODUCERS.

The producers of magnesite in California in 1921 were as follows:

Andrew Ferguson, Post Office Box 338, Fresno.
Frank Sweasey, Humboldt Bank Building, San Francisco.
Ralph Moore, 74 New Montgomery Street, San Francisco.
C. S. Maltby, 785 Market Street, San Francisco.
Hoff Asbestos Co., Monadnock Building, San Francisco.
Plastic Magnesite Co., 625 Market Street, San Francisco.
W. K. Minerals Co., Patterson.
Alva Joyner, Exeter.
E. Duryea, Hollingsworth Building, Los Angeles.
Sierra Magnesite Co., Balfour Building, San Francisco.
E. F. Schrei, Lindsay.
Frank Wilson, Strathmore.

WASHINGTON.

No magnesite was produced at the mines of Washington in 1921. The general slackness in the steel industry and the increased imports of European magnesite material caused the manufacturers of refractory materials to cease ordering from the Washington companies, thus necessitating the closing down of mines and plants. Nevertheless, 4,928 tons of calcined ore was shipped from Washington in 1921, of which 3,140 tons came from Chewelah and 1,788 tons from Valley. This ore had been mined in 1920, and the quantity was duly stated in the statistics of production of that year.

Detailed descriptions of the magnesite mines of Washington have been given in Mineral Resources for 1917, 1918, 1919, and 1920.

Bulletin 25 of the Washington Geological Survey, by G. E. Whitwell and E. N. Patty, entitled "The magnesite deposits of Washington, their occurrence and technology," has recently been published.

ANALYSES, USES, AND FOREIGN DEPOSITS.

A number of analyses of crude and calcined magnesite from both California and Washington may be found in Mineral Resources for 1918; descriptions of various foreign deposits are given in the same report; and the uses of magnesite are enumerated in the report for 1919.

GYPSUM.

By K. W. Cottrell.

PRODUCTION.

In 1921 the quantity of gypsum produced in the United States was less than 3,000,000 tons, or 8 per cent less than in 1920; the value of the marketed product decreased 3 per cent. Five of the nine principal producing States showed increases ranging from 6 per cent in Texas to 55 per cent in Oklahoma; the other four States showed decreases ranging from 9 per cent in New York to 42 per cent in Virginia. The total output of agricultural gypsum in 1921 decreased about 2 per cent, but there was an increase of 120 per cent in Michigan.

The quantity of gypsum sold crude to Portland cement factories decreased 3 per cent, from 541,901 tons in 1920 to 528,280 tons in 1921. Michigan sales showed an increase of 42 per cent, but sales for Ohio decreased 49 per cent.

Keenes cement decreased 13 per cent in quantity and 6 per cent in value; the average price per ton rose from $14.90 to $16.11.

Plaster board, tile, and blocks were made in 15 States at plants operated by the original producers of the gypsum used in their manufacture. Plants of firms that make these products but do not mine gypsum are not included here, the gypsum they use being already accounted for as plaster sold by the original manufacturers. Therefore the figures given for boards and blocks do not include the entire production of these articles in the United States. Wall board decreased 52 per cent in quantity and 24 per cent in value from 1920. The average price per ton increased from $26.28 to $41.75. Blocks and tile decreased 44 per cent in quantity and 29 per cent in value from 1920. The average price increased from $13.12 to $16.65.

Calcium sulphate, or "gypsum residue," which was produced in the manufacture of fertilizer by the treatment of phosphate rock with sulphuric acid, was marketed in 1921 as gypsum or a substitute therefor. The quantity and value are not included in this report.

Gypsum produced and sold in the United States, 1916–1921.

Year.	Crude mined (short tons).	Value of crude and calcined sold.
1916	2,757,730	$7,959,032
1917	2,696,226	11,116,452
1918	2,057,015	11,470,854
1919	2,420,163	15,727,907
1920	3,129,142	24,533,065
1921	2,890,784	23,700,290

Gypsum produced and sold in the United States, 1920 and 1921, by States.

State.	Number of plants reporting.	Total quantity mined (short tons).	Sold without calcining.				Sold calcined.		Total value.
			Agricultural gypsum.		For Portland cement, paint, and other purposes.				
			Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	
1920.									
Iowa	6	571,895	41,404	$161,838	69,435	$252,593	321,400	$4,008,534	$4,422,965
Kansas	3	130,044	(a)	(a)	(a)	(a)	78,347	864,334	968,298
Michigan	6	382,212	12,092	54,050	61,750	214,918	261,499	3,252,060	3,521,028
Nevada	4	143,929	(a)	(a)	13,043	32,123	105,280	1,036,158	1,100,261
New York	8	780,295	15,510	67,862	255,567	919,641	387,856	5,451,426	6,438,929
Ohio	3	277,899	(a)	(a)	8,474	35,707	220,903	2,122,223	2,161,038
Oklahoma	4	135,279	(a)	(a)	(a)	(a)	69,924	772,749	816,768
Texas	5	220,157	(a)	(a)	16,900	47,961	164,956	1,391,382	1,439,491
Wyoming	4	57,732	(a)	(a)	(a)	(a)	43,384	410,599	410,724
Other States [b]	18	429,700	[c] 38,437	[c] 274,175	[c] 136,648	[c] 504,327	250,935	2,658,405	3,253,563
	61	3,129,142	107,443	557,925	561,817	2,007,270	1,904,484	21,967,870	24,533,065
1921.									
Iowa	6	350,247	26,364	98,311	58,293	135,727	216,930	2,688,662	2,922,700
Kansas	3	92,526	(a)	(a)	28,566	89,792	50,663	574,601	665,164
Michigan	5	408,224	26,558	98,139	84,119	271,046	240,648	2,942,911	3,312,096
Nevada	4	178,275	(a)	(a)	15,558	45,477	132,837	1,471,960	1,533,037
New York	9	712,665	20,081	84,283	186,223	610,235	418,695	5,715,703	6,410,221
Ohio	3	363,905	2,645	13,493	4,344	15,179	263,879	3,163,265	3,191,937
Oklahoma	3	209,201	(a)	(a)	72,087	238,494	99,923	1,046,844	1,289,226
Texas	4	232,806	(a)	(a)	10,709	33,068	183,159	1,732,463	1,765,600
Wyoming	5	38,927	....	....	(a)	(a)	24,244	222,960	224,258
Other States [b]	20	304,008	[c] 29,318	[c] 196,676	[c] 78,079	[c] 336,091	165,873	1,874,910	2,386,051
	62	2,890,784	104,966	490,902	537,978	1,775,109	1,796,851	21,434,279	23,700,290

[a] Included under "Other States."
[b] Alaska, Arizona, California, Colorado, Montana, New Mexico, Oregon, South Dakota, Utah, and Virginia. Includes also a small quantity sold by warehouses and not elsewhere accounted for.
[c] This figure includes also output of States entered as "(a)" above.

Gypsum produced and sold in the United States in 1921, by uses.

	Short tons.	Value.
Calcined:		
Stucco	364,728	$3,105,683
Neat plaster	938,939	9,371,324
Sanded plaster	61,233	966,181
Mixed plaster	[a] 178,676	[a] 1,689,997
Plaster of Paris, molding, casting plaster, etc	[b] 45,838	[b] 504,647
Keenes cement	14,430	232,457
Plaster board	31,316	1,005,552
Wall board	74,222	3,099,345
Partition tile	65,262	849,629
Roof tile	(c)	(c)
Special tile or blocks	7,108	70,574
Other purposes	15,099	538,890
	1,796,851	21,434,279
Crude		2,266,011
		23,700,290

[a] Includes small quantity of wood fiber plaster.
[b] Includes dental plaster and plaster sold to plate-glass works.
[c] Included under "Other purposes."

Keenes cement produced and sold in the United States, 1918–1921.

Year.	Manufacturers.	Short tons.	Value.
1918	5	12,823	$151,802
1919	6	15,395	200,360
1920	6	16,542	246,433
1921	7	14,430	232,457

Gypsum produced and sold in Canada, 1917–1921.[a]

Year.	Short tons.	Value.
1917	336,332	$881,984
1918	152,287	823,006
1919	299,063	1,215,287
1920	429,144	1,893,991
1921	357,183	1,725,730

[a] Report on mineral production of Canada, Canada Dept. Mines.

IMPORTS AND EXPORTS.[1]

Five companies reported to the Geological Survey that they imported gypsum in 1921. These were the Connecticut Adamant Plaster Co., J. B. King & Co., New Red Beach Plaster Co., Rock Plaster Corporation, and Charles W. Priddy & Co. The report of the Connecticut Adamant Plaster Co. covered six months only; the old plant of the company was burned and the new one was not put into operation until July 1. The quantity of crude gypsum imported by these five companies was somewhat less than that reported by the Bureau of Foreign and Domestic Commerce. Of the imported gypsum over 30,000 tons was sold crude, more than half as agricultural gypsum, and the remainder to paint mills and as

[1] The tables relating to imports and exports were compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce.

terra alba. More than 175,000 tons was sold calcined and was used principally in the manufacture of gypsum plasters. Values for the imported gypsum manufactured and sold by these companies can not be given, because two of the companies did not report them in detail. It is estimated, however, that the total value of the gypsum and products sold by these five firms in 1921 was more than $3,000,000, in comparison with a business of more than $23,000,000 done by the entire industry.

Gypsum imported and entered for consumption in the United States, 1916–1921.

Year.	Unground.		Ground or calcined.		Manufactured plaster of Paris.	Keenes cement.		Total value.
	Short tons.	Value.	Short tons.	Value.		Short tons.	Value.	
1916	254, 131	$275, 043	11, 706	$72, 345	$9, 085	600	$9, 890	$366, 363
1917	240, 269	265, 504	16, 533	109, 732	6, 016	484	8, 003	389, 255
1918	50, 653	55, 004	6, 117	70, 028	1, 765	111	2, 259	129, 056
1919	171, 733	211, 946	10, 415	126, 405	7, 719	187	5, 984	352, 054
1920	282, 486	397, 942	14, 921	179, 191	10, 282	202	5, 338	592, 753
1921	266, 796	364, 318	4, 495	55, 109	33, 072	184	6, 836	459, 335

Gypsum, crude, ground, or calcined, imported into the United States in 1921, by countries.

[General imports.]

Country.	Short tons.	Value.
Canada	267, 035	$409, 063
British West Indies:		
Bermuda	784	625
Other	2, 128	4, 147
Cuba		5
France	6	34
Germany	22	1, 165
Greece		11
Italy	1	12
England	1, 303	4, 267
Hongkong	12	98
	271, 291	419, 427

Value of gypsum plaster or wall board exported from the United States, 1918–1921.

Country.	1918	1919	1920	1921
North America:				
Bermuda	$21			$205
British Honduras	61	$4	$632	
Canada	39, 785	107, 462	244, 168	100, 956
Central America—				
Costa Rica		18		780
Guatemala	4, 067	8, 288	698	
Honduras		1, 856	2, 664	3, 434
Nicaragua			16	42
Panama	53	7, 290	1, 935	690
Salvador	1, 181	495	360	215
Mexico	3, 518	14, 663	72, 273	89, 090
Newfoundland	51	2, 789	598	392
British West Indies—				
Barbados		28		
Jamaica	47	90	734	210
Trinidad and Tobago		175	416	1, 053
Other British	52	1, 131	1, 101	60

Value of gypsum plaster or wall board exported from the United States, 1918–1921—Con.

Country.	1918	1919	1920	1921
North America—Continued.				
Cuba	$81,910	$8,455	$86,919	$21,652
Dominican Republic	1,808	398	6,779	2,319
Dutch West Indies		57	110	327
French West Indies			355	
Haiti	308		1,604	689
Virgin Islands of the United States	225	182	258	400
South America:				
Argentina	12,031	62,715	58,811	24,270
Bolivia		116	413	5,700
Brazil	4,907	19,419	20,217	
Chile	3,156	15,546	7,564	421
Colombia		1,320	3,951	5,143
Ecuador			65	
Guiana—				
British	80		31	
Dutch				
French				
Paraguay				
Peru	4,574	663	24,555	8,343
Uruguay		5,171	6,187	
Venezuela	6	330	4,236	237
Europe:				
Belgium		4,398	18,868	2,788
Denmark		3,546		
France			1,435	3,794
Germany				
Greece		2,177	30,466	24
Iceland and Faroe Islands	1,975			
Italy	454		88	
Malta, Gozo, and Cyprus Islands			164	
Netherlands		18,573	47,328	183
Norway		4,456	4,664	5,782
Poland and Danzig			4,000	
Portugal				1
Russia		27		
Spain		487	32,150	1,264
Sweden		5,553	222	1,713
Switzerland			33,228	
United Kingdom—				
England	15,394	303,573	382,338	102,407
Scotland		12,564	30,112	74
Ireland		9,058	13,460	10,903
Asia:				
China	407	22,623	19,890	5,880
Chosen				112
British East Indies—				
India	4,585	8,293	42,779	6,456
Straits Settlements		38		
Other British	24		199	
Dutch East Indies	5,440	5,535	3,440	
Hongkong	170	4,723	893	13,447
Japan	113,931	229,010	20,146	13,416
Palestine and Syria				1,012
Kwantung, leased territory				
Russia in Asia		78	114	
Turkey in Asia		8,886	5,242	3,979
Australia	70,796	90,091	102,133	48,048
New Zealand	20,285	53,054	165,433	101,011
Oceania:				
French	65	3	2,668	
Former German		142		
Other Oceania			270	177
Philippine Islands	10,608	5,608	15,575	8,667
Africa:				
Belgian Kongo			60	
British Africa—				
South	13,786	79,556	35,056	39,085
West	3,838	7,099	1,227	3,320
East	2,386	8	2,491	
French			443	52
Kamerun, etc				181
Egypt		808	359	
Portuguese Africa		3,187	1,329	7,271
	421,985	1,141,815	1,565,920	647,675

BUSINESS NOTES.

The following notes have been abstracted from reports in trade journals.

California.—The holdings of the Avery Gypsum Co. in California were transferred to the United States Gypsum Co. in July, 1921. The California Gypsum Corporation, 321 Central Building, Los Angeles, reports that it has acquired about 600 acres of gypsum in Imperial County and contemplates building a plant for manufacturing gypsum products. The Imperial Gypsum & Oil Co. began the construction of 18 miles of railroad from Maria to its mines and will build plants and warehouses at Maria; the head offices of the company are in the Spreckles Building, at San Diego. The Kern County Gypsum Co., W. T. Davis, manager, reported the production of gypsite.

New York.—Frank P. Spellman, president of the International Gypsum Co. of America, reported the discovery of a vein of gypsum about 12 feet thick on the banks of Otaka Creek, near Leroy, Genesee County, N. Y. Development work will begin in the near future. The Ralph Gypsum Co. has located a deposit of gypsum of good quality 5 miles north of Leroy, but development work has not begun. The Oakfield Gypsum Products Corporation, of Oakfield, expects to begin work in 1922.

MANUFACTURERS.

MANUFACTURERS OF GYPSUM PLASTER.

HEAD OFFICES.

Acme Cement Plaster Co., 703 Frisco Building, St. Louis, Mo.
Alabastine Co., Grand Rapids, Mich.
American Cement Plaster Co., Buffalo, N. Y.
American Gypsum Co., Port Clinton, Ohio.
Arizona Gypsum Plaster Co., Douglas, Ariz.
Best Bros. Keenes Cement Co., Medicine Lodge, Kans.
Cardiff Gypsum Plaster Co., Fort Dodge, Iowa.
Centerville Gypsum Co., Centerville, Iowa.
Colorado Portland Cement Co., Ideal Building, Denver, Colo.
Connecticut Adamant Plaster Co. (importer), New Haven, Conn.
Dakota Plaster Co., Rapid City, S. Dak.
Ebsary Gypsum Co. (Inc.), 171 Court Street, Rochester, N. Y.
Empire Gypsum Co., Rochester, N. Y.
Garbutt & Orcutt, 712 Pantages Building, Los Angeles, Calif.
Globe Plaster & Mining Co., 222 Commerce Building, Kansas City, Mo.
Grand Rapids Plaster Co., Grand Rapids, Mich.
Jumbo Plaster & Cement Co., Sigurd, Utah.
J. B. King & Co. (importer), 17 State Street, New York, N. Y.
Lycoming Calcining Co., Williamsport, Pa.
Nephi Plaster & Manufacturing Co., 322 Ness Building, Salt Lake City, Utah.
Niagara Gypsum Co., Buffalo, N. Y.
Oklahoma Portland Cement Co., Denver, Colo.
Overland Cement Plaster Co., Laramie, Wyo.
Pacific Coast Gypsum Co., Tacoma, Wash.
Pacific Portland Cement Co., Pacific Building, San Francisco, Calif.
Plymouth Gypsum Co., Fort Dodge, Iowa.
Rock Plaster Corporation (importer), 381 Fourth Avenue, New York, N. Y.
Southern Gypsum Co., North Holston, Va.
Texas Cement Plaster Co., Oklahoma City, Okla.
Three Forks Portland Cement Co., Denver, Colo.
United States Gypsum Co., 205 West Monroe Street, Chicago, Ill.
Wasem Plaster Co., Fort Dodge, Iowa.
White Star Plaster Co., 1324 Washington Building, Los Angeles, Calif.
Wyoming Cement Plaster Co., Greybull, Wyo.

MANUFACTURERS OF GYPSUM PLASTER OPERATING MORE THAN ONE PLANT.

Acme Cement Plaster Co	Grand Rapids, Mich.
	Acme, Okla.
	Acme, Tex.
	Acme, N. Mex.
	Laramie, Wyo.
	Gypsum, Oreg.
American Cement Plaster Co	Akron, N. Y.
	Gypsum, Ohio.
	Grand Rapids, Mich.
	Fort Dodge, Iowa.
	Blue Rapids, Kans.
	Acme, Tex.
Colorado Portland Cement Co	Portland, Colo.
	Red Butte, Wyo.
Grand Rapids Plaster Co	Grand Rapids, Mich.
	Grandville, Mich.
United States Gypsum Co	Oakfield, N. Y.
	Plasterco, Va.
	Gypsum, Ohio.
	Alabaster, Mich.
	Grand Rapids, Mich.
	Fort Dodge, Iowa.
	Blue Rapids, Kans.
	Southard, Okla.
	Eldorado, Okla.
	Piedmont, S. Dak.
	Loveland, Colo.
	Arden, Nev.
	Amboy, Calif.

MANUFACTURERS OF KEENES CEMENT.

Acme Cement Plaster Co., 703 Frisco Building, St. Louis, Mo.
Best Bros. Keenes Cement Co., Medicine Lodge, Kans.
Nephi Plaster & Manufacturing Co., 322 Ness Building, Salt Lake City, Utah.
Pacific Portland Cement Co., 827 Pacific Building, San Francisco, Calif.
Texas Cement Plaster Co., Oklahoma City, Okla.
United States Gypsum Co., 205 West Monroe Street, Chicago, Ill.
Utah National Products Co., Sigurd, Utah.

MANUFACTURERS OF GYPSUM PLASTER BOARD AND WALL BOARD.

American Cement Plaster Co., Buffalo, N. Y.
Bell, H. W., & Co., 2592 Park Avenue, New York City.
Bestwall Manufacturing Co., Military Road, Buffalo, N. Y.
Buttonlath Manufacturing Co., Vernon and Boyle avenues, Los Angeles, Calif.
Duffy, J. P., & Co., 51st Street and Second Avenue, Brooklyn, N.Y.
Empire Gypsum Co., Rochester, N. Y.
Gypsite Fireproofing Co., 2034 Dime Bank Building, Detroit, Mich.
Hercules Plaster Board Co., Hampton, Va.
Kelley Plaster & Plaster Board Co., 261 Central Avenue, Passaic, N. J.
Keyhole Plaster Lath Co., 148 Hooper Street, San Francisco, Calif.
King, J. B., & Co., 17 State Street, New York City.
New Jersey Adamant Manufacturing Co., 79 Passaic Avenue, East Newark, N. J.
Pacific Coast Gypsum Co., 403 Perkins Building, Tacoma, Wash.
Plymouth Gypsum Co., Fort Dodge, Iowa.
Rader, Gustav, 1105 Metropolitan Avenue, Brooklyn, N. Y.
Reeb, M. A., Corporation, 597 Michigan Avenue, Buffalo, N. Y.
Rock Plaster Corporation, 381 Fourth Avenue, New York City.
Schumacher Wall Board Co., 58th Street and San Pedro and Slauson avenues, Los Angeles, Calif.
Southern Gypsum Co., North Holston, Va.
United States Gypsum Co., 205 West Monroe Street, Chicago, Ill.

MANUFACTURERS OF GYPSUM BLOCK AND TILE.

Acme Cement Plaster Co., 703 Frisco Building, St. Louis, Mo.
Alabastine Co., Grand Rapids, Mich.
American Cement Plaster Co., Buffalo, N. Y.
American Gypsum Co., Port Clinton, Ohio.
Arizona Gypsum Plaster Co., Douglas, Ariz.
Ebsary Gypsum Co. (Inc.), Rochester, N. Y.
Empire Gypsum Co., Rochester, N. Y.
King, J. B., & Co., 17 State Street, New York, N. Y.
Nephi Plaster & Manufacturing Co., 322 Ness Building, Salt Lake City, Utah.
Plymouth Gypsum Co., Fort Dodge, Iowa.
Reeb, M. A., Corporation, 597 Michigan Avenue, Buffalo, N. Y.
United States Gypsum Co., 205 West Monroe Street, Chicago, Ill.
Wyoming Cement Plaster Co., Greybull, Wyo.

MINERS.

[Gypsum sold crude only.]

American Gypsum Co., 301 Livingston Building, Rochester, N. Y.
Briggs, H. H., 4621 Bliss Street, El Paso, Tex.
Phoenix Gypsum Co., 325 Arlington Building, Rochester, N. Y.
Simmons, Arthur, Norwich, N. Y.

TALC AND SOAPSTONE.

By Edward Sampson.

PRODUCTION.

GENERAL SUMMARY.

The sales of talc and soapstone in 1921 showed a great decline after the very large sales of 1920. The quantity of talc sold was the smallest since 1908 and was about 40 per cent less than the average for the five preceding years.

Vermont was the largest producer, a position which it has held since 1917. New York followed in quantity sold but for the first time took second place in value. Virginia ranked next to New York in quantity but for the first time led in value, owing to the fact that the soapstone industry in that State was not nearly so much affected by the reduction in prices as the ground talc industry in New York, and elsewhere. In quantity, California, Pennsylvania, New Jersey, Georgia, North Carolina, Massachusetts, and Maryland followed in the order named. There were in all States 30 operators, as compared with 29 in 1920.

Talc and soapstone mined and sold in the United States, 1913 and 1917–1921.

Year.	Crude.		Sawed and manufactured.				Ground.		Total.	
			Talc.		Soapstone.					
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1913	3,898	$14,687	138	$36,272	24,698	$618,410	147,099	$1,238,728	175,833	$1,908,097
1917	12,619	69,140	5,781	176,404	19,885	402,506	180,563	1,644,828	218,848	2,292,878
1918	17,633	193,278	1,075	116,952	12,330	501,059	177,269	1,869,730	208,307	2,681,019
1919	15,625	73,437	921	147,339	16,504	530,163	151,793	1,601,736	184,843	2,352,675
1920	11,008	43,820	1,415	139,335	19,707	709,400	178,505	2,142,894	210,635	3,035,449
1921	2,150	12,911	(a)	(a)	[b]17,423	[b]627,826	106,861	1,180,714	126,434	1,821,451

a Included under "Soapstone."

b Includes some sawed and manufactured talc.

The production of talc and soapstone for 1921 and for past years is shown graphically in figure 6. The average price per ton of ground talc in 1921 was $11.05; in 1913 it was $8.42; 1917, $9.11; 1918, $10.55; 1919, $10.55; 1920, $12.

PRODUCTION BY STATES.

Talc and soapstone mined and sold in the United States, 1919–1921, by States.

State.	1919		1920		1921				
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Per cent of total quantity.	Percentage of decrease in 1921. Quantity.	Percentage of decrease in 1921. Value.
Vermont	78,661	$665,652	86,489	$816,794	48,648	$438,534	38	44	46
New York	62,495	750,765	68,168	977,228	41,937	530,154	33	38	46
Virginia	17,663	542,022	21,715	729,767	17,721	601,878	14	18	18
California	9,837	147,470	13,199	232,182	8,233	128,188	7	38	45
Pennsylvania	(a)	(a)	} 11,183	121,302	7,205	76,912	6	36	37
New Jersey	....	....							
North Carolina	2,602	76,158	2,267	75,474	731	17,048	} 2	68	77
Maryland	(a)	(a)	4,372	17,948	(a)	(a)		....	....
Other States [b]	13,585	170,608	3,242	64,754	1,959	28,737		....	....
	184,843	2,352,675	210,635	3,035,449	126,434	1,821,451	100	40	40

[a] Included under "Other States."
[b] 1919: Georgia, Maryland, Massachusetts, Pennsylvania, Washington; 1920 and 1921: Georgia, Massachusetts.

California.—The accompanying table shows the value of the California output since 1919. The total production and value in 1921, as compared with that of New York, Vermont, and the United States, are shown in figure 6. The average price per ton of the California ground talc was $18.39, as compared with $19.66 in 1920 and with $10.58 for all other States in 1921.

Talc was mined in San Bernardino, Inyo, and Eldorado counties in 1921. In San Bernardino County there were three producers. The Pacific Coast Talc Co. operated its mine near Silver Lake, and the Talc Products Co. shipped a small quantity, as did also a new company, the Death Valley Talc Refining & Manufacturing Co., of Tonopah, Nev. It is reported [1] that this company owns a large high-grade deposit 3 miles west of Paddy Pride. Transportation to the railroad offers difficulties.

In Inyo County the Inyo Talc Co. continued operations at Keeler, and a new company, the Tramway Talc Co., made a small output of talc from Tramway, near Keeler.

The operators in Eldorado County were C. S. Swift, at Latrobe, and A. W. Prouty, at Shingle Springs. The talc of this region differs in nature and origin from the other deposits in California, being formed by the alteration of basic igneous rock and somewhat resembling the talc of Vermont, Virginia, and Maryland.

Georgia.—The Georgia Talc Co. was the only producer in Georgia in 1921.

Maryland.—Two companies were active in Maryland in 1921. The Harford Talc Co., which mines a refractory talc, although forced to close its plant for six months because of the low price of the imported product, has greatly increased the size of its quarry, which is now about 200 feet long at the surface. A 50-foot face consisting largely of talc, though containing lenses of valueless rock, is now exposed.

[1] Min. and Sci. Press, vol. 121, p. 23, 1920.

A 1½-inch Flory cableway of 1,000-foot span has been installed. It is operated by a 50-horsepower steam engine and is capable of lifting 15 tons. This installation has solved the rather difficult problem of disposing of the large quantity of waste incident to mining a deposit of this type. The rough blocks as raised from the pit are sawed by a gasoline drag saw. The resulting squared blocks about 1 foot cube are sawed in the circular-saw plant, consisting of 9 saws. The finished product consists of squares of various sizes cut to order.

The same company has opened another deposit known as Air's mine, about 1 mile from Rocks station and half a mile from the railroad. It is planned to grind the talc from this property. The powdered talc is somewhat fibrous.

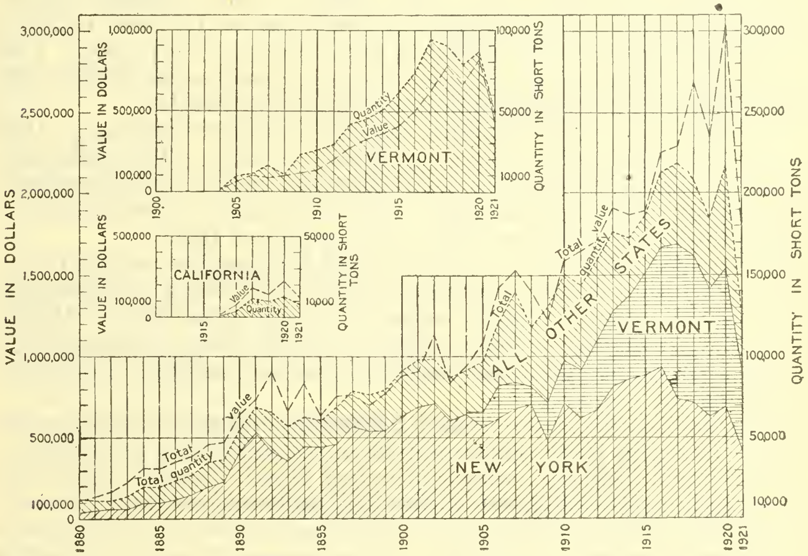

FIGURE 6.—Talc and soapstone produced in the United States, 1880-1921.

Herbert I. Ousler shipped crude material (an impure talc schist) from Henryton. Mr. Ousler has reduced his operating costs so greatly that he is able to compete with producers of the ordinary foundry-facing grades.

The Maryland Mineral Co., which operated in 1920, was inactive in 1921.

The Pure Talc & Mining Co., of Conowingo, reported to the Geological Survey a large production in 1920. This report has not been substantiated.

New Jersey and Pennsylvania.—In the New Jersey-Pennsylvania field, which lies on both sides of Delaware River near Easton, Pa., operations were continued in 1921 by C. K. Williams & Co. and J. O. Wagner, who operated on the Pennsylvania side of the river, and the Rock Products Co., which operated in New Jersey. All three have offices at Easton.

New York.—The Union Talc Co. division of the International Pulp Co. resumed operations in 1921 after four years of inactivity. The W. H. Loomis Co., whose property is at Fowler, N. Y., has started its new mill and has greatly increased its output. During part of the year it leased the mill of the Uniform Fibrous Talc Co. and operated this mill in addition to its own. Prior to this lease the Uniform Fibrous Talc Co. ran the mill on material purchased from Loomis. The old workings of the company caved in, and the company sunk a two-compartment, concrete-lined shaft which was to strike the talc deposit below the old workings, which followed the dip of the deposit. This shaft struck a small lens of talc before reaching the depth of the main deposit, and some mining was done. The shaft has not been continued to the main deposit and was reported by the company to be flooded. It is said that the deposit has been sold.

The Carbola Chemical Co., whose mine is near Natural Bridge, continued operations and supplied ground talc to the trade and also manufactured carbola, for which a good market is reported. Carbola is a chemically treated talc used as a cold-water disinfecting paint instead of whitewash and as a disinfecting powder.

North Carolina.—The principal activity in North Carolina in 1921 was in the pyrophyllite region in Moore County. The Talc Products Co., whose property is near Glendon, manufactured crayons and also produced ground talc. The company reported that it expected to start a 100-ton mill by the spring of 1922.

The Standard Mineral Co. has acquired the property of the Oliver Quartz Co., near Hemp, and has completed a 35-ton grinding mill and a crayon plant having a capacity of 100 gross daily. Mining machinery, including a channeling machine, was purchased. A considerable supply of crude material was accumulated in further developing the property.

Fields, Jones & Co., who erected a grinding mill and crayon-cutting plant at Hemp in 1920, apparently have not yet begun production.

The Georgia Talc Co., whose principal North Carolina properties are on Big Laurel Creek north of Marshall, in Madison County, continued the manufacture of crayons. In Cherokee County the Biltmore Talc Co. is reported to have done a little mining, though it is said to have been inactive during most of the year and to have dismantled its mill at Biltmore. T. J. Mauney is reported to have produced no talc in 1921.

Vermont.—The operating companies in Vermont in 1921 were the Eastern Talc Co., at Rochester and East Granville; the Magnesia Talc Co., at Waterbury; the American Mineral Co., at Johnson; the American Soapstone Finish Co., at Chester; and the Vermont Talc Co., at Windham. These companies produced only ground talc, except the Magnesia Talc Co., which also cut crayons.

Virginia.—The Virginia Alberene Co. continued operations on a very large scale in 1921. This company is now the only producer of manufactured soapstone in North America. Oliver Brothers (Inc.), who also have produced soapstone, have not operated their plant since October, 1920. The Bull Run Talc & Soapstone Co. (Inc.) marketed ground talc from its property near Clifton. The Blue Ridge Talc Co., which took over in 1920 the property of the Franklin Soapstone Products Co., at Henry, marketed ground talc and a small quantity of crude. It is reported that the company has increased its capital and the capacity of its plant.

WORLD'S PRODUCTION.

The best available figures of the production of talc and soapstone in foreign countries are given in the following table. A few estimates have been made where the information at hand appeared to justify it. The sources of all figures are given in the footnotes.

World's production of talc and soapstone, 1913 and 1917–1920, by countries, in metric tons.

[For more complete data see U. S. Geol. Survey Mineral Resources, 1921, pt. 1, pp. 513–564.]

Country.	1913	1917	1918	1919	1920
Australia:					
New South Wales [a]	55	238	365	364	214
South Australia [b]	51	....	315	268	201
Austria [c]	16,000	8,000	(d)	(d)	(d)
Canada [e]	11,113	14,336	16,483	16,912	19,659
France [f]	60,175	(f)	(f)	35,600	(d)
Germany (Bavaria) [g]	....	2,171	9,308	14,500	20,943
India [h]	2,565	7,955	13,191	2,169	(d)
Italy [i]	24,001	21,863	18,111	17,550	21,475
Norway [j]	1,500	7,084	15	(d)	(d)
Spain [k]	4,407	3,450	3,328	3,024	2,146
Union of South Africa: [l]					
Natal	....	....	11	(d)	....
Transvaal	....	712	597	687	619
United Kingdom [m]	41	1,253	951	699	367
United States	159,512	198,535	188,972	167,686	191,084

[a] New South Wales Dept. Mines, Ann. Repts.
[b] South Australia Dept. Mines, Rev. Mining Operations.
[c] Estimates.
[d] Figures not yet available.
[e] Canada Dept. Mines, Mines Branch, Ann. Repts.
[f] 1913: Statistique de l'industrie minérale en France. Statistics from 1914–1918 not separately recorded. 1919: Information furnished by Director of Mines, Paris.
[g] 1913: Imperial Mineral Resources Bureau; 1917–18 and 1920: Glückauf; 1919: estimate.
[h] India Geol. Survey Rec.
[i] Rivista del servizio minerario.
[j] Norges Officielle Statistik, Norges Bergverksdrift.
[k] Estadística minera de España.
[l] Ann. Repts. Government Mining Engineer, Union of South Africa, Dept. Mines.
[m] Mines and quarries.

The increase in the output of the mines in Bavaria, Germany, is remarkable. The material is classed as steatite, and much of the ground product is probably a rather low-grade talc. However, the best refractory talc known comes from Germany. A small quantity of this material was imported into the United States before the World War, but as the talc was partly machined it was equivalent to a considerably larger quantity than the figures indicate.

The table probably does not include all countries that produced talc in the years covered, but the figures are sufficient to warrant estimates of world production. In 1913 the world total was probably about 279,400 metric tons, and in 1919 and 1920 the total production was approximately 270,000 and 295,000 metric tons, respectively. In 1913 the United States produced about 57 per cent of the world's supply, and in 1920 about 65 per cent. In 1920 Germany produced about 7 per cent and Canada a little less than 7 per cent.

IMPORTS AND EXPORTS.[2]

No material that might be classed as soapstone is imported. It will be seen that the total imports in 1921 were reduced, as compared with 1920, by about one-half in both quantity and value. The imports from Canada decreased most, being only 46 per cent of the quantity imported in 1920; the imports from France were less affected,

[2] Statistics of imports and exports compiled from records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

for the French product is of a higher grade and a considerable part of it is used for toilet powder and for refractory purposes.

No separate classification is made of the quantity of talc exported in bulk. It is reported that fibrous talc from New York is able to compete in European markets for use as a filler in paper.

General imports and imports for consumption for any period will differ to the extent that the entries for warehouse for the period differ from the withdrawals from warehouse for consumption. The term "entry for consumption" is the technical name of the import entry made at the customhouse and implies that the goods have been delivered into the custody of the importer and that the duties have been paid on the dutiable portion. Some of them may be afterward exported.

Talc imported for consumption in the United States, 1917–1921.

Year.	Crude and unground steatite and French chalk.[a]			Talc, steatite, and French chalk—cut, ground, or washed.[b]			Total.	
	Short tons.	Value.	Average value.	Short tons.	Value.	Average value.	Short tons.	Value.
1917	2,452	$10,710	$4.37	16,157	$258,787	$16.02	18,609	$269,497
1918	1,434	9,253	6.45	12,735	251,323	19.73	14,169	260,576
1919	1,641	10,105	6.16	12,961	248,899	19.20	14,602	259,004
1920	941	7,206	7.57	21,739	443,514	20.40	22,680	450,720
1921	153	2,279	14.90	11,468	239,469	20.88	11,621	241,748

[a] Duty free. [b] 15 per cent duty.

General imports of talc, ground or unground, into the United States, 1913 and 1917–1921, in short tons.

Country.	1913	1917	1918	1919	1920	1921		
						Quantity.	Value in country of origin.	
							Total.	Average per ton.
Austria	391				22	361	$22,112	$61.25
Belgium	8							
Canada	3,348	10,287	12,185	11,852	15,123	6,993	108,197	15.47
Denmark					11			
England	34	55			34	72	2,057	28.57
France	5,466	1,512	22	163	1,834	1,031	15,263	14.80
French Africa		33			22			
Germany	15				2	1	24	24.00
India					1	1	64	64.00
Ireland						(a)	9	
Italy	4,510	4,167	490	958	4,619	2,969	90,628	30.52
Japan		10						
Jamaica		66			33			
Kwantung (leased territory)						(a)	4	
Netherlands	2							
Other British West Indies					28			
Spain		1						
Sweden					(a)			
Switzerland						28	223	7.96
	13,774	16,131	12,697	12,973	21,729	11,456	238,581	20.83

[a] Less than 1 ton.

USES.

The Geological Survey has attempted to obtain information to show the quantity of talc consumed by the various industries. Each producer who marketed ground talc was asked to report his best estimate as to the uses to which his talc was put. The returns have been highly satisfactory, only one company—unfortunately a large producer—refusing to report. Estimates were made for this company from independent information. The results of the canvass are shown below and in figure 7. Some of the figures as received are only estimates and probably ignore the minor uses. The figures for the textile industry and for toilet powder are probably too low. The figures for minor uses are also undoubtedly low, but those for paper and paint are high. This investigation has emphasized the extremely varied uses to which talc is put; it is found, for example, that an appreciable quantity of talc is used in the manufacture of buttons and dolls. Some of the principal minor uses for talc are in gypsum products, composition flooring, foundry facings, pipe covering, bleacheries, and heat-insulating cement.

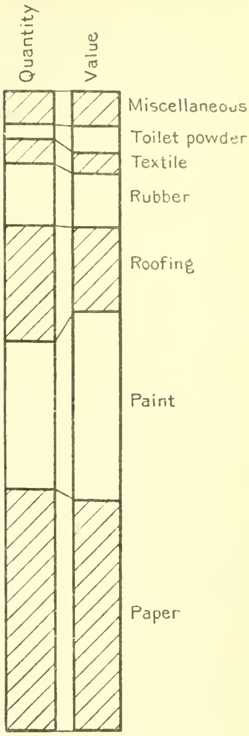

FIGURE 7.—Relative proportions of ground talc sold in 1921 to various industries.

Ground talc sold in 1921, by uses.[a]

	Short tons.	Value.	Approximate average price.	Percentage of total quantity.
Paper	40,400	$428,000	$10.60	38
Paint	24,500	345,000	14.10	23
Roofing	19,400	155,000	8.00	18
Rubber	10,300	97,000	9.50	9½
Textile	4,000	38,000	9.40	4
Toilet powder	2,800	51,000	18.60	2½
Other	5,500	67,000	12.00	5
	106,900	1,181,000	11.05	100

[a] In this table figures have been rounded. The figures for average price, except that for the total, are rounded to the nearest $0.10 from the average computed from the total quantity and total value before rounding.

CLAY.

By Jefferson Middleton.

GENERAL CONDITIONS.

Clay available for the manufacture of clay products is widely distributed, and there are clay-working plants in every State in the Union. The following tables represent only clay that is mined and sold as clay. The quantity thus sold is small compared with the total output and includes mainly clay used for making high-grade pottery and tile, and refractory products. The values given for domestic production are values f. o. b. at the mines. The values of imports are those at the principal markets of the countries from which the clay is exported. The values of exports are those at the port of shipment.

The general business depression had a marked effect on the clay-mining industry in 1921, the output decreasing 45 per cent and the value 48 per cent, as compared with 1920. Fire clay, which showed the largest output in both quantity (70 per cent of the total in 1921) and value (59 per cent of the total in 1921), decreased 49 per cent in quantity and 52 per cent in value, as compared with 1920. The output of every kind of clay decreased in quantity, value, and average price per ton. Imports and exports of clay decreased in even greater proportion than domestic production.

PRODUCTION.

Clay marketed in the United States, 1912–1921.

Year.	Kaolin.		Paper clay.		Ball clay.		Slip clay.		Fire clay.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value	Short tons.	Value.
1912	25,852	$220,747	119,857	$522,924	64,939	$227,545	16,339	$27,573	1,695,337	$2,363,357
1913	28,834	235,457	126,377	567,977	67,134	237,672	10,902	24,505	1,820,379	2,592,591
1914	34,191	284,817	116,328	558,334	67,927	255,767	8,237	17,731	1,409,467	2,147,277
1915	28,031	241,520	113,033	539,622	75,348	301,910	7,646	18,774	1,570,481	2,361,482
1916	47,723	306,819	153,434	768,911	89,761	391,152	14,064	47,939	2,057,814	3,708,009
1917	31,885	301,378	174,449	962,421	107,406	569,240	16,972	70,505	2,347,972	5,625,095
1918	37,969	391,109	141,725	1,068,420	89,896	590,631	13,552	49,898	2,305,033	5,664,064
1919	38,758	490,510	114,070	985,171	65,026	520,849	5,149	17,556	1,755,331	4,628,605
1920	[a]268,203	[a]2,865,407	(a)	(a)	69,477	584,611	9,006	41,519	2,341,076	7,425,674
1921	[a]162,726	[a]1,579,163	(a)	(a)	54,014	354,565	4,608	14,841	1,195,861	3,560,373

[a] Paper clay included under "Kaolin."

Clay marketed in the United States, 1912–1921—Continued.

Year.	Stoneware clay.		Brick clay.		Miscellaneous.		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1912	124,409	$115,522	229,306	$204,504	254,226	$263,848	2,530,265	$3,946,020
1913	153,353	143,587	158,890	137,976	282,120	240,694	2,647,989	4,180,459
1914	130,383	116,610	199,154	161,852	244,173	214,180	2,209,860	3,756,568
1915	134,297	126,429	101,968	93,863	332,150	288,341	2,362,954	3,971,941
1916	135,958	137,779	97,164	76,854	336,672	314,311	2,932,590	5,751,774
1917	81,352	113,839	93,779	94,703	260,029	305,365	3,113,844	8,042,546
1918	86,800	147,098	(a)	(a)	301,386	421,421	2,976,361	8,332,641
1919	60,236	80,367	(a)	(a)	236,530	367,573	2,275,100	7,090,631
1920	106,350	229,221	(a)	(a)	322,100	467,856	3,116,212	11,614,288
1921	86,574	184,540	(a)	(a)	212,963	331,818	1,716,746	6,025,300

a Included under "Miscellaneous."

Clay marketed in the United States in 1920.

State.	Kaolin and paper clay.		Fire clay.		Stoneware clay.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama			45,612	$51,220	(a)	(a)
Arkansas			(a)	(a)	(a)	(a)
California	3,786	$60,412	170,838	306,832	6,860	$11,249
Colorado			124,531	162,858	(a)	(a)
Connecticut					(a)	(a)
Delaware	4,345	70,682				
Florida	(a)	(a)				
Georgia	116,420	1,025,819	1,703	9,282		
Idaho			873	8,802		
Illinois			156,700	371,636	32,200	45,900
Indiana			54,412	98,878	(a)	(a)
Kentucky			69,924	287,944		
Maryland	(a)	(a)	20,632	102,450	(a)	(a)
Mississippi					(a)	(a)
Missouri	606	7,309	440,728	1,397,080	(a)	(a)
Montana			2,582	15,614		
Nebraska			(a)	(a)		
Nevada	(a)	(a)				
New Jersey			285,842	1,423,159	20,627	91,067
New Mexico			1,916	7,119		
New York			(a)	(a)		
North Carolina	(a)	(a)			(a)	(a)
North Dakota			(a)	(a)		
Ohio			254,422	650,796	28,897	44,641
Pennsylvania	20,164	298,213	543,610	1,946,772	9,833	17,814
South Carolina	49,892	459,951	(a)	(a)		
Tennessee			66,902	283,961		
Texas			3,328	23,103	(a)	(a)
Utah			(a)	(a)		
Vermont	4,716	52,697				
Virginia	(a)	(a)	(a)	(a)		
Washington			763	8,854		
West Virginia			86,360	211,029		
Wisconsin			(a)	(a)		
Wyoming			(a)	(a)		
Undistributed	68,274	890,324	9,398	58,285	7,933	18,550
	268,203	2,865,407	2,341,076	7,425,674	106,350	229,221
Average price per ton		10.68		3.17		2.16

a Included under "Undistributed."

Clay marketed in the United States in 1920—Continued.

State.	Miscellaneous.[a]		Total.	
	Short tons.	Value.	Short tons.	Value.
Alabama			47,512	$91,010
Arkansas			(b)	(b)
California	30,980	$52,780	214,799	437,078
Colorado	6,266	7,010	131,797	172,378
Connecticut	(b)	(b)	(b)	(b)
Delaware	(b)	(b)	10,007	97,492
Florida			(b)	(b)
Georgia	69,241	36,693	187,364	1,071,794
Idaho			873	8,802
Illinois	6,521	15,428	195,421	432,964
Indiana	21,879	25,197	76,341	124,200
Iowa	36,577	36,275	36,577	36,275
Kentucky	(b)	(b)	93,491	469,302
Maryland	(b)	(b)	27,772	116,280
Massachusetts	(b)	(b)	(b)	(b)
Michigan	4,561	9,046	5,066	11,295
Minnesota	(b)	(b)	(b)	(b)
Mississippi			(b)	(b)
Missouri	(b)	(b)	448,984	1,413,189
Montana			2,582	15,614
Nebraska			(b)	(b)
Nevada			(b)	(b)
New Jersey	43,164	99,484	354,613	1,656,867
New Mexico			1,916	7,119
New York	(b)	(b)	8,545	43,672
North Carolina			15,679	244,695
North Dakota			(b)	(b)
Ohio	28,487	34,190	311,806	729,617
Oregon	(b)	(b)	(b)	(b)
Pennsylvania	29,393	69,426	603,000	2,332,225
South Carolina			50,131	462,819
South Dakota	(b)	(b)	(b)	(b)
Tennessee	6,631	11,172	110,479	603,374
Texas	(b)	(b)	3,478	23,503
Utah	(b)	(b)	3,814	16,337
Vermont			4,716	52,697
Virginia	(b)	(b)	12,094	131,883
Washington	(b)	(b)	1,319	10,377
West Virginia			86,360	211,029
Wisconsin	(b)	(b)	(b)	(b)
Wyoming	(b)	(b)	(b)	(b)
Undistributed	38,400	71,155	69,676	590,401
	[c] 400,583	[c] 1,093,986	3,116,212	11,614,288
Average price per ton				3.73

[a] Includes ardmorite, bentonite, brick clay, clay for cement, hollow ware, paint, plaster, pencil leads, red earthenware, roofing tile, sewer pipe, stove polish, terra cotta, and shale.
[b] Included under "Undistributed."
[c] These totals include 69,477 short tons of ball clay, valued at $584,611, or $8.41 per ton, from Alabama, California, Kentucky (23,404 tons, valued at $181,195), Maryland, Mississippi, New Jersey (4,980 tons, valued at $43,157), and Tennessee (36,946 tons, valued at $308,241); and 9,006 short tons of slip clay, valued at $41,519, or $4.61 per ton, from California, Massachusetts, Michigan (505 tons, valued at $2,249), New York, and Washington.

Clay marketed in the United States in 1921.

State.	Kaolin and paper clay.		Ball clay.		Fire clay.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama			1,332	$10,659	45,520	$38,077
Arkansas					193	2,189
California	2,507	$35,586	7,828	16,753	101,183	174,996
Colorado					90,576	113,100
Connecticut						
Delaware	(a)	(a)			(a)	(a)
Florida	28,426	388,751				
Georgia	52,500	388,480			2,660	11,735
Idaho					196	2,369
Illinois					62,137	131,943
Indiana					35,171	56,156
Kentucky			16,245	107,310	19,145	96,068
Maryland	(a)	(a)			12,858	29,171
Missouri	689	7,761			255,794	929,774
Montana					523	2,811

[a] Included under "Undistributed."

Clay marketed in the United States in 1921—Continued.

State.	Kaolin and paper clay.		Ball clay.		Fire clay.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Nebraska					55	$350
New Jersey			8,230	$62,638	195,572	842,257
New Mexico					(a)	(a)
New York					244	2,928
North Carolina	11,681	$188,825				
North Dakota					16	183
Ohio					89,632	205,777
Pennsylvania	12,331	146,768			220,578	713,345
South Carolina	35,866	273,867				
Tennessee			20,379	157,205	32,513	130,167
Texas					2,075	10,625
Utah					(a)	(a)
Vermont	2,560	35,210				
Virginia	(a)	(a)			670	2,465
Washington					(a)	(a)
West Virginia					25,244	42,595
Undistributed	16,166	113,915			3,306	21,292
	162,726	1,579,163	54,014	354,565	1,195,861	3,560,373
Average price per ton		9.70		6.56		2.98

State.	Stoneware clay.		Miscellaneous clay.[b]		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama					46,852	$48,736
Arkansas					193	2,189
California	4,572	$9,460	62,526	$101,234	181,039	341,288
Colorado			4,189	5,991	94,765	119,091
Connecticut	139	480			139	480
Delaware					2,137	17,314
Florida					28,426	388,751
Georgia					55,160	400,215
Idaho					196	2,369
Illinois	25,255	41,921	(a)	(a)	89,060	177,004
Indiana	527	527	7,394	12,254	43,092	68,937
Iowa			7,457	7,617	7,457	7,617
Kentucky			(a)	(a)	35,587	204,400
Maryland	(a)	(a)	6,100	12,700	26,108	54,471
Massachusetts			26	90	26	90
Michigan			208	308	692	2,355
Minnesota			29,222	43,065	29,222	43,065
Mississippi			1,000	2,000	1,000	2,000
Missouri			300	600	256,783	938,135
Montana					523	2,811
Nebraska					55	350
New Jersey	16,354	71,919	43,022	72,934	263,178	1,049,748
New Mexico					(a)	(a)
New York			2,373	4,760	4,247	16,423
North Carolina	(a)	(a)	(a)	(a)	11,712	188,862
North Dakota					16	183
Ohio	37,279	51,915	23,991	19,822	150,902	277,514
Oregon	223	836	1	21	224	857
Pennsylvania	1,712	6,334	19,558	28,947	254,179	895,394
South Carolina	25	25			35,891	273,892
South Dakota			900	9,000	900	9,000
Tennessee	37	37			52,929	287,409
Texas	295	474			2,370	11,099
Utah			(a)	(a)	(a)	(a)
Vermont					2,560	35,210
Virginia			(a)	(a)	9,430	92,730
Washington			(a)	(a)	439	5,153
West Virginia					25,244	42,595
Wisconsin			160	480	160	480
Wyoming			433	2,155	433	2,155
Undistributed	156	612	4,103	7,840	3,420	14,928
	86,574	184,540	c 217,571	c 346,659	1,716,746	6,025,300
Average price per ton		2.13				3.51

a Included under "Undistributed."

b Includes adobe, ardmorite, bentonite, black-burning clay, shale and clay for building brick, cement, conduits, flowerpots, foundries, graphite crucibles, hollow tile, modeling, mortar, oilcloth, paint, pencil leads, plaster, sewer pipe, and terra cotta.

c These totals include 4,608 tons of slip clay, valued at $14,841, or $3.22 per ton, from California, Kentucky, Michigan, and New York.

PRODUCTION BY USES.

Statistics showing the production of clay by uses are necessarily incomplete, as many clay miners do not know the purposes to which their clay is put, but it is believed that the figures given in the following table are sufficiently complete to serve as a guide in the study of the uses of domestic clays. In considering these figures it should be borne in mind that they represent only the clay sold as clay by the original producers and do not include the much greater quantities of clay that are burned into clay products by those who mine their own clay.

Domestic clay marketed in the United States in 1921, by uses, in short tons.

Use.	Kaolin and paper clay.	Ball clay.	Slip clay.	Fire clay (including fire-clay dust).	Stoneware clay.	Miscellaneous clay.	Total.
White bodied ware made from white burning clays, including china, bone china, Delft and Belleek ware, whiteware, cream-colored, white granite, semiporcelain and semivitreous porcelain ware, hard porcelain, chemical porcelain, porcelain electrical supplies, and sanitary ware	45,606	16,141	102	5,433	1,547	...	68,829
Art pottery	2,552	1,265	368	100	492	102	4,879
High-grade tile	11,688	5,609	...	2,156	...	59	19,512
Chemical stoneware	104	...	...	4,320	5,497	...	9,921
Stoneware	...	1,152	...	320	69,893	...	71,365
Enameling, as coating for granite ware, etc	...	101	161	...	...	...	262
Paper filler	68,894	...	...	4,204	...	...	73,098
Paper coating	6,697	...	...	...	...	...	6,697
Rubber	2,871	...	...	20	...	...	2,891
Oilcloth or linoleum	2,166	...	...	...	...	714	2,880
Paint filler or extender	6,949	1,000	...	...	...	240	8,189
Paint pigment	...	...	...	...	...	29	29
Architectural terra cotta	...	6,108	...	70,635	4,000	11,869	92,612
Asbestos products	1,800	...	...	2,305	...	...	4,105
Plaster and plaster products	1,593	...	...	9,021	...	1,680	12,294
Slip for glazing purposes	...	...	1,894	...	...	...	1,894
Cement	111	...	...	218	...	22,797	23,126
Kalsomine	3,599	...	...	...	...	...	3,599
Artificial abrasives (as emery wheels, etc.)	1	100	130	25	26	...	282
Crayons (for tailors' use, etc.)	263	...	...	...	...	...	263
Chemicals	33	...	...	...	...	...	33
Pencil leads (graphite)	...	...	...	...	...	150	150
Saggers	300	8,904	...	74,812	1,090	...	85,106
Pins, stilts, and spurs for potters' use	...	1,770	...	4,927	...	...	6,697
Wads	...	...	...	14,450	250	...	14,700
Gas retorts	...	...	...	5,000	101	...	5,101
Fire brick and block	351	...	...	390,911	...	...	391,262
Fire clay mortar, including clay processed for laying fire brick	...	...	...	211,790	...	30	211,820
Glasshouse pots	...	...	...	18,198	...	...	18,198
Glasshouse supplies, blocks, tiles, etc	...	...	...	14,672	...	...	14,672
Zinc retorts	...	...	...	7,837	...	...	7,837
Zinc condensers	...	...	...	20,612	...	...	20,612
Clay crucibles	...	...	...	588	...	...	588
Graphite crucibles and stoppers	...	...	...	800	...	50	850
Foundry use and steel works for cupola lining, etc	...	...	...	155,080	185	13,903	169,168
Unspecified [a]	7,148	11,864	1,953	177,427	3,493	161,340	363,225
	162,726	54,014	4,608	1,195,861	86,574	212,963	1,716,746

[a] Includes ardmorite, bentonite, clay used for brick, conduits, flowerpots, hollow tile, ink, medicinal use, modeling, phonograph records, roofing tile, sewer pipe, stove lining, tinning, ultramarine, etc.

IMPORTS AND EXPORTS.[1]

Clay imported and entered for consumption in the United States 1912–1921.

Year.	Kaolin or china clay.			Common blue and Gross Almerode glass-pot clay.		All other clays.				Total.	
						Unwrought.		Wrought.			
	Short tons.	Value.	Average price.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1912	278,276	$1,629,105	$5.85	23,112	$184,018	32,473	$127,004	794	$12,109	334,655	$1,952,236
1913	268,666	1,623,993	6.04	24,986	204,911	42,582	155,693	1,889	22,178	338,123	2,006,775
1914	328,038	1,927,425	5.88	16,761	122,325	50,069	195,956	3,232	41,712	398,100	2,287,418
1915	209,132	1,152,778	5.51	8,864	62,569	23,718	90,367	1,343	12,433	243,057	1,318,147
1916	253,707	1,326,684	5.23	2,501	12,134	42,478	163,421	180	1,994	298,866	1,504,233
1917	241,029	1,315,769	5.46	88	709	26,581	123,439	338	2,142	268,036	1,442,059
1918	168,100	1,153,240	6.86	114	983	26,984	163,484	137	1,087	195,335	1,318,794
1919	180,592	1,965,393	10.88	4	133	23,759	187,550	498	4,262	204,853	2,157,338
1920	361,800	3,568,677	9.86	6,837	157,201	34,252	272,524	691	10,267	403,580	4,008,669
1921	162,906	1,546,285	9.49	4,468	77,217	41,421	348,870	120	2,313	208,915	1,974,685

Clay exported from the United States, 1916–1921.

Year.	Fire clay.		All other.		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1916	45,752	$144,552	27,941	$145,970	73,693	$290,522
1917	54,023	268,093	29,194	178,764	83,217	446,857
1918	60,206	333,880	24,348	192,053	84,554	525,933
1919	37,486	262,501	30,983	249,571	68,469	512,072
1920	54,125	393,177	66,035	775,222	120,160	1,168,399
1921	23,666	177,979	23,779	183,449	47,445	361,428

[1] Figures of imports and exports compiled by J. A. Dorsey, of the U. S. Geological Survey, from records of the Bureau of Foreign and Domestic Commerce.

FELDSPAR.

By F. J. Katz.

PRODUCTION.

The crude feldspar mined and sold in the United States in 1921 showed a decrease of 32 per cent in quantity and 27 per cent in value as compared with the production in 1920. The output for 1921 is also smaller than that for any other year since 1912 except 1918 and 1919, when the activities of feldspar-consuming industries were curtailed on account of the war. The production in 1920 was the largest ever recorded and was apparently in excess of requirements. On that account and also on account of the growing production in Canada and the depressed condition of the domestic ceramic industries the production of feldspar in the United States in 1921 was less than normal.

Statistics of production of feldspar in this report are presented in tabular form only for the mine and quarry output (crude feldspar). The reports for preceding years have shown the quantity and value of both crude and ground feldspar as sold by the producers. The combination of figures of crude and ground feldspar gives a distorted view of the relative importance of the States in production of feldspar and also of the values per unit of quantity. In order to avoid such distortion all feldspar produced and marketed in each State is now reported as crude feldspar at the average value for such feldspar in each State, in spite of the fact that much of the feldspar was first marketed in the ground form.

The average value of all feldspar sold crude in 1921 was $6.62 a long ton. The average values as reported by individual producers ranged from $3 to $11.18 a long ton.

GROUND FELDSPAR.

No satisfactory data are available on the total production of ground feldspar in the United States, although an effort was made to collect statistics of the output of ground feldspar of domestic origin. From such information as has been obtained it would appear that the total output of ground feldspar of both domestic and Canadian origin in the United States in 1921 was about 90,000 short tons, valued at $1,600,000 to $1,750,000. The average value per ton of ground feldspar sold in 1921, so far as reported to the United States Geological Survey by producers, was $17.91, and the averages as shown by the reports of individual producers ranged from $12.23 to $21.56. These averages cover various grades of ground feldspar at the mills in different States. Reports to the Survey indicate that No. 1 feldspar, ground to pass 160-mesh screen or finer, brought prices as follows in carload lots in Maine: $26 a ton from January to June 1, $25 during June, $23 from July to September, inclusive, and $22 from October until the end of the year. Early in 1922 the price had declined to $20.50. Corresponding figures for other States are not available but were probably not very different.

Crude feldspar produced and sold in the United States in 1920 and 1921.

State.	1920		1921	
	Long tons.	Value.[a]	Long tons.	Value.[a]
California	1,021	$4,797	[b] 2,057	[b] $15,847
Connecticut	7,719	64,066	9,565	65,864
Maine	45,352	329,626	18,866	134,168
Maryland	17,999	100,822	5,155	33,798
New Hampshire			(c)	(c)
New York	19,294	121,027	(c)	(c)
North Carolina	36,521	187,136	40,712	259,603
Pennsylvania	7,645	43,649	(c)	(c)
Undistributed			15,510	108,372
	135,551	851,123	91,865	617,652

[a] Value at mine or nearest shipping point.
[b] Includes a small quantity from Colorado.
[c] Included under "Undistributed."

Crude feldspar produced and sold in the United States in 1917–1921.

Year.	Long tons.	Value.	Year.	Long tons.	Value.
1917	126,715	$474,767	1920	135,551	$851,123
1918	88,498	429,989	1921	91,865	617,652
1919	63,441	347,992			

Notwithstanding the business depression in the feldspar industry there was considerable increase in the feldspar-grinding capacity. Two new mills were established at Johnson City, Tenn., and a third mill at that place has been remodeled. New mills for grinding Canadian feldspar were also established at Rochester, N. Y., and in Cleveland and Toledo, Ohio, and one new mill was built during the year in Canada. A recent report by the Bureau of Mines[1] describes feldspar-grinding plants and makes suggestions for increased efficiency in the industry.

FELDSPAR INDUSTRY BY STATES.

Sales of crude feldspar in 1921 were reported from the following States, named in the order of production: North Carolina, Maine, Connecticut, New York, New Hampshire, Maryland, California, Colorado, and Pennsylvania.

[1] Ladoo, R. B., Conditions in the feldspar industry: Bur. of Mines Repts. Investigations, Serial No. 2311, January, 1922.

California.—Only two producers reported from California, one in San Diego County and one in Riverside County

Colorado.—A small production was reported by one operator in Jefferson County, Colo.

Connecticut.—Reports were received from four operators in Connecticut, one in Litchfield and three in Middlesex counties. There were, however, a large number of individual operators, some of whom marketed their product to reporting companies. One commercial feldspar mill was in operation during the year at South Glastonbury.

Maine.—The production of feldspar was reported by five large operators in Maine; they also marketed the feldspar from a number of small quarries. Ten or more quarries in Androscoggin, Oxford, and Sagadahoc counties were worked during the year, and there were four mills in operation, one each at Bath, Cathance, Auburn, and Topsham.

Maryland.—Eight quarries produced feldspar in Maryland, in Baltimore, Cecil, and Howard counties.

New Hampshire.—The production from New Hampshire was reported by two operators in Cheshire County. No feldspar was ground in the State.

New York.—The production of feldspar was reported by two operators in New York, one each in St. Lawrence and Westchester counties. Feldspar-grinding plants at Bedford and Rochester were in operation during the year. The statistics given for New York do not include the quarrying and crushing in Essex County of pegmatite material, which is largely used for roofing. The output from the quarries in that county is reported with the statistics relating to stone as building material.

North Carolina.—North Carolina is the principal producing State, its output of crude feldspar in 1921 being nearly 45 per cent of the total for the United States and more than twice as much as that of the State next in rank. Individual reports were received on 40 quarries in Avery, Buncombe, Mitchell, and Yancey counties, and production from a considerable number of other small operations was reported by the larger producers, through whom the small quarrymen marketed their product. Besides having the largest number of feldspar quarries North Carolina now has in several of the operations near Penland, at Bowditch, and near Spruce Pine quarries ranking among the largest in the United States. These quarries have been expensively equipped for large outputs and are served by either aerial tramways or narrow-gage railroads connecting them with the Carolina, Clinchfield & Ohio Railway.

In addition to these operations that were productive in 1921, new and extensive developments are being conducted in Yancey County. A new quarry on a large dike of pegmatite on Crabtree Creek has been connected by a narrow-gage railroad with the Carolina, Clinchfield & Ohio Railway, and another large quarry has been opened near Micaville, where a new grinding plant was put in operation early in 1922. The operators of this Micaville quarry, as also those of another new one at Swannanoa, in Buncombe County, have prepared to offset the heavy costs of production of No. 1 grade feldspar by crushing the large quantity of waste rock necessarily handled and disposing of the crushed product as material for concrete facing or for use in concrete aggregates or for other purposes. Another interesting development in North Carolina feldspar fields is the mining by stoping practiced by the Wiseman Mines Corporation, at Spruce Pine, and the Southern Spar & Mica Co., at Swannanoa.

The bold investment in expensive development and preparation for production and marketing and the courageous attack of the problems of feldspar mining by new methods will cause the North Carolina feldspar operations to be watched with a great deal of interest during the coming year. It is hoped that generally improved business conditions will stimulate the feldspar market, so that the aggressive North Carolina operators may have every possible chance for success.

Pennsylvania.—Only a small output was reported in Pennsylvania in 1921 and that by one producer. No mills were in operation in the State during the year. Feldspar mining in Pennsylvania has practically ceased.

FOREIGN PRODUCTION.

The supply of feldspar annually available for the ceramic and other feldspar-consuming industries in the United States is made up in considerable part of the feldspar mined in Canada. According to a preliminary report of the Dominion Bureau of Statistics the mine output in Canada in 1921 amounted to 33,597 short tons, all from Ontario and Quebec. Of this quantity 30,540 tons was shipped. 90 per cent of which was exported, probably all in crude form, to the United States. As shown in the following table the Canadian shipments in 1921, although considerably less than in 1920, were much larger than in any year prior to 1920. This increasing production of Canadian feldspar is seriousyl affecting the production of the United States.

Feldspar produced and sold in Canada, 1916–1921.[a]

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1916	19,488	$71,407	1919	14,679	$86,231
1917	19,462	89,826	1920	37,873	280,895
1918	18,782	112,728	1921 [b]	30,540	223,000

[a] Statistics taken from reports on the mineral production of Canada, Canada Dept. Mines.
[b] Figures for 1921 preliminary and subject to revision.

The most recent figures for the production of feldspar in other foreign countries are shown in the accompanying table. Norway and Sweden are important producers, and Germany also produces a considerable quantity. Feldspar is also quarried in England and France. Trade journals recently reported plans for the operation of a feldspar quarry in Finland.

Feldspar sold in principal producing countries, 1916–1921, in metric tons.[a]

[For more complete data see U. S. Geol. Survey Mineral Resources, 1921, pt. 1, pp. 513–564.]

Country.	1916	1917	1918	1919	1920	1921
Canada	17,679	17,656	17,039	13,316	34,358	27,705
Germany (Bavaria)	2,650	2,530	3,772	(b)	5,850	(b)
Italy	900	1,292	1,517	1,100	2,600	(b)
Norway [c]	12,811	4,435	3,488	(b)	(b)	(b)
Sweden	12,724	18,533	17,850	12,905	12,049	(b)
United Kingdom	762	986	2,461	4,903	(b)	(b)
United States	120,366	128,749	89,918	64,459	137,727	93,339

[a] Sources of information: Canada, Canada Dept. Mines. Germany, Glückauf, Nov. 8, 1919; Aug. 7, 1920; Jan. 14, 1922. Italy, Rivista del servizio minerario. Norway, Statistiskes Centralbyra Norges Bergverksdrift, Norges Officielle Statistik. Sweden, Sveriges Officiella Statistik Industri och Bergshantering. United Kingdom, Imperial Mineral Resources Bureau.

[b] Statistics not available.

[c] Includes crude and ground feldspar.

SALT, BROMINE, AND CALCIUM CHLORIDE.

By K. W. Cottrell.

SALT.

PRODUCTION.

Most producers of salt reported trade conditions very bad in 1921 in spite of the increase in the selling prices of some products. The trade carried over large stocks and had to contend with high operating costs and freight rates and a reluctant market.

The salt produced and sold in the United States in 1921 showed a decrease of 27 per cent in quantity and of 18 per cent in value from 1920. This decrease was general throughout the country, ranging from 6 per cent in quantity in West Virginia and 1 per cent in value in Ohio to 37 per cent in quantity and 30 per cent in value in Michigan.

Salt produced and marketed in the United States, 1916–1921.

Year.	Short tons.				Value.[a]	
	Manufactured (evaporated).	In brine.	Rock salt.	Total.	Total.	Average.
1916	2,454,836	2,539,717	1,368,353	6,362,906	$13,645,947	$2.14
1917	2,482,564	2,890,588	1,605,025	6,978,177	19,940,442	2.86
1918	2,724,203	2,830,600	1,683,941	7,238,744	26,940,361	3.72
1919	2,392,290	2,850,639	1,639,973	6,882,902	27,074,694	3.93
1920	2,409,924	2,819,916	1,610,189	6,840,029	29,894,075	4.37
1921	1,931,243	1,577,335	1,472,576	4,981,154	24,557,966	4.93

[a] The values are f. o. b. mine or refinery and do not include cost of cooperage or containers.

PRODUCTION BY STATES.

In 1921 the leading State in the production of salt was New York. Michigan was a close second, and Ohio, Kansas, and Louisiana followed in the order named. The number of operating plants in California was 19, Kansas 11, Michigan 22, New York 13, and Ohio 6. The other States had from 1 to 5 plants each, making a total of 90 active plants as compared with 104 plants in 1920.

Salt produced and marketed in the United States, 1918–1921, by States.

State.	1918		1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Michigan	2,403,125	$9,048,650	2,492,378	$9,456,138	2,262,915	$10,698,674	1,427,465	$7,439,445
New York	2,130,530	7,336,867	1,947,829	7,159,547	1,903,101	7,584,921	1,455,014	6,505,041
Ohio	1,089,887	3,273,390	991,730	2,362,941	1,057,802	3,324,492	749,349	3,284,952
Kansas	819,504	3,598,289	773,576	4,497,247	783,655	3,839,409	665,968	3,268,661
Louisiana	(a)	(a)	(a)	(a)	265,085	1,517,414	(a)	(a)
California	204,957	1,167,777	200,115	1,555,596	212,008	1,301,426	193,618	1,043,912
Texas	79,657	762,006	(a)	(a)	91,103	667,835	(a)	(a)
Utah	94,204	580,375	77,336	432,130	75,259	546,186	68,874	491,354
West Virginia	26,077	251,668	18,599	167,529	29,802	348,556	27,964	320,537
Porto Rico	(a)	(a)	(a)	(a)			7,418	24,908
Idaho	(a)	(a)	39	530	(a)	(a)		
Nevada	970	4,175	(a)	(a)	(a)	(a)		
Undistributed [b]	389,833	917,164	381,300	1,443,036	159,299	65,162	385,484	2,179,156
	7,238,744	26,940,361	6,882,902	27,074,694	6,840,029	29,894,075	4,981,154	24,557,966

[a] Included under "Undistributed."
[b] 1918: Hawaii, Idaho, Louisiana, New Mexico, Oklahoma, Porto Rico, and Virginia; 1919: Hawaii, Louisiana, Nevada, New Mexico, Porto Rico, Texas, and Virginia; 1920: Hawaii, Idaho, Nevada, New Mexico, and Virginia; 1921: Hawaii, Louisiana, New Mexico, Texas, and Virginia.

PRODUCTION BY METHODS OF MANUFACTURE.

In order that production might be shown by methods of manufacture rather than by uses the salt data for 1921 have been assembled in different form from that for preceding years.

Salt produced and marketed in the United States in 1921, by method of manufacture.

Method of manufacture.	Short tons.	Value.	
		Total.	Average.
Evaporated in open pans or grainers	693,174	$7,153,007	$10.32
Evaporated in vacuum pans	916,145	7,390,064	8.07
Solar evaporated	224,333	1,197,653	5.34
Pressed blocks from evaporated salt	97,591	1,106,239	11.34
Rock	1,452,428	6,524,679	4.49
Pressed blocks from rock salt	20,148	169,244	8.40
Salt in brine (sold or used as such)	1,577,335	1,017,080	.64
	4,981,154	24,557,966	4.93

Rock salt was reported by 17 plants in 6 States. New York led in the production, its output being almost double that of Kansas and more than three times that of Louisiana.

Rock salt produced and marketed in the United States, 1916–1921.

Year.	Short tons.	Value.	
		Total.	Average.
1916	1,368,353	$2,665,270	$1.95
1917	1,605,025	3,897,595	2.43
1918	1,683,941	5,684,661	3.38
1919	1,639,973	6,224,920	3.80
1920	[a]1,610,189	[a]7,048,315	4.38
1921	[a]1,472,576	[a]6,693,923	4.55

[a] Includes pressed blocks made of rock salt, as follows: 1920, 15,182 tons, valued at $172,211; 1921, 20,148 tons, valued at $169,244.

Evaporated salt produced and marketed in the United States in 1920 and 1921, by States.

State.	1920		1921	
	Short tons.	Value.	Short tons.	Value.
California	211,978	$1,301,126	178,118	$962,412
Kansas	282,533	2,461,287	251,769	2,407,642
Louisiana	1,495	12,512		
Michigan	951,189	9,156,170	706,218	6,279,781
Nevada	(a)	(a)		
New York	471,727	3,996,265	367,119	3,016,855
Ohio	297,802	2,534,490	249,349	2,784,952
Porto Rico			7,418	24,908
Texas	91,103	667,835	(a)	(a)
Utah	71,473	522,620	64,401	468,461
West Virginia	29,802	348,556	27,964	320,537
Undistributed [b]	822	10,502	78,887	581,415
	2,409,924	21,011,363	1,931,243	16,846,963
Percentage of increase in 1920 and of decrease in 1921.	+0.74	+8.16	−19.9	−19.8

[a] Included under "Undistributed."
[b] 1920: Hawaii, Idaho, New Mexico, and Virginia; 1921: Hawaii, New Mexico, and Texas.

The production of pressed blocks in the last five years as reported by the original producers of the salt and shown in the following table does not represent the entire pressed-block industry, because some firms that do not produce salt are making pressed blocks of salt bought in the open market.

Pressed salt blocks produced and sold in the United States, 1917–1921.

Year.	Short tons.	Value.		Year.	Short tons.	Value.	
		Total.	Average.			Total.	Average.
1917	64,380	$457,273	$7.10	1920	129,224	$1,515,041	$11.72
1918	94,150	939,900	9.98	1921	117,739	1,275,483	10.83
1919	119,510	1,358,757	11.37				

CONSUMPTION.

Of the total consumption of salt in 1921 in the United States 98.1 per cent was of domestic production and only 1.9 per cent was imported.

Supply of salt for domestic consumption, 1917–1921, in short tons.

Source.	1917	1918	1919	1920	1921
Domestic production	6,978,177	7,238,744	6,882,902	6,840,029	4,981,154
Imports	64,922	40,290	59,514	137,654	93,095
	7,043,099	7,279,034	6,942,416	6,977,683	5,074,249
Exports	113,993	136,783	119,416	139,272	109,563
Domestic consumption	6,929,106	7,142,251	6,823,000	6,838,411	4,964,686
Comparison with preceding year	+528,186	+213,145	−319,251	+15,411	−1,873,725
Percentage of imports to total consumption.	0.9	0.6	0.9	2.0	1.9

IMPORTS AND EXPORTS.

According to figures obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, and converted from pounds, as reported by that bureau, to short tons, the salt imported and entered for consumption in the United States in the last six years has been as follows:

Salt imported and entered for consumption in the United States, 1916–1921.

Year.	In bags, barrels, and other packages.		In bulk.		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1916	24,402	$200,290	97,677	$142,298	122,079	$342,588
1917	13,472	139,339	51,450	140,796	64,922	280,135
1918	10,259	148,128	30,031	133,340	40,290	281,468
1919	9,676	137,627	49,838	105,077	59,514	242,704
1920	29,567	240,923	108,087	435,576	137,654	676,499
1921	38,374	333,282	54,721	197,749	93,095	531,031

Salt imported into the United States, 1918–1921, by countries.

[General imports.]

Country.	1918		1919		1920		1921	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
France			56,000	$601				
Germany			6,613,800	81,698	47,669,300	$143,158	82,712,700	$250,614
Italy							5,846,400	8,347
Netherlands					314,700	294		
Portugal	112,000	$216	22,100	242	17,008,000	34,624	2,912,000	2,850
Spain	10,180,000	6,750	55,722,100	37,952	65,732,100	71,158	12,494,400	29,597
England	34,102,700	219,007	18,401,200	139,408	44,281,500	236,374	16,676,700	123,999
Scotland					200	1		
Canada	589,200	6,663	299,700	3,050	3,156,200	22,188	1,692,000	13,560
Panama				1				
Mexico	76,500	614	79,700	637			18,200	142
British West Indies	25,779,400	35,815	41,930,900	55,423	74,961,600	124,654	35,761,400	54,271
Cuba	103,800	134						
Dutch West Indies	4,731,400	8,779	2,139,300	4,633	20,415,600	39,571	9,603,200	12,425
French West Indies	200,000	425			1,106,200	2,868	62,000	151
Virgin Islands of the United States			374,600	725			902,800	1,788
Argentina					228,400	1,142		
Dominican Republic	3,858,000	4,824						
Venezuela					75,600	137		
Japan	200	5	1,500	12	300	4	500	19
Hongkong			200	5	100	17	1,100	11
Turkey in Asia							700	6
Portuguese Africa	896,000	800						
Australia			1,100	15				
Canary Islands					358,400	309		
French Africa							17,506,000	33,251
	80,629,200	284,032	125,642,200	324,402	275,308,200	676,499	186,190,100	531,031

Less salt was exported in 1921 than in any other year since 1916.

Salt exported from the United States, 1916–1921.

Year.	Short tons.	Value.	Year.	Short tons.	Value.
1916	84,065	$567,441	1919	119,416	$1,396,625
1917	113,993	1,000,773	1920	139,272	1,901,593
1918	136,783	1,677,577	1921	109,563	1,415,471

Salt exported from the United States, 1919–1921, by countries.

Country.	1919		1920		1921	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Europe:						
Azores and Madeira Islands	1,471	$25				
Belgium			600	$16		
Denmark			4,800	150		
France			38,140	3,654	1,344	$48
Germany	820	17	2,051	30		
Greece			112	2		
Iceland and Faroe Islands	12,570	439	2,000	77	2,400	95
Italy	2,520	48				
Netherlands	1,000	20				
Norway	7,500	222				
Poland and Danzig			395	19		
Rumania			274	17		
Russia in Europe	5,308	174	6,000	96	3,380	44
Serbia and Montenegro, etc	200	3				
Spain			92	8		
Sweden			778,748	14,366		
Turkey in Europe	8,536	526	4,720	118		
United Kingdom—England			227,600	1,226	10,000	150
North America:						
Bermuda	34,840	622	138,221	1,697	128,284	2,128
British Honduras	320,166	3,228	300,285	3,404	262,212	2,813
Canada	157,596,910	654,657	182,799,386	959,451	163,278,742	908,753
Central American States:						
Costa Rica	649,177	6,233	438,134	4,995	59,380	1,145
Guatemala	132,199	1,883	132,098	2,219	128,559	2,182
Honduras	1,842,919	17,730	2,641,512	23,022	1,859,679	23,202
Nicaragua	700,306	8,932	566,838	8,908	451,557	8,046
Panama	3,945,329	37,980	3,137,777	36,457	2,236,694	24,089
Salvador	5,632	336	2,000	60	1,821	82
Mexico	7,931,184	89,534	10,647,691	130,022	9,305,018	113,261
Miquelon, Langley, etc	1,656	63	1,520	42	576	11
Newfoundland and Labrador	4,891,549	31,211	879,888	7,660	603,490	5,582
West Indies:						
Barbados	15,557	219	1,450	26	724	25
Jamaica	28,511	334	78,503	1,405	196,438	1,392
Trinidad and Tobago	4,890	66	15,908	445	6,098	244
Other British	19,327	646	10,551	330		
Cuba	47,291,884	388,956	62,569,363	519,224	30,965,628	234,577
Dominican Republic	361,246	4,630	348,192	7,151	426,830	7,083
Dutch West Indies	190	12			50	5
French West Indies	24,281	705	8,539	367	8,500	320
Haiti	7,530	304	12,804	529	8,422	292
Virgin Islands of the United States	16,714	466	10,080	228	12,341	261
South America:						
Argentina	521,600	4,110	143,035	4,504	20,730	283
Bolivia	1,400	8	1,575	13		
Brazil	3,799	118	3,831	217	528 136	11,130
Chile	5,160	132	20,386	647		
Colombia	445,096	4,283	75,933	1,244	55,242	770
Ecuador	244	12	1,700	22		
Guiana:						
British	710	19	9,739	373	280	4
Dutch	21,910	370	13,500	215	1,500	60
French	5,000	75	11,112	344		
Peru	148	4	1,920	60		
Uruguay			54	2		
Venezuela	1,320	40	1,049	20	1,440	29
Asia:						
China	36,651	1,882	46,488	3,097	22,093	1,996
Kwangtung, leased territory	36	3	4,400	425	504	36
Chosen	11,297	386	6,802	192	7,147	425
East Indies:						
British:						
British India	18,619	1,201	6,169	634	6,900	463
Straits Settlements	18,728	742	1,458	148	1,234	126
Other British	5,506	299	2,776	207	3,920	238
Dutch	95,222	3,626	16,134	1,407	4,213	262
French	4,192	230	120	14		
"Far Eastern Republic"					3,240	280
Hongkong	29,360	2,257	15,569	1,049	90,574	3,646
Japan	7,138,600	38,974	8,571,850	66,622	6,708,380	28,448
Russia in Asia	249,600	2,287	96,529	3,279	10,810	278
Siam	595	57	3,044	196	1,065	105
Turkey in Asia	12	1	176	12	872	48

Salt exported from the United States, 1919–1921, by countries—Continued.

Country.	1919		1920		1921	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Oceania:						
British:						
Australia	2,209,634	$44,457	1,155,704	$29,652	900,918	$17,317
New Zealand	1,553,914	26,484	1,932,538	43,065	486,898	8,261
Other British	21,069	552	24,949	679	14,240	345
French Oceania	174,384	2,865	295,672	4,111	217,218	2,169
German Oceania	44,836	866				
Other Oceania			13,430	280	4,446	103
Philippines	192,976	7,760	252,593	11,256	72,157	2,734
Africa:						
Belgian Kongo	6,605	343	3,143	95	2,420	66
British Africa:						
West	61,110	1,034	2,274	28	265	7
South			100	2		
East	595	19	700	21		
French Africa	89,648	901				
German Africa	74	3				
Canary Islands			96	4		
Liberia	56	1	302	14	23	1
Portuguese Africa	78	3	1,216	22	1,215	31
	238,831,706	1,396,625	278,544,338	1,901,593	219,126,247	1,415,471

BROMINE.

PRODUCTION.

The bromine marketed in 1921 was 39 per cent less in quantity and 77 per cent less in value than in 1920. The average price decreased 63 per cent. A large part of the output is not marketed as bromine but in the form of potassium and sodium bromides and other salts. The figures given in the following table include the bromine content of these salts. The values given in the table are reported to the Geological Survey by the producers and represent averages for the year f. o. b. at the plants.

The wholesale price per pound of bulk bromine as quoted in 1921, according to Chemical and Metallurgical Engineering, ranged from 50 to 52 cents in January and February, 40 to 41 cents from March to May, and 41 to 42 cents from June until about the middle of August, when it dropped to 27 to 28 cents; these rates continued until December 21, when the price dropped to 23 to 24 cents.

Bromine had not been imported into the United States for several years prior to 1921, when imports of 300 pounds, valued at $84, were reported. The exports of bromine are not separately reported by the Bureau of Foreign and Domestic Commerce.

Bromine marketed in the United States, 1911–1921.

Year.	Pounds.	Value.		Year.	Pounds.	Value.	
		Total.	Average.			Total.	Average.
1911	651,541	$110,902	$0.17	1917	895,499	$492,703	$0.55
1912	647,200	145,805	.22	1918	1,727,156	970,099	.56
1913	572,400	115,436	.20	1919	1,854,971	1,234,969	.67
1914	576,991	203,094	.35	1920	1,160,584	745,381	.64
1915	855,857	856,307	1.00	1921	711,953	172,759	.24
1916	728,520	951,932	1.31				

CALCIUM CHLORIDE.

The calcium chloride reported in the following table is an original constituent of the natural brine produced in connection with the manufacture of salt and bromine in California, Michigan, Ohio, and West Virginia.

Calcium-magnesium chloride from natural brines produced and marketed in the United States, 1911–1921.

Year.	Short tons.	Value.		Year.	Short tons.	Value.	
		Total.	Average.			Total.	Average.
1911	14,606	$91,215	$6.25	1917	30,503	$451,480	$14.80
1912	18,559	117,272	6.32	1918	26,624	503,452	18.91
1913	19,611	130,030	6.63	1919	26,123	321,596	12.31
1914	19,403	121,766	6.28	1920	27,849	539,471	19.37
1915	20,535	130,830	6.37	1921	23,672	510,723	21.57
1916	27,709	224,997	8.12				

BARYTES AND BARIUM PRODUCTS.[1]

By George W. Stose.

CRUDE BARYTES.

PRODUCTION AND SALES.

The quantity of crude barytes mined and sold in the United States, which had been more than 100,000 short tons a year for six years, fell to about 66,000 tons in 1921, an output not much larger than the average annual sales before the World War. This decrease is regarded as being only temporary and in large part caused by the postwar depression; the business is expected to be much larger in normal years. The average price per ton obtained in 1921 was nearly 15 per cent lower than that in 1920 but considerably higher than the prices that prevailed prior to 1919. The value of the sales in 1921 was about one-fourth the value of the sales in 1920.

Crude barytes produced and marketed in the United States, 1915–1921.

Year.	Short tons.	Value.[a]	
		Total.	Average.
1915	108,547	$381,032	$3.51
1916	221,952	1,011,232	4.56
1917	206,888	1,171,184	5.66
1918	155,368	1,044,905	6.73
1919	209,330	1,727,822	8.25
1920	228,113	2,142,464	9.39
1921	66,369	531,958	8.02

[a] Value f. o. b. mine shipping point.

Crude barytes produced and marketed in the United States, 1919–1921, by States.

State.	1919			1920			1921		
	Short tons.	Value.[a]		Short tons.	Value.[a]		Short tons.	Value.[a]	
		Total.	Average.		Total.	Average.		Total.	Average.
California	(b)	(b)	(b)	2,250	$20,850	$9.27	942	$5,084	$5.40
Georgia	85,303	$667,521	$7.83	84,644	790,362	9.34	24,614	191,442	7.78
Kentucky	5,435	36,408	6.70	(b)	(b)	(b)	......	......	......
Missouri	73,247	640,398	8.74	99,654	1,013,570	10.17	25,200	217,913	8.65
Tennessee	34,700	288,622	8.32	29,319	213,657	7.29	8,180	61,148	7.48
Other States [c]	10,645	94,873	8.91	12,246	104,025	8.49	7,433	56,371	7.58
	209,330	1,727,822	8.25	228,113	2,142,464	9.39	66,369	531,958	8.02

[a] Value f. o. b. mine shipping point.
[b] Included under "Other States."
[c] States having less than 3 producers each are grouped together to avoid disclosing confidential information. 1919: Alabama, California, Illinois, Nevada, North Carolina, South Carolina, Virginia, and Wisconsin; 1920: Alabama, Illinois, Kentucky, Nevada, North Carolina, South Carolina, Virginia, and Wisconsin; 1921: Alabama, Illinois, North Carolina, South Carolina, and Virginia.

Missouri and Georgia together marketed about 75 per cent of the total domestic output in 1921. Missouri's production declined about

[1] The statistical data in this report were prepared by Mrs. E. R. Phillips, of the United States Geological Survey.

75 per cent from that in 1920, but Georgia's production declined only 71 per cent, so that Missouri exceeded Georgia by less than 600 tons. Tennessee had the next largest output, which showed a decline of about 72 per cent. In California, which is the only Western State that produced barytes, the production in 1921 decreased 58 per cent.

STOCKS.

The quantity of ore that has been mined and is held in storage at the mine or at the railroad shipping point can only be estimated roughly, as the ore is generally stored in irregular piles. The estimates furnished by the producers indicate that the total stock so held at the end of 1921 was much larger than that at the end of 1920 and somewhat larger than that at the end of 1919. In 1920 the production could scarcely keep pace with the demand, and stocks did not accumulate. Large stocks of ore that are held in reserve for emergency by the larger manufacturers of barium products are not included in the figures in the following table:

Estimated crude barytes in stock at mines at end of year, 1919–1921, in short tons.

State.	1919	1920	1921
Missouri	8,090	3,154	10,136
Georgia	3,900	1,708	4,838
Tennessee	7,094	915	4,021
Alabama, North Carolina, South Carolina, Virginia, and Kentucky [a]	1,759	2,643	4,705
California, Illinois, Nevada, and New Mexico [b]	1,675	1,027	85
	22,518	9,447	23,785

[a] 1919, Alabama and Kentucky not included; 1921, Kentucky not included.
[b] 1919, California not included; 1921, Nevada and New Mexico not included.

IMPORTS.

Although the quantity of crude barytes imported in 1921 was less than one-half that imported in 1920, it constituted a larger percentage of the quantity consumed than in any other recent year. In 1920 less than 10 per cent of the ore consumed was imported, whereas in 1921 about 14 per cent was imported. The low ocean freight rates from Europe as compared with freight rates from barytes mines of the United States to the barium-product factories near the Atlantic coast and the cheapness of the ore, particularly that mined in Germany, are two points in favor of imported ore, which are hardly offset by the present import duty. Since the influx of foreign ore many mines have been shut down.

Crude barytes imported for consumption, 1912–1921.

Year.	Short tons.	Value.[a]		Year.	Short tons.	Value.[a]	
		Total.	Average.			Total.	Average.
1912	26,186	$52,467	$2.00	1917	6	$63	$10.50
1913	35,840	61,409	1.71	1918			
1914	24,423	46,782	1.92	1919	118	594	5.03
1915	2,504	4,877	1.95	1920	24,874	146,858	5.90
1916	17	245	14.41	1921	11,054	59,371	5.37

[a] Value at port of shipment on which duty is levied. Does not include railroad and ship freight charges to this country or import duty.

MARKETS.

Barytes is used chiefly in the manufacture of ground barytes, lithopone, and other barium chemicals, and most of the plants consuming barytes are in the eastern part of the country. Many of the larger plants have their own mines, but there are also middlemen who buy up the products of scattered small mines, especially in Missouri, and ship the ore to central points or direct to industrial plants. The ore used by all the barium industries in 1921 showed a decline of 56 per cent from the total in 1920; the decline in the ground barytes trade was 64 per cent, in the chemical trade 71 per cent, but in the lithopone trade only 46 per cent. Nearly 61 per cent of the barytes used in 1921 was made into lithopone, 28 per cent into ground barytes, and 11 per cent into barium chemicals.

Crude domestic and imported barytes used in the manufacture of barium products in the United States, 1916–1921, in short tons.[a]

Year.	Ground barytes.	Litho-pone.	Barium chemicals.	Total.
1916	75,507	71,898	38,283	185,688
1917	60,132	86,065	49,842	196,039
1918	62,440	85,282	38,041	185,763
1919	64,922	103,688	32,976	201,586
1920	79,052	113,181	37,210	229,443
1921	28,296	61,359	10,952	100,607

[a] Compiled from reports made by the manufacturers of barium products.

More than half the barytes consumed in the United States in 1921 was used by eight plants in Pennsylvania, New Jersey, Delaware, and New York, centering around Philadelphia, in the manufacture of lithopone and other chemicals. Missouri, the second State in quantity of barytes used, ground 98 per cent of its product into refined barytes, the remainder being manufactured into lithopone.

Barytes used by manufacturers of barium products in 1921, in short tons.

State.	Product manufactured.	Plants.	Barytes used.
Missouri	Ground barytes and lithopone	4	23,778
New Jersey	Lithopone and chemicals	4	16,862
Illinois	do	4	9,953
Pennsylvania and Delaware	Lithopone	4	34,527
New York	Chemicals		
Maryland	Lithopone	3	7,229
Georgia and South Carolina	Ground barytes		
West Virginia	Chemicals		
California	Ground barytes, lithopone, and chemicals	4	8,258
Kentucky	Ground barytes		
		23	100,607

PRICES.

The average price obtained for barytes is difficult to determine from the reports received from the producers, for some of the reports represent the prices received at small remote mines or gathering grounds in Missouri, others come from dealers who sell to larger middlemen or to manufacturing plants; and others are made by manufacturers who mine their own ore and probably assign an arbitrary value to it. The average price thus determined in 1921 for all States except Missouri and California was about $7.50 a ton. The higher average of $8.65 for the large quantity of ore mined in Missouri raised the average for all barytes produced in the United States to $8.02. The prices reported by California producers, which averaged only $5.40 a ton, are surprisingly small. The average prices by States are given in the second table in this report.

CONSUMPTION.

The consumption of crude barytes as given in the following table was determined by adding to the quantity of domestic ore mined and sold the quantity of ore imported. No barytes was exported. Figures obtained in this way are generally considerably larger than those derived from the reports of manufacturers of barium products, the difference being approximately represented by barytes imported in excess of the foreign ore reported as having been used by these manufacturers. This year the figures in the table are smaller than those in the preceding table, which gives the quantity of barytes used in the barium-products factories, because manufacturers in 1921 used accumulated stocks that are not accounted for in the following estimates of consumption.

Crude barytes consumed in the United States, 1913–1921, in short tons.

Year.	Sales of domestic barytes.	Imports for consumption.	Consumption.
1913	45,298	35,840	81,138
1914	52,747	24,423	77,170
1915	108,547	2,504	111,051
1916	221,952	17	221,969
1917	206,888	6	206,894
1918	155,368	....	155,368
1919	209,330	118	209,448
1920	228,113	24,874	252,987
1921	66,369	11,054	77,423

BARYTES INDUSTRY BY STATES.

Alabama.—The Bertha Mineral Co. more than doubled the output of 1920 from its mine at Jacksonville, Ala., and was the only producer in the State reporting shipments.

Alaska.—No production was reported from Alaska in 1921, and the Walters mine was apparently not reopened.

California.—The Western Rock Products Co. mined and shipped ore from the El Portal mine, Mariposa County, Calif., and milled its product at San Francisco for the retail trade. William Maguire reported shipments of ore from his mine in the Liberty Hill mining district, formerly operated by the Metals & Chemicals Extraction Corporation. H. C. Austin began development of a new deposit near Ydalpom, Shasta County, and reported shipments of ore beginning in September. No production was reported from James Bardin's mine, on Fremont Peak, in Monterey County.

Georgia.—The Bertha Mineral Co. reported shipments of ore from its own land and from lands of the Georgia Peruvian Ocher Co. and the Cherokee Ocher Co., near Cartersville, Bartow County, Ga. The product was sent to the plant of the New Jersey Zinc Co., at Palmerton, Pa. Some of the property of the Etowah Development Co. was apparently worked on lease. The National Pigments & Chemicals Co. (formerly the Nulsen Co.) and the Thompson-Weinman Co. also reported production.

Illinois.—The Illinois Barite Co. (Inc.) made small shipments from its property south of Golconda, Pope County, Ill.

Kentucky.—There were apparently no shipments of barytes from Kentucky in 1921.

Missouri.—Shipments of barytes were reported from 67 operators in Missouri in 1921, of whom only 40 reported more than 50 tons each, 9 more than 400 tons each, and 4 more than 1,000 tons each. Washington County, as usual, led in the output, shipping 88 per cent of the total from Missouri.

Barytes produced and marketed in Missouri, 1921, by counties.

County.	Mines.	Short tons.	Value.
Washington	43	22,272	$194,898
Jefferson	8	1,115	7,561
St. Francois	10	594	4,354
Miller, Morgan, Cole, and Franklin	6	1,219	11,100
	67	25,200	217,913

Nevada.—The mines of the American Barium Co., at Blair and Kinkead, Nevada County, Nev., and the House & Mallory mine, at Kinkead, were idle during 1921.

North Carolina.—The Rollin Chemical Corporation and Anson G. Betts both shipped ore from mines near Stackhouse, Madison County, N. C., and the Rollin Corporation used the product of both mines in its plant at Charleston, W. Va.

South Carolina.—The Cherokee Chemical Co. (Inc.) continued to mine barytes for its own use near Kings Creek, in Cherokee County, S. C.

Tennessee.—The Bertha Mineral Co. mined ore at its property near Jearoldstown, Greene County, Tenn., and shipped it to the plant of the New Jersey Zinc Co., at Palmerton, Pa. All other operations in Tennessee were in the Sweetwater district, McMinn and Monroe counties, where the Krebs Mining Co., the National Barium Corporation, and J. J. Fitzgerald reported shipments of ore.

Virginia.—The Rollin Chemical Corporation reported production from its mine near Evington, Campbell County, Va. The output was used in its plant at Charleston, W. Va. The Bertha Mineral Co. began operations on its recently acquired property near Toshes, Pittsylvania County, and shipped a small quantity of ore to the plant of the New Jersey Zinc Co., at Palmerton, Pa.

Wisconsin.—There was no output from the mine of the Porter Mining Co. near Cuba City, Lafayette County, Wis.

BARIUM PRODUCTS.

The quantity of barium products manufactured in the United States, including refined ground barytes, lithopone, and barium chemicals, which had increased steadily from 1915 to 1920, declined in 1921 to about half the output of 1920. The decline in the production of barium chemicals was the greatest, amounting to 74 per cent, and the decline in ground barytes was 58 per cent. Lithopone proved to be the more stable product and declined only 38 per cent. These declines are in part due to the large influx of foreign products.

Barium products made from domestic and imported crude ores and marketed in the United States, 1920–21.

Product.	1920			1921		
	Short tons.	Value.		Short tons.	Value.	
		Total.	Average.		Total.	Average.
Ground barytes	65,748	$1,381,868	$21.02	27,661	$622,871	$22.52
Lithopone	89,373	12,484,925	139.69	55,016	6,681,563	121.45
Barium chemicals [a]	20,760	1,743,634	83.99	5,487	412,275	75.14
	175,881	15,610,427	88.76	88,164	7,716,709	87.53

[a] Barium chemicals manufactured from secondary barium products bought in open market are not included in table.

REFINED GROUND BARYTES.

Uses.—Barytes when ground to an impalpable powder and purified by washing and leaching is used as a pigment, a filler, and an inert base. As a pigment it is much used with lithopone and other pigments in interior flat white or light-colored paints. As a filler it is extensively used in rubber goods, linoleum, oilcloth, highly glazed paper, and other articles. It forms an inert base on which dyes are precipitated to make colored paints. The highest grade of ground barytes is obtained by flotation on a stream of water, the most impalpable particles being thus separated. Ground barytes has recently been made into brick for the construction of X-ray laboratories, in place of a lining of sheet lead, to absorb the rays and prevent their escape to do possible injury.

Production.—Ground barytes was produced in 1921 by three plants in Missouri and by one each in Georgia, South Carolina, Kentucky, and California. The production by States can therefore not be given separately. The total quantity of refined barytes produced and marketed in the United States is given in the preceding table. The three plants in Missouri produced 83 per cent of the total. Although California was the only State that increased its production in 1921, its output was relatively small. Some barytes was ground in Kentucky, but none of this was shipped in 1921.

Price.—The average price received for ground barytes by producers in 1921, as given in the preceding table, was about $1.50 a ton higher than that in 1920, so that the decrease in production was apparently not due to lack of demand or decline in prices. The average prices obtained in South Carolina and Georgia were considerably lower than the average price received for all shipments.

Domestic prime white ground barytes in bags at New York was quoted in 1921 by the Oil, Paint, and Drug Reporter at $32 to $38 a ton, January to March 13; $24.50 to $26.50, March 14 to August 21;

and $23 to $23+, August 22 to December. Foreign prime white ground barytes ranged between $25 and $45 a ton during the year.

LITHOPONE.

Uses.—Lithopone is a pigment prepared chemically from barytes and zinc. It is composed of about 70 per cent of barium sulphate and 30 per cent of zinc sulphide, being an intimate mixture of chemical precipitates of these two compounds and of exceedingly fine grain. It is used not only in paint but as a filler in rubber goods, linoleum, oilcloth, window shades, and certain kinds of paper.

Production.—Lithopone was marketed by 15 plants in 1921. Three plants that were in operation in 1920 made no shipments in 1921, and one new plant—the United Color & Pigment Co., Newark, N. J.—began work in 1921. New Jersey, which in the past has been the largest producer, marketed less than half as much as in 1920, and so fell to second place. Pennsylvania, on the other hand, increased its output somewhat and took first place. The value of the total production in 1921 was a little more than half that of 1920.

Lithopone manufactured and sold in 1921, by States.

State.	Plants.	Short tons.	Value.
Pennsylvania and Delaware	4	28,453	$3,467,050
New Jersey	5	15,487	1,916,757
Illinois	3	6,926	783,531
Maryland, Missouri, and California	3	4,150	514,225
	15	55,016	6,681,563

Price.—The average price received by the makers of lithopone in the United States in 1921, as shown in the table on page 130, declined about 13 per cent from the price in 1920. Some plants received as high as $134 a ton for their product, others as low as $108.50, the variation in price depending on quality of material or location of plant. The prices of lithopone in barrels at New York, as reported by the Oil, Paint, and Drug Reporter, were as follows: 7–7¾ cents a pound in January; 7–7+ cents, February to July; 6–6+ cents, August to December.

BARIUM CHEMICALS.

Production.—Barium chemicals were made and sold in 1921 by six manufacturers—two in New Jersey and one each in California, Illinois, New York, and West Virginia. Several of the larger manufacturers that formerly produced made no barium chemicals in 1921, and the total quantity produced declined to less than one-quarter of the maximum production (that of 1918) and even fell below that of any preceding year recorded by the United States Geological Survey. Barium sulphate, the chief chemical made, and barium carbonate, next in importance, were each produced in three plants. Barium chloride, third in quantity produced, was made in two plants, and the other chemicals in only one plant each.

Barium chemicals of domestic manufacture sold, 1915 and 1918–1921, in short tons.

Chemical.	1915	1918	1919	1920	1921 Short tons.	1921 Value.	1921 Average price per pound.
Barium carbonate	2,746	7,661	7,135	7,484	1,956	$158,929	$0.041
Barium chloride	2,106	4,530	4,509	3,084	(a)	(a)	(a)
Barium nitrate	971	(a)	(a)	(a)	....	....	....
Barium sulphate (blanc fixe)	(a)	9,522	5,227	8,046	2,471	180,130	.036
Other barium chemicals [b]	3,000	1,473	3,142	2,146	1,060	73,216	.035
	8,823	23,186	20,013	20,760	5,487	412,275	.038

[a] Included under "Other barium chemicals."
[b] The quantities of chemicals manufactured in less than three plants are combined in the table to avoid divulging confidential information, as follows: 1915: Binoxide, hydroxide, sulphate, sulphide, and other barium chemicals not specified; 1918: Binoxide, hydroxide, nitrate, and sulphide; 1919: Binoxide, nitrate, and sulphide; 1920: Binoxide, hydroxide, nitrate, and sulphide; 1921: Chloride, hydroxide, and sulphide.

Price.—The average prices received in 1921 by manufacturers for barium carbonate, barium sulphate, and the average of all barium chemicals are given in the preceding table. Prices quoted in New York during the year are shown below.

Prices of barium chemicals quoted in New York wholesale market, 1920 and 1921.[a]

Chemical.	Unit.	1920	Jan. 1, 1921.	Dec. 31, 1921.
Barium chlorate	Pound	$0.40 – 0.60	$0.40 – 0.45	$0.40 – 0.45
Barium chloride (white crystals)	Short ton	75.00 –180.00	75.00 –100.00	48.00 –52.00
Barium dioxide	Pound	.21½– .25	.22½– .25	.22½– .25
Barium nitrate	...do	.10 – .18	.11½– .13½	.07 – .09½
Barium sulphate (blanc fixe), dry, in barrels	...do	.04 – .06½	.05½– .05¾	.04½–......
Barium sulphate (blanc fixe), pulp	Short ton	30.00 –50.00	30.00 – 40.00	40.00 –50.00

[a] Oil, Paint, and Drug Reporter.

Imports.—The quantity of barium products imported into the United States increased greatly in 1921. The quantity of some of the barium chemicals imported exceeded the pre-war records, and that of lithopone was far greater than in any previous year. Although a considerable quantity of foreign ground barytes found a market in this country, it was less than one-fourth the quantity imported in 1913 or 1914. Natural barium carbonate, or ground witherite, is the only barium compound that showed a decline in quantity imported as compared with 1920.

Barium compounds imported for consumption in the United States, 1913–1921.[a]

[Value at port of shipment.]

Year.	Ground barytes.			Lithopone.[b]		
	Short tons.	Value.		Pounds.	Value.	
		Total.	Average.		Total.	Average.
1913	5,463	$38,155	$6.98	4,725,000	$146,474	$0.03
1914	4,323	30,483	7.05	7,980,000	271,310	.03⅖
1915	1,308	10,736	8.21	4,087,826	137,816	.03⅖
1916	147	2,072	14.10	4,681,560	405,730	.08¾
1917	88	1,743	19.81	448,000	29,199	.06½
1918	....	....	....	....	....	....
1919	....	....	....	1,477,296	122,708	.08½
1920	274	3,017	11.01	3,427,321	263,240	.07⅗
1921	1,002	16,942	16.91	10,493,938	432,019	.04

Year.	Barium binoxide.			Blanc fixe (precipitated barium sulphate).		
	Pounds.	Value.		Pounds.	Value.	
		Total.	Average.		Total.	Average.
1913	4,173,188	$239,000	$0.05¾	4,883,014	$62,785	$0.01¼
1914	5,741,752	332,709	.05⅘	2,847,791	32,619	.01
1915	2,397,359	218,776	.09	1,441,989	18,501	.01¼
1916	106,863	6,590	.06⅕	676,908	17,810	.02⅗
1917	....	....	....	229,040	3,333	.01½
1918	....	....	....	....	....	....
1919	....	....	....	1,285	90	.07
1920	501,673	64,447	.12⅘	329,299	8,485	.02⅗
1921	1,337,972	127,631	.09½	1,538,383	22,470	.01½

Year.	Artificial barium carbonate (chemically precipitated).			Natural barium carbonate (ground witherite).		
	Pounds.	Value.		Pounds.	Value.	
		Total.	Average.		Total.	Average.
1913	4,085,878	$38,949	$0.01	1,795,396	$13,116	$0.00¾
1914	3,065,362	28,221	.01	1,187,284	8,084	.00¾
1915	286,504	2,786	.01	1,211,310	12,165	.01
1916	....	....	....	1,607,352	18,169	.01
1917	107,092	1,554	.01½	1,186,260	17,321	.01½
1918	....	....	....	723,676	14,134	.02
1919	8,549	2,666	.31⅕	224,000	4,739	.02
1920	951,501	37,462	.03⅘	3,020,304	61,284	.02
1921	4,475,225	80,603	.01⅘	1,336,712	25,188	.01⅘

[a] Compiled from records of Bureau of Foreign and Domestic Commerce, Department of Commerce.

[b] Prior to October, 1913, imported as zinc sulphide white. Figures for 1913 and 1914 have been adjusted on basis of some lithopone having been listed under that name. Since 1914 apparently no lithopone has been imported as zinc sulphide white.

Barium compounds imported for consumption in the United States, 1913–1921—Contd.

Year.	Barium chloride.			Total.	
	Pounds.	Value.		Short tons.	Value.
		Total.	Average.		
1913	3,725,239	$37,620	$0.01	17,159	$576,099
1914	5,921,370	68,866	.01$\frac{1}{5}$	17,696	772,292
1915	2,561,056	31,295	.01$\frac{1}{5}$	7,302	432,075
1916	6,614	608	.09$\frac{1}{5}$	3,686	450,979
1917				1,074	53,150
1918				362	14,134
1919	1,099,686	19,846	.01$\frac{4}{5}$	1,406	150,049
1920	3,190,255	151,778	.04$\frac{3}{5}$	5,984	589,713
1921	4,372,939	72,621	.01$\frac{2}{3}$	12,780	777,474

ASBESTOS.

By Edward Sampson.

PRODUCTION.

Asbestos mining in the United States, which had been pushed with unprecedented vigor in 1920, showed a great falling off in 1921. The extreme peak of the prices of "crude" asbestos came at the beginning of the year. By the time weather conditions were most favorable for active mining in the Arizona field prices had begun to fall, by the end of summer production had been much curtailed, and by the end of the year it had almost ceased.

The following tables have been made possible by the consent of several producers to have the data presented in a form that does not conceal figures on individual operations:

Domestic asbestos marketed in the United States, 1913–1921.

Year.	Chrysotile.		Amphibole.		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1913			1,100	$11,000	1,100	$11,000
1914	22	$5,450	1,225	13,515	1,247	18,965
1915	316	65,148	1,415	11,804	1,731	76,952
1916	[a] 808	[a] 167,683	830	13,311	[a] 1,638	[a] 180,994
1917	[a] 1,391	[a] 279,270	567	11,744	[a] 1,958	[a] 291,014
1918	[a] 392	[a] 101,059	606	17,628	[a] 998	[a] 118,687
1919	502	229,265	659	19,000	1,161	248,265
1920	1,245	[a] 661,907	403	16,324	1,648	[a] 678,231
1921	438	313,268	393	23,700	831	336,968

[a] Revised figures.

Asbestos marketed in the United States in 1921, by States and grades.

State.	Chrysotile.						Amphibole.		Total.	
	Crude No. 1.		Crude No. 2.		Short fiber.					
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Arizona	127	$144,618	267	$163,640	19	$3,510			413	$311,768
California					25	1,500			25	1,500
Georgia, Idaho							390	$11,700	390	11,700
Maryland							3	12,000	3	12,000
									831	336,968

Total chrysotile 438 tons, value $313,268; total amphibole 393 tons, value $23,700.

The asbestos sold in 1921 declined about 50 per cent in both quantity and value below that marketed in 1920. Chrysotile, however, which formed 93 per cent of the total value, declined 65 per cent in quantity and 53 per cent in value.

A description of the mineralogic character and geologic occurrence of the several varieties of asbestos was published in the asbestos report for 1920.

The asbestos of Arizona is cross-fiber chrysotile occurring in limestone. In California the asbestos mined is chrysotile occurring in disseminated veins in altered peridotite. In Georgia and Idaho the asbestos is mass-fiber anthophyllite, and in Maryland it is slip-fiber anthophyllite occurring as lenticular veins in schist.

REVIEW BY STATES.

ARIZONA.

Arizona continued to be by far the chief asbestos-producing State in spite of the great decline in production as compared with 1920.

The Arizona Asbestos Association, the pioneer in the Globe field and the largest producer since the beginning of mining operations, has received a patent to 21 of its claims at Chrysotile. Shipments were suspended in April, and all mining operations in August. A considerable supply of "crude" accumulated during this time. The American Ores & Asbestos Co., the second largest producer in 1920, did not mine any asbestos in 1921 and has closed its mine and disposed of some of its equipment. Shipments appear to have been made from stock mined in 1920. The Globe Asbestos Co., which began production in 1920, continued operations on the Locke workings, near Chrysotile, and on the Clarke lease, in the foothills of the Sierra Ancha, overlooking the Roosevelt reservoir. Development work during the year consisted of about 2,000 feet of driving on both properties. C. A. Watkins also worked on the Clarke property, owned by James K. Bury. Mr. Watkins reports that 800 feet of tunneling was done during the year. The Regal Asbestos Mines (Inc.) has taken over the property formerly owned by E. Schaaf-Regelman. Mr. Regelman is president of the new company, and H. E. Hacker, formerly on the staff of the American Ores & Asbestos Co., has been in charge of mining operations. Production was suspended in April. Shanley & Morrison made an initial shipment in 1921 from their property near the Regal mine. Wightman & Pierce in performing assessment work got out a small quantity of asbestos, which was sold. The first production of asbestos on Cherry Creek was made by the Triangle Asbestos Association, which worked properties about a mile southeast of the Flying V home ranch and at the confluence of Walnut and Cherry creeks. The owners estimate that about 200 tons of fiber has been blocked out in the main workings. A small shipment was made in 1921, and a larger stock remains to be disposed of. At the Penn mine only assessment work was done. A small quantity of fiber was obtained but not marketed. The property of the Alene Asbestos Association has been leased to Sánchez & Fonderhide, but the Geological Survey has received no report from the new operators.

The Arizona Asbestos Clearing House has been organized in Globe. This institution has a great opportunity to serve the asbestos producers of Arizona. It is reported that the clearing house will aid those who are operating on a small scale by purchasing small lots of asbestos. Careful cobbing and grading of the Arizona fiber is very important, and although much improvement has been made there is still need for more. The clearing house should and undoubtedly will use its influence to see that high standards are maintained.

A notable event during the year was the legalizing of asbestos locations within the Fort Apache and San Carlos Indian reservations. A portion of these reservations was previously thrown open for the location of metalliferous deposits. The Indian appropriation act of March, 1921, contains a provision "that wherever the term 'metalliferous' is used in the original act it shall be defined and construed by the Secretary of the Interior to include magnesite, gypsum, limestone, and asbestos." Accordingly the Secretary of the Interior has issued the ruling that

> the act of March 3, 1921, as an amendment to section 26 of the act of June 30, 1919 (41 Stat. L., 14), is a legislative interpretation of the term "metalliferous" so as to include magnesite, gypsum, limestone, and asbestos, and that the rights to asbestos claims heretofore located under the act of June 30, 1919, will be determined on the basis of good faith, and where conflicting locations are made priority shall govern. This means in effect that all lands of Indian reservations heretofore opened to mining for metalliferous minerals were also open to exploration for the discovery of magnesite, gypsum, limestone, and asbestos, subject to location and lease under the existing regulations.

The Secretary's ruling construes this legislative definition of "metalliferous" as retroactive, and locations of asbestos claims made before the act of March 3, 1921, are therefore valid. Many applications for leases have been made, and most of them have been approved, but at the end of May, 1922, only three leases had been closed. The following is a list of applications on which action had been taken up to the end of May:

Leases granted and applications approved for asbestos claims in Arizona Indian reservations up to May 31, 1922.

Leases granted.

[All on San Carlos Reservation.]

Name of property.	Owners.	Location.
Blue Mule and Rex groups.	Apache Asbestos Co.	Bear Creek (Bear Canyon).
Penn group	do	South side of Salt River canyon, ¾ mile N. 76° E. from 20-mile monument of San Carlos Reservation boundary.
Great View group	J. B. Cobb, G. P. Bartlett, et al.	South side of Salt River canyon, 1¼ miles S. 81° E. from 20½-mile monument of San Carlos Reservation boundary.

Applications approved.

Name of property.	Owners.	Location.
Fort Apache Reservation:		
Kerrick group	B. H. Kerrick, W. G. Shanley, et al.	North side of Salt River canyon, apparently about opposite Regal mine.
Horse Shoe group	L. R. Jacobson et al.	North side of Salt River canyon on trail north from "the Peninsula" and high above river.
Gun Sight group	H. S. Colcord and Wesley Goswick.	Apparently near Horse Shoe group.

Leases granted and applications approved for asbestos claims in Arizona Indian reservations up to May 31, 1922—Continued.

Applications approved—Continued.

Name of property.	Owners.	Location.
Fort Apache Reservation—Continued.		
Bluff group	J. Hansen, Arch Penrod, and Eph Penrod.	North side of Salt River canyon "about 5 miles easterly from mouth of Cibique Creek and about 1 mile north of Salt River."
Cyax group	do	North side of Salt River canyon "¾ mile easterly from 'the Peninsula' and 1 mile north of Salt River."
Snake Hill group	B. H. Kerrick, W. G. Shanley, et al.	North side of Salt River canyon about 1½ miles east of "the Peninsula" and 2 miles N. 70° E. from 20½-mile monument of San Carlos Reservation boundary.
Sun group	Apache Asbestos Co	West side of Salt River draw about 2 miles north of Salt River.
San Carlos Reservation:		
Sunset group	C. A. Johnson, Frank Wren, and Neils S. Hansen.	South side of Salt River canyon "½ mile south of Salt River and east of Peninsula."
Squirrel group	do	About 1 mile south of "the Peninsula" and "near the Jack Nighter trail."
Wonder claim	J. E. Malone	At bottom of Salt River canyon at mouth of Saw Mill canyon.
Silk claim	W. M. Malone	300 feet north of mouth of Saw Mill canyon.

The following scale of royalties was incorporated in leases in May, 1922:

No. 1 crude, 10 per cent.
All other grades crude and mill fiber, 5 per cent.
The net value to be determined by deducting from settlement the following items:

1. All railroad freight charges to selling point.
2. All local packing and hauling expenses to be allowed at the following flat rates: $1.50 per ton-mile for packing on burros or mules; $0.50 per ton-mile for team or motor haulage.
3. Hand cobbing expenses at the flat rate of $150 per ton of No. 1 crude, $250 per ton of No. 2 crude, $250 per ton of mill fiber, regardless of grade.
4. Mechanical cobbing or milling, allowance to be determined in each case based on operating cost of milling plant, to which shall be added 15 per cent per annum of mill investment to cover interest, insurance, repairs, depreciation, and amortization.

CALIFORNIA.

The Sierra Asbestos Co., which has operated its mill near Washington post office, in Nevada County, Calif., each year since its construction in 1918, was the only company in California that reported sales of asbestos in 1921. The property is developed by a glory hole and extraction tunnel, and also by small open cuts. There were no new developments of importance during the year. A considerable quantity of fiber was milled, although only a small part of it was sold. The company reported that in the early part of 1922 the demand for mill fiber on the Pacific coast was very small. The Stock Asbestos Co., which worked its deposit near Hazel Creek post office in 1920, has not reported any production in 1921. The California Asbestos Mining Co., near Hernandez, in Fresno County, and the Pacific Asbestos Corporation, near Copperopolis, in Calaveras County, have both erected mills and made extensive surface improvements and expected to begin operations in 1922. Mathews & West have developed and patented a new asbestos property on Monument Hill, 3½ miles from Cisco, in Placer County. W. S.

Russell is reported to have shipped asbestos rock with an estimated content of 25 per cent of short fiber from a property near Edgewood, Siskiyou County.

GEORGIA.

The Sall Mountain Co., whose mine near Nacoochee, Ga., was idle, purchased and milled asbestos mined by Boyd Denton, who was the only miner of asbestos in the southern Appalachian region. The Sall Mountain Co. reports the erection of new drying sheds and the installation of new grinding machinery in its mill at Gainesville.

IDAHO.

A development of interest has been the formation of the Western Mineral Co., of Kamiah, Idaho. This company took over in September, 1921, the property of the Kamiah Asbestos Manufacturing Co. and during the rest of the year made repairs to equipment and mined some asbestos. In the early part of 1922 the company reported that it was installing saws to saw out fire blocks and brick. The deposits of the Kamiah region, which are of the mass-fiber anthophyllite type, have been described by J. S. Diller.[1]

MARYLAND.

The Powhatan Mining Co. continued its production in Maryland of high-grade slip-fiber anthophyllite, which is used for chemical filters. The deposits worked by the company are small, but new ones have been discovered as the demand required.

MONTANA.

The property of the Idaho-Montana Asbestos Co., which is just over the Montana boundary line near Henry Lake, Idaho, was briefly described in the asbestos report for 1920. During 1921 the company did a large amount of exploratory work. No production has yet been made.

VERMONT.

The Asbestos Corporation of America, which has developed the well-known deposit on Belvidere Mountain, near Hyde Park, Vt., made an experimental run starting in December. It is reported that an extensive shear zone rich in asbestos, overlooked by earlier operators, has been found. The extraction is said to have been 8 per cent, which is a remarkably high recovery of fiber. It is further said that the principal value of the output will be in the medium grades of mill fiber.

WYOMING.

The American Asbestos Milling & Mining Co., whose property is in Lincoln County, Wyo., about 7 miles south of the Yellowstone National Park, continued development work and road construction in 1921. The deposit is said to require a mill for successful exploita-

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[1] U. S. Geol. Survey Bull. 470, pp. 505–524, 1911.

tion, and the company has not yet reached this stage of development. The property was briefly described in the asbestos report for 1920. No production of asbestos was reported from the Lander or Casper regions.

PRICES.

As most of the asbestos manufactured and used in the United States comes from Canada, the price of such asbestos as is mined in this country is controlled by the Canadian prices. Some Arizona asbestos has been sold at prices almost equal to that of the best Cana-

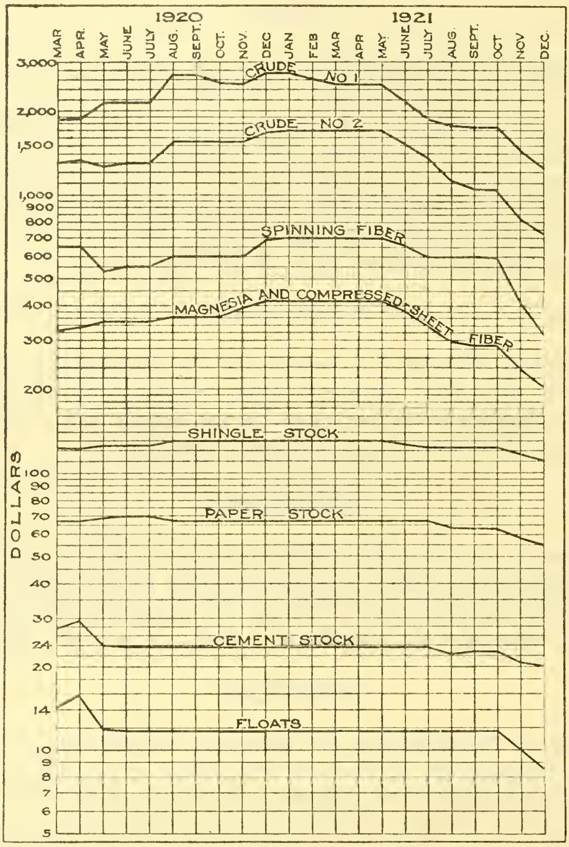

FIGURE 8.—Prices of Canadian asbestos, "crude" and "fiber."

dian asbestos, but the larger part of the output brings prices considerably lower, which vary according to the Canadian prices. Figure 8 shows the monthly average prices of different grades of Canadian asbestos as computed from weekly prices published by the Engineering and Mining Journal up to the end of 1921. On this graph the forms of the curves are strictly comparable. Like variations are shown by similar curves, whether for the highest grade or for the lowest—in other words, when the slopes of the curves are the same the proportionate change in price has been the same. For example, if the price of "crude" No. 1 dropped one-quarter and if the price of shingle stock dropped one-quarter in the same interval of time, the slope of the curves of both lines representing this change would be the same.

The most notable fact brought out by these curves is the relative stability of the lower grades, particularly shingle stock and paper stock.

IMPORTS.

The following table shows the imports of all grades of asbestos for the last five years as compiled from the records of the Bureau of Foreign and Domestic Commerce. The figures for value apply to the value in the country of origin.

General imports of asbestos (unmanufactured), 1917–1921, in short tons.

Source.	1917	1918	1919	1920	1921	
					Short tons.	Value.
Australia				3	1	$371
British India			1			
British South Africa	1,791	837	900	2,233	504	72,980
Canada	131,525	134,813	133,662	162,717	71,412	2,687,439
Chile					1	212
China			1	17	50	5,187
Colombia		1				
England	296		156	746	200	73,264
France			450			
Germany					11	10,253
Greece				81		
Hongkong					1	227
Italy				3	2	800
Japan				100	1	1,239
Portuguese Africa	496	2,049	100	1,584	279	96,250
Trinidad and Tobago					1	80
Turkey in Asia				74		
	134,108	137,700	135,270	167,558	72,463	
Total value	$4,521,172	$6,337,585	$7,369,685	$9,120,253		$2,948,302

The unmanufactured asbestos imported from Canada in 1921 amounted to 71,412 tons, valued at $2,687,439. The total general imports amounted to 72,463 tons, valued at $2,948,302, as compared with 167,558 tons, valued at $9,120,253, in 1920. This was a decrease of 57 per cent in quantity and 68 per cent in value.

WORLD'S PRODUCTION.

World's production of asbestos, 1917–1921, by countries, in metric tons.

[For more complete data see U. S. Geol. Survey Mineral Resources, 1921, pt. 1, pp. 513–564.]

Country.	1917	1918	1919	1920	1921
Australia:					
New South Wales [a]	5	....	145	675	(b)
South Australia [c]	....	....	....	5	(b)
Tasmania [d]	275	2,900	52	....	(b)
Western Australia [e]	....	....	54	159	(b)
British South Africa:					
Rhodesia [f]	8,675	7,778	8,889	17,076	17,716
Union [g]	5,642	3,333	3,567	6,452	4,647
Canada [h]	122,925	128,334	124,070	162,037	82,015
China [i]	378	243	69	(b)	(b)
Chosen [j]	....	....	118	(b)	(b)
Cyprus [k]	1,086	232	1,352	910	(b)
India [l]	150	363	394	1,847	(b)
Italy [m]	85	60	98	165	420
Philippine Islands [n]	....	70	375	....	(b)
Russia [o]	(b)	....	....	....	(b)
United States	1,776	905	1,053	1,495	754
	140,997	144,218	140,236	190,821	p 106,500

[a] New South Wales, Dept. Mines Repts.
[b] Figures not yet available.
[c] South Australia Dept. Mines, Review of mining operations.
[d] Tasmania, Repts. Secretary Mines.
[e] Western Australia, Repts. Secretary Mines.
[f] 1917–1920, Southern Rhodesia Secretary Mines, Ann. Repts. 1921, Mining Jour., London.
[g] Union of South Africa Secretary Mines, etc., 1917–1920, Ann. Repts.; 1921, Monthly Repts. of mineral production.
[h] 1917–1920, Canada Dept. Mines, Mines Branch, Ann. Repts. of mineral production. 1921, Prelim. Rept.
[i] U. S. Dept. Commerce, Commerce Rept. 77, Apr. 1, 1920. Figures in table above in part estimated from values.
[j] American consul, Tokyo. Data from Japan, Dept. Agr. and Commerce, Mining Bur.
[k] Imperial Mineral Resources Bur., The mineral industry of the British Empire and foreign countries—Asbestos, war period (1913–1919), p. 28, 1921. Official figures for 1919–1920 furnished to the American diplomatic agency, Cairo, Egypt.
[l] India Geol. Survey Records.
[m] Rivista del servizio minerario.
[n] Philippine Bur. Sci., Div. Mines, Mineral Resources.
[o] Mining Jour., London, Feb. 9, 1918.
[p] Total includes estimates for figures not yet available.

This table shows the asbestos mined and sold in all countries since 1917. The outstanding features for 1921 are the great decline in the Canadian production, which is about half of the quantity for 1920, and the maintenance of the Rhodesian production, which is mostly chrysotile. The total world's production in 1921 was the smallest since 1914.

GEMS AND PRECIOUS STONES.

By B. H. Stoddard.

PRODUCTION.

Value of precious stones produced in the United States, 1917–1921.

Variety.	1917	1918	1919	1920	1921
Agalmatolite				(a)	
Andalusite	(a)	(a)			$10
Beryl	$2,178	$1,906	(a)	$3,440	1,090
Calamine		(a)			
Chlorastrolite	45	146	$53	(a)	100
Copper-ore gems	2,857	2,299	(a)	(a)	8,775
Corundum (sapphire)	54,204	42,414	40,304	214,705	482,745
Datolite	(a)	(a)	(a)	(a)	
Diamond	4,175	1,910	(a)	(a)	(b)
Epidote	(a)	(a)		(a)	
Feldspar	(a)	(a)	(a)	520	155
Fluorite		(a)			
Fossil coral	(a)		(a)		200
Garnet	624	1,277	1,630	331	606
Hematite	(a)	138	(a)	45	
Iceland spar	(a)	(a)	(a)	398	(a)
Jet			(a)	(a)	460
Lapis lazuli	(a)	(a)	(a)		
Mariposite		(a)			
Meerschaum (sepiolite)	(a)	(a)	(a)		
Obsidian	(a)	(a)		40	67
Olivine	458	1,018		100	
Opal	805	6,304	(a)	(a)	336
Phenacite	(a)	(a)			
Pyrite	(a)	(a)		(a)	
Quartz	28,273	15,211	17,632	14,676	11,114
Rhodonite	512	515	160	(a)	275
Rutile	(a)				
Satin spar (gypsum)		(a)			
Smithsonite	(a)				(a)
Spinel			(a)	(a)	
Spodumene	(a)	281	(a)		
Staurolite	(a)	(a)		(a)	
Thomsonite	(a)	(a)	(a)	10	10
Topaz	230	907	210	767	(a)
Tourmaline	12,452	6,206	17,700	4,869	1,450
Turquoise	14,171	20,667	22,750	16,865	6,272
Variscite	2,350	753	925	(a)	560
Vesuvianite	2,765	320			
Willemite	(a)	(a)			
Zircon				144	
Zoisite	(a)	(a)			
Undistributed	4,913	4,251	10,399	8,295	4,055
	131,012	106,523	111,763	265,205	[b] 518,280

[a] Less than three producers; figures included under "Undistributed."
[b] Production of diamond in Arkansas not reported.

Value of precious stones produced in the United States in 1921, by States.

Montana	$489,021
Arizona	8,805
Nevada	5,538
Colorado	3,848
Other States[1]	11,068
	518,280

[1] California, Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Mexico, North Carolina, Oregon, Pennsylvania, South Dakota, Texas, Utah, Washington, and Wyoming.

NOTES ON SOME PRECIOUS STONES.

DIAMOND.

Crystallized quartz (rock crystal), colorless topaz, zircon rendered colorless by heating, white sapphire, spinel, beryl, tourmaline, phenacite, and even glass are often mistaken for diamond. The hardness, specific gravity, and dispersive power of diamond, however, render it distinguishable from other colorless gems. Of the minerals mentioned, spinel is the only one that is singly refracting like the diamond. Glass is also singly refracting. As crystallized quartz is perhaps the mineral that is most frequently mistaken for diamond, the following notes may be useful: Many diamond crystals, as found, are not perfectly transparent, are either nearly round or 8-sided or contain a multiple of eight sides, and are covered with rounded greasy-looking faces. Quartz crystals are generally transparent, somewhat elongated, with six sides (prisms), topped by a pointed termination. The crystal faces are usually planes, look glassy, and do not have the greasy appearance commonly shown by diamonds. The six prism faces of a quartz crystal show horizontal striations when the crystal is so held that the pointed termination is on top. Small black carbonaceous inclusions are perhaps not so common in quartz as in diamond, but they occur in both minerals.

Diamond has a perfect cleavage, whereas quartz generally shows no cleavage. Some quartz crystals show imperfect cleavage or parting, which, however, is not perfectly plain and brilliant like the cleavage surface of a diamond. The diamond is the hardest mineral known; it will scratch any other mineral, whereas quartz, which is much softer, will not scratch a diamond.

The distinction between diamond and quartz, if in the form of cut stones, is best made in a laboratory fitted for the purpose and involves the determination of the optical and physical properties of the stone and the comparison of these properties with those of quartz and diamond. Hardness could, of course, be used as a means of distinguishing them, for a ruby, sapphire, topaz, or beryl would cut quartz, but no mineral other than a diamond can cut a diamond.

No production of diamonds in the Arkansas diamond field, Pike County, Ark., was reported for 1921. Information in possession of the Geological Survey concerning this field will be presented in a report by H. D. Miser and C. S. Ross, which will probably be published before the end of 1922.

TOPAZ.

Topaz, a silicate of aluminum combined with fluorine, is widely distributed through the United States,[2] but crystals of gem quality are somewhat rare. Topaz occurs in many colors. The purest variety is colorless; others are blue, yellow, and red, the red variety being rare. A remarkably clear, colorless, transparent crystal may be mistaken for a diamond, but it is not nearly so hard and it has a much weaker double refractive and dispersive power. Very little

[2] Sterrett, D. B., Gems and precious stones: U. S. Geol. Survey Mineral Resources, pt. 2, for 1907, 1908, 1912, 1913, and 1914.

play of prismatic colors is, therefore, shown by a faceted topaz, which in some other respects resembles the diamond.

Both the yellow (or citrine) and the smoky varieties of quartz often masquerade in the trade under the name of topaz, but they have nothing in common with topaz except color. Yellow quartz is bought and sold under the names "Indian," "Bohemian," and "Spanish" or "Saxon" topaz, but it is not difficult to distinguish the two, for topaz, with a hardness of 8, will scratch citrine and is much heavier than citrine, sinking rapidly in pure methylene iodide, in which citrine floats. Moreover, topaz may be distinguished from many precious stones by its perfect cleavage, which is in only one direction, parallel to the basal plane. Quartz has no distinct cleavage; its fracture is conchoidal.

Ground topaz is used as an abrasive, topaz powder being frequently used instead of emery powder with a disk of copper, tin, or lead for grinding agate, jasper, chalcedony, and other gem minerals.

CORUNDUM (SAPPHIRE).

The increased production of sapphires at Utica, Mont., by the New Mine Sapphire Syndicate, of London, England, was due to the washing of the accumulation of old dirt of five years' standing. The material had been exposed to the weather so long that valuable results were obtained. Mr. Francis H. Wood, director of the company, stated (February 15, 1922) that a larger force of miners were at work below ground and that the washing floors were being enlarged so that the syndicate would be able to wash new dirt to any desirable extent during the summer of 1923.

OPAL.

There were practically no operations on the opal property of the Rainbow Ridge Mining Co. in Virgin Valley, Humboldt County, Nev., in 1921. This is the property that produced the large black opal, weighing 16.95 troy ounces, mentioned in the Survey's report for 1919.

COPPER ORE GEMS.

Col. H. C. Demming, of Harrisburg, Pa., kindly furnished the Geological Survey with a sample of copper ore called "cuprous gem" from Ferry County, Wash., which he says has been cut and marketed to a slight extent as a gem. It is a mixture of chalcocite and chrysocolla with small quantities of other undetermined minerals. The combination of black and green colors makes a pleasing appearance.

MANGANOSITE.

Mr. F. A. Canfield, of Dover, N. J., reported that a small quantity of manganosite from Franklin Furnace, N. J., has been cut into gem stones. This rare mineral is a green oxide of manganese, and the compact variety when cut in cabochon form is said to make a very pretty gem stone.

IMPORTS.[3]

Gems and precious stones imported and entered for consumption in the United States, 1917–1921.

Year.	Diamonds.				Other stones not set.	Total, excluding pearls.	Pearls.
	Glazier's.	Dust and bort.	Rough or uncut.	Cut but not set.			
1917	$1,098,102	$349,746	$13,092,855	$18,421,838	$1,883,810	$34,846,351	$4,947,509
1918	718,397	475,870	12,636,024	7,734,150	1,102,398	22,666,839	765,929
1919	984,381	1,420,442	20,306,758	64,085,610	5,161,639	91,958,830	11,008,973
1920	1,527,753	3,387,488	10,526,125	45,240,013	5,419,363	66,100,742	7,879,384
1921	435,872	466,345	2,207,365	26,144,323	2,778,931	32,032,836	4,492,063

Diamonds imported into the United States in the calendar years 1920 and 1921.

[General imports.]

Country.	1920				1921			
	Uncut.		Cut but not set.		Uncut.		Cut but not set.	
	Carats.	Value.	Carats.	Value.	Carats.	Value.	Carats.	Value.
Aden							173	$19,538
Argentina							14	1,011
Australia			1	$710	1	$40	13	1,938
Austria			121	13,325			222	21,257
Belgium	2,343	$185,965	63,390	8,345,615	3,519	175,954	127,087	12,024,417
Brazil	7,679	503,236	737	67,445	3,662	123,076	170	24,984
British Guiana	2,242	118,483	5	1,112	1,694	57,249		
British India							2	138
British South Africa	3,374	334,618	171	39,599	5,013	246,677	85	5,728
Canada			41	5,945			53	6,386
China							23	1,658
Czechoslovakia			18	3,215				
Denmark			485	86,276			11	1,881
Egypt			9	1,592	125	2,197		
England	102,339	9,283,918	22,104	3,003,534	17,035	1,264,767	16,259	1,996,096
Finland							5	624
France	1,875	55,342	16,247	2,506,090	618	20,653	5,820	638,443
Germany			144	16,374			93	7,735
Greece			50	6,565				
Hungary							20	3,818
Ireland							1	138
Italy			306	48,857			28	2,710
Japan	80	4,748	68	34,456				
Jugoslavia			21	4,431				
Mexico			1	250				
Netherlands	1,146	40,189	198,477	31,024,241	4,453	366,686	104,663	11,497,228
New Zealand							274	25,258
Poland and Danzig			486	48,898			20	1,550
Portugal			333	69,376				
Rumania			100	8,448				
Spain							10	1,628
Sweden							70	19,942
Switzerland			758	108,090			209	16,734
Turkey in Europe	4	863	3	555			192	17,615
	121,082	10,527,362	304,076	45,444,999	36,120	2,257,299	255,517	26,338,455

[3] Statistics compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce.

SAND AND GRAVEL.

By L. M. Beach.

PRODUCTION.

As reported to the United States Geological Survey, the production of sand and gravel in 1921 showed a decrease of 3 per cent from 1920 but was much larger than in any other year since 1916. There was a decrease in the quantity of sand and gravel used for every purpose except filtering and paving. Filtering sand increased 24 per cent, paving sand 27 per cent, and paving gravel 38 per cent.

The total value of all the sand and gravel produced in 1921 was $56,582,624, as compared with $65,661,605 in 1920.

According to reports the producers could not supply the demand for sand and gravel in 1920 because of the car shortage, whereas in 1921 with more cars available the demand was not so great. The smaller demand, according to the reports of most producers, was due to high freight rates. As a result of the high rates many companies shipped by water and more by truck, and many roadside pits were opened during the year.

Sand and gravel produced and sold in the United States, 1919–1921, by kinds, in short tons.

Kind.	1919	1920	1921
Glass sand	1,827,409	2,165,926	1,280,359
Molding sand	3,774,612	5,128,075	1,906,977
Building sand	21,969,736	26,539,365	24,565,605
Grinding and polishing sand	988,240	1,132,810	910,670
Fire or furnace sand	355,458	400,953	204,655
Engine sand	1,481,481	1,754,897	1,302,739
Paving sand	4,431,306	5,920,328	7,529,522
Filter sand	58,342	83,983	103,914
Other sands	1,083,152	649,805	490,513
Railroad ballast	8,715,842	9,081,815	8,949,274
Gravel (exclusive of railroad ballast)	25,890,829	29,183,431	32,600,780
	70,576,407	82,041,388	79,845,008

Sand and gravel produced and sold in the United States in 1921, by States and uses, in short tons.

State.	Glass sand.		Molding sand.		Building sand.		Grinding and polishing sand.		Fire or furnace sand.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alabama			18,904	$16,743	205,984	$130,363				
Arizona					532	524				
Arkansas					143,744	113,769				
California	5,486	$12,721	14,949	28,075	1,522,843	1,130,207	418	$1,015	(a)	(a)
Colorado					70,178	52,832				
Connecticut			587	235	210,629	106,522				
Delaware			(a)	(a)	2,376	1,780	1,178	2,356	350	$875
District of Columbia					(a)	(a)				
Florida					79,799	43,843	1,700	1,105		
Georgia	3,904	4,489	12,605	11,364	211,707	104,694	1,500	1,095	(a)	(a)
Hawaii										
Idaho					5,625	4,500				
Illinois	259,889	406,632	309,180	352,857	2,015,749	1,101,105	55,615	119,648	(a)	(a)
Indiana	39,860	15,846	172,001	74,232	785,535	380,661	6,104	3,659		
Iowa			13,132	10,401	887,470	524,627	3,403	2,454		
Kansas			150	225	934,808	565,351				
Kentucky	(a)	(a)	42,861	52,656	409,027	370,748	(a)	(a)	(a)	(a)
Louisiana	1,800	1,350			237,277	126,794	(a)	(a)		
Maine					(a)	(a)				
Maryland	3,000	4,800	(a)	(a)	689,524	536,701	500	165		
Massachusetts	1,200	5,400	12,040	9,148	575,256	507,968	6,903	16,264	6,564	7,620
Michigan	33,424	106,886	96,545	25,576	823,791	515,338	(a)	(a)	(a)	(a)
Minnesota			13,049	12,936	579,067	351,976	3,343	11,253	1,318	896
Mississippi					20,251	8,751				
Missouri	(a)	(a)	32,699	37,589	669,621	366,439	(a)	(a)	(a)	(a)
Montana					1,689	3,234				
Nebraska			1,000	1,500	634,745	260,323	(a)	(a)		
Nevada										
New Hampshire					90,131	72,950				
New Jersey	103,694	196,814	241,587	306,209	1,426,327	627,232	49,479	132,351	20,292	30,252
New Mexico			213	160	21,469	16,142				
New York	(a)	(a)	288,354	447,481	3,818,671	1,815,086	(a)	(a)	21,240	34,6[illegible]0
North Carolina					155,187	70,458				
North Dakota					(a)	(a)				
Ohio	26,767	68,706	327,788	582,097	1,530,785	1,020,114	39,057	100,337	23,148	53,221
Oklahoma	14,200	28,400			279,233	172,937				
Oregon					224,424	245,377				
Pennsylvania	347,238	468,357	242,810	384,349	2,335,006	2,691,175	475,466	900,245	97,319	155,177
Rhode Island			4,648	8,968	(a)	(a)				
South Carolina					29,775	23,796				
South Dakota					44,184	35,184				

Tennessee	(a)	(a)	30,477	56,732	397,461	347,965	5,358	5,358		
Texas	13,178	24,314	160	96	486,854	345,566				
Utah					85,300	45,365				
Vermont			(a)	(a)	2,368	863	30,360	10,728		
Virginia	11,201	29,894	9,181	11,728	324,296	233,282	(a)	(a)	(a)	(a)
Washington			140	135	662,890	314,879				
West Virginia	303,130	747,845	(a)	(a)	302,833	382,869	16,294	20,558	(a)	(a)
Wisconsin	100	150	17,972	17,553	565,841	318,846	8,228	19,632	3,682	2,723
Wyoming					24,665	29,625				
Undistributed	112,288	191,710	3,945	2,921	40,678	33,031	205,764	118,676	30,742	34,373
	1,280,359	2,314,314	1,906,977	2,451,966	24,565,605	16,151,792	910,670	1,466,899	204,655	319,797

State.	Engine sand.		Paving sand.		Filter sand.		Other sands.		Total sand.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alabama	1,000	$600	7,329	$4,840					233,217	$152,546
Arizona			123,930	92,948					124,462	93,472
Arkansas	2,600	1,200	75,726	69,697					222,070	184,666
California			313,877	183,414	(a)	(a)	4,192	$2,462	1,876,714	1,376,822
Colorado	21,326	17,377	8,120	5,220			979	218	100,603	75,647
Connecticut	2,084	833	11,583	4,633	33,250	$5,000			258,133	117,223
Delaware	(a)	(a)	(a)	(a)					43,954	25,337
District of Columbia	(a)	(a)	(a)	(a)					(a)	(a)
Florida	5,850	1,350	30,750	19,988	1,700	1,105			119,799	67,391
Georgia	9,057	3,741	58,944	41,059	(a)	(a)	608	608	(a)	(a)
Hawaii										
Idaho			37,500	18,750					43,125	23,250
Illinois	160,464	56,969	497,772	237,335	(a)	(a)	35,493	60,605	3,343,996	2,346,236
Indiana	87,380	34,019	597,359	326,058			35,464	16,445	1,723,703	850,920
Iowa	37,042	23,443	288,163	160,478	16,465	9,339	64,763	40,172	1,310,438	770,914
Kansas	16,766	9,780	54,863	29,164			(a)	(a)	(a)	(a)
Kentucky	10,615	8,440	44,842	39,759	(a)	(a)	(a)	(a)	524,205	496,707
Louisiana	(a)	(a)	64,710	34,034					306,103	163,728
Maine			(a)	(a)					15,291	11,683
Maryland	39,115	69,915	122,895	91,388			(a)	(a)	872,483	738,287
Massachusetts	60,937	(a)	47,904	32,611	3,504	6,003	(a)	(a)	720,844	662,179
Michigan	3,508	1,201	754,011	311,341			4,954	2,935	1,848,784	995,894
Minnesota	9,099	3,565	187,298	104,618	7,754	18,578	1,158	750	802,086	504,572
Mississippi	(a)	(a)	(a)	(a)			24,351	13,187	79,672	31,906
Missouri			90,374	35,848			2,700	1,836	975,570	712,627
Montana	(a)	(a)	11,183	9,863					(a)	(a)
Nebraska	(a)	(a)	15,858	11,208			9,490	2,918	663,712	276,529
Nevada										
New Hampshire	9,842	5,045	49,000	31,850					148,973	109,845
New Jersey	49,107	27,612	632,368	345,376	17,289	47,799	13,148	20,846	2,553,291	1,734,491

a Included under "Undistributed."

Sand and gravel produced and sold in the United States in 1921, by States and uses, in short tons—Continued.

State.	Engine sand.		Paving sand.		Filter sand.		Other sands.		Total sand.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
New Mexico	2,426	$1,824	266	$200	87	$74			24,461	$18,400
New York	85,575	77,934	230,883	173,519	5,772	5,574	69,799	$93,329	4,521,619	2,649,120
North Carolina	3,640	1,926	87,117	34,885					245,944	107,269
North Dakota									(a)	(a)
Ohio	44,273	36,533	645,457	511,696			28,161	21,309	2,665,436	2,394,013
Oklahoma	2,900	2,043	242,958	171,721			8,505	3,150	547,796	378,251
Oregon	(a)	(a)	118,474	115,302			20,727	20,637	(a)	(a)
Pennsylvania	298,328	392,621	776,633	655,627			24,182	27,082	4,596,982	5,674,633
Rhode Island			(a)	(a)					7,332	12,998
South Carolina	(a)	(a)	(a)	(a)					38,768	27,898
South Dakota	(a)	(a)	50,120	35,963			3,801	2,017	98,355	73,504
Tennessee	10,203	7,810	78,686	90,883			22,950	17,000	(a)	(a)
Texas	26,196	13,559	63,512	47,053			1,800	1,500	591,700	432,088
Utah	11,570	6,500					590	142	97,460	52,007
Vermont			(a)	(a)					36,989	13,49[illegible]
Virginia	73,634	34,889	123,174	53,097	540	1,160	(a)	(a)	554,976	371,230
Washington	6,624	2,366	129,746	83,263			10,687	10,436	810,087	411,079
West Virginia	146,257	182,307	137,832	151,419					908,768	1,487,888
Wisconsin	32,560	8,547	620,675	331,265			59,909	45,030	1,308,967	743,746
Wyoming			1,995	3,375					26,660	33,000
Undistributed	32,761	84,538	95,635	52,247	17,553	20,953	42,102	51,880	2,301,426	1,744,843
	1,302,739	1,118,487	7,529,522	4,752,995	103,914	115,585	490,513	456,494	38,294,954	29,148,329

State.	Building gravel.		Roofing gravel.		Paving gravel.		Railroad ballast.		Total gravel.		Total sand and gravel.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Alabama	69,165	$98,643	1,000	$750	84,468	$29,097	386,766	$100,389	541,399	$228,879	774,616	$381,425
Arizona	1,125	800			257,580	193,205			258,705	194,005	383,167	287,477
Arkansas	79,635	67,644	1,050	1,550	704,580	409,220	456,672	119,732	1,241,937	598,146	1,464,007	782,812
California	1,402,671	1,175,591	4,702	7,300	791,492	575,936	628,635	113,430	2,827,500	1,872,257	4,704,214	3,249,079
Colorado	106,099	96,255	695	767	10,410	11,039	59,476	11,014	176,680	119,075	277,283	194,722
Connecticut	76,593	61,868	676	1,269					77,269	63,137	335,402	180,360
Delaware					4	10			4	10	43,958	25,347
District of Columbia					(a)	(a)			(a)	(a)	(a)	(a)
Florida					40,646	29,933			40,646	29,933	160,445	97,324
Georgia	(a)	(a)					26,000	8,500	(a)	(a)	329,048	177,745

Hawaii					(a)	(a)			(a)	(a)	(a)	(a)
Idaho	28,000	11,202			195,728	72,548			223,728	83,750	266,853	107,000
Illinois	1,272,413	799,419	53,391	28,239	875,209	547,206	914,683	295,706	3,115,696	1,670,570	6,459,692	4,016,806
Indiana	671,810	411,533	15,944	13,142	1,789,304	1,093,191	1,076,743	412,513	3,553,801	1,930,379	5,277,504	2,781,299
Iowa	333,097	282,771	10,390	13,893	595,229	548,576	392,828	110,804	1,331,544	956,044	2,641,982	1,726,958
Kansas	19,917	9,190	150	475	25,352	26,228	(a)	(a)	(a)	(a)	1,082,914	647,723
Kentucky	(a)	(a)	(a)	(a)	288,633	154,106	286,671	92,190	(a)	(a)	1,356,512	963,584
Louisiana	414,099	496,972			1,056,526	788,463	44,967	42,243	1,515,592	1,327,678	1,821,695	1,491,406
Maine	14,967	14,556			10,626	10,120			25,593	24,676	40,884	36,359
Maryland	534,389	717,845			136,581	136,603			670,970	854,448	1,543,453	1,592,735
Massachusetts	354,479	483,360	22,243	44,152	19,096	9,293	5,292	2,457	401,110	539,262	1,121,954	1,201,441
Michigan	1,306,010	827,410	7,684	2,694	2,103,187	1,129,506	249,588	59,792	3,666,469	2,019,402	5,515,253	3,015,296
Minnesota	352,543	300,805	32,697	35,042	466,987	291,581	9,507	3,042	861,734	630,470	1,663,820	1,135,042
Mississippi	164,950	117,969			1,517,583	805,159	693,200	228,163	2,375,733	1,151,291	2,455,405	1,183,197
Missouri	357,517	218,967	1,279	830	44,210	22,888	160,497	63,013	563,503	305,698	1,539,073	1,018,325
Montana	4,986	7,184			49,731	59,095	(a)	(a)	(a)	(a)	68,377	79,812
Nebraska	(a)	(a)	(a)	(a)	338,069	248,385	14,526	2,721	355,280	252,689	1,018,992	529,218
Nevada	10,856	3,008					142,429	31,854	153,285	34,862	153,285	34,862
New Hampshire	43,922	98,695			165,743	90,200	9,924	4,736	219,589	193,631	368,562	303,476
New Jersey	698,929	554,449	(a)	(a)	314,952	146,030	(a)	(a)	1,015,489	701,807	3,568,780	2,436,298
New Mexico	43,419	25,381	(a)	(a)	6,151	3,618	(a)	(a)	302,884	150,495	327,345	168,895
New York	1,199,441	776,861	2,114	2,735	234,126	217,494	63,929	26,917	1,499,610	1,024,007	6,021,229	3,673,127
North Carolina	106,135	151,609			104,190	127,056	255,113	99,900	465,438	378,565	711,382	485,834
North Dakota											(a)	(a)
Ohio	683,841	574,148	41,981	32,324	903,809	717,980	843,209	342,021	2,472,840	1,666,473	5,138,276	4,060,486
Oklahoma	162,694	129,319			169,595	177,937	(a)	(a)	334,053	308,256	881,849	686,507
Oregon	195,897	162,725	(a)	(a)	640,272	492,576	147,812	36,890	(a)	(a)	1,351,425	1,079,815
Pennsylvania	1,068,851	1,097,768			957,125	814,799	17,376	13,511	2,043,352	1,926,078	6,640,334	7,600,711
Rhode Island	3,426	1,657	(a)	(a)	(a)	(a)			4,032	2,592	11,364	15,590
South Carolina	29,417	17,650			121,316	59,709	141,168	49,404	291,901	126,763	330,669	154,661
South Dakota	(a)	(a)			(a)	(a)	31,426	5,589	(a)	(a)	185,639	136,152
Tennessee	151,214	123,575	(a)	(a)	360,676	254,140	(a)	(a)	(a)	(a)	1,095,114	930,767
Texas	697,520	579,060	11,756	14,730	717,474	464,540	952,118	357,323	2,378,868	1,415,653	2,970,568	1,847,741
Utah	107,997	48,037			49,600	21,780	272,346	41,120	429,943	110,937	527,403	162,944
Vermont	282	40			1,481	210			1,763	250	38,752	13,740
Virginia	321,696	433,610	500	1,125	127,594	128,456	43,527	24,106	493,317	587,297	1,048,293	958,527
Washington	160,950	116,950	630	450	413,739	328,110	96,168	25,253	671,487	470,763	1,481,574	881,842
West Virginia	256,714	312,704			209,197	238,450			465,911	551,154	1,374,679	2,039,042
Wisconsin	345,050	234,693	9,438	7,236	1,189,469	777,956	46,885	19,547	1,590,842	1,039,432	2,899,809	1,783,178
Wyoming	23,970	9,018			3,598	5,742	164,746	33,169	192,314	47,929	218,974	80,929
Undistributed	307,136	267,687	10,482	13,315	96,818	106,482	315,047	151,947	2,698,243	1,845,552	153,200	145,008
	14,183,822	11,918,628	228,802	222,018	18,188,156	12,364,653	8,949,274	2,928,996	41,550,054	27,434,295	79,845,008	56,582,624

a Included under "Undistributed."

IMPORTS AND EXPORTS.

A considerable quantity of the sand imported is brought into the country as ballast; a certain quantity is building sand brought in from Pelee Island, which is across the Canadian boundary in Lake Erie. White sand is imported from Belgium for the glass-making industry on the Pacific coast.

Sand imported for consumption in United States, 1919–1921.

Year.	Short tons.	Value.	
		Total.	Average.
1919	597,481	$126,586	$0.21
1920	1,226,684	912,282	.74
1921	906,905	771,734	.85

The value of the sand and gravel exported in 1921 decreased 43 per cent as compared with 1920. Canada receives most of the sand exported, and the value of that shipped to Canada in 1921 was less than half that shipped in 1920. The increase in the value of the sand shipped to Mexico in 1921 was 153 per cent. It is not known for what purposes the exported sand was used.

Value of sand and gravel exported from the United States in 1919–1921.

Destination.	1919	1920	1921
Canada	$347,578	$583,574	$247,895
Mexico	14,803	38,402	97,342
Panama	4,650	13,307	8,600
Japan	3,091	6,758	4,072
England	967	6,161	3,718
Cuba	2,438	10,746	7,285
Newfoundland	279	1,418	854
Brazil	40	66	622
China	130	833	1,301
Argentina	712	58	....
Other countries	7,382	8,622	8,293
	382,070	669,945	379,982

PRICES.

There was a general decrease in prices of sand and gravel used for various purposes in 1921, although the prices are still higher than they were in 1919.

Average price per short ton of sand and gravel produced and sold in the United States, 1917–1921.

[Based on prices realized for sales f. o. b. pits or nearest shipping points.]

Kind.	1917	1918	1919	1920	1921
Glass sand	$1.38	$1.94	$1.97	$2.19	$1.81
Molding sand	.92	1.04	1.10	1.46	1.29
Building sand	.39	.50	.56	.68	.66
Grinding and polishing sand	1.04	1.60	1.34	1.80	1.61
Fire or furnace sand	1.15	1.48	1.23	1.81	1.56
Engine sand	.59	.76	.77	.82	.86
Paving sand	.41	.54	.66	.68	.63
Filter sand	.76	1.47	1.48	1.27	1.11
Railroad ballast	.17	.22	.30	.32	.33
Gravel (exclusive of railroad ballast)	.46	.57	.66	.81	.75
All kinds	.46	.61	.65	.80	.71

GLASS SAND.

PRODUCTION.

The production of glass sand in the United States decreased 41 per cent in 1921. Pennsylvania, West Virginia, Illinois, Missouri, and New Jersey produced 88 per cent of the total quantity of glass sand in 1921. These States are named in the order of their production. The average price per ton of the glass sand sold in Pennsylvania was $1.35, West Virginia $2.47, Illinois $1.56, New Jersey $1.90. In Massachusetts the average price was $4.50 and in Michigan $3.20.

Glass sand produced and sold in the United States, 1916–1921.

Year.	Short tons.	Value.	
		Total.	Average.
1916	2,018,317	$1,957,797	$0.97
1917	1,942,675	2,685,014	1.38
1918	2,172,887	4,209,728	1.94
1919	1,827,409	3,593,371	1.97
1920	2,165,926	4,748,690	2.19
1921	1,280,359	2,314,314	1.81

Localities where glass sand was reported as produced in 1921.

California: Ione, Lake Majella.
Georgia: Lumber City.
Illinois: Millington, Oregon, Ottawa, Utica.
Indiana: Michigan City.
Kentucky: Lawton.
Louisiana: Le Blanc.
Maryland: Hancock.
Massachusetts: Cheshire.
Michigan: Rockwood.
Missouri: Crystal City, Gray Summit, Klondike, Pacific.
New Jersey: Cedarville, Clayville, Milltown, Millville, Pembryn, South Vineland, Williamstown Junction.
New York: Cleveland.
Ohio: Austintown, Chalfants, Millwood, Toboso.
Oklahoma: Hickory, Roff.
Pennsylvania: Althom, Daguscahonda, Dunbar, Falls Creek, Kennerdell, Lewistown, Mapleton Depot, Parrish.
Tennessee: Siam.
Texas: Haiduk, Santa Anna.
Virginia: Kermit, Mendota.
West Virginia: Berkeley Springs, Great Cacapon, Greer, Hancock, Imperial, Sturgisson, Thayer.
Wisconsin: Portage.

MOLDING SAND.

The output of molding sand decreased 63 per cent in comparison with the production in 1920. Named in the order of their output, Ohio, Illinois, New York, Pennsylvania, New Jersey, and Indiana supplied 83 per cent of the molding sand produced. The average price per ton varied greatly in different localities. The average in Ohio was $1.78, Pennsylvania $1.58, New York $1.55, New Jersey $1.27, Illinois $1.14, and Indiana 43 cents.

Molding sand produced and sold in the United States, 1916–1921.

Year.	Short tons.	Value.	
		Total.	Average.
1916	4,662,649	$3,219,839	$0.69
1917	4,660,968	4,303,809	.92
1918	4,910,178	5,121,865	1.04
1919	3,774,612	4,153,990	1.10
1920	5,128,075	7,504,759	1.46
1921	1,906,977	2,451,966	1.29

OTHER SANDS.

More than 490,000 tons of sand was reported as sold for uses other than those specified in the foregoing tables. Of this quantity over 28,000 tons was sold for fertilizer filler, at an average price of $1.55. About 17,000 tons was sold for bedding stock cars, at a price of 42 cents. A small quantity is reported each year as sold for standard testing sand.

LIME.

By G. F. Loughlin and A. T. Coons.

GENERAL CONDITIONS.

The severe effect of the general industrial depression on the lime industry in 1921 is reflected by the fact that the total quantity of lime sold in the United States during that year was less than that sold in any other year since 1904, when the United States Geological Survey began to collect statistics of the quantity of the lime manufactured. The decrease in sales was most marked in those States whose lime is used largely in chemical industries and in agriculture.

Of the 42 producing States and Territories, including Hawaii and Porto Rico, 34 decreased their output in 1921. The eight that increased their output were all among the smaller producing States, and their small gains were due to special conditions, such as contracts made late in 1920. Fewer large plants were operated in 1921 than in 1920, and some firms that had been continuously active for many years discontinued operations for part or all of the year, as there were no prospects of profit. A few new plants were put into operation during the year, however, though some firms intending to begin work either postponed or abandoned their plans. In Pennsylvania, where the number of field kilns operated by farmers for local use had been decreasing for several years, there was an increase of 20 operators. Similar small increases occurred in Virginia and West Virginia.

PRODUCTION.

Lime sold in the United States in 1919–1921.

Year.	Short tons.	Value.[a]		Number of plants in operation.
		Total.	Average.	
1919	3,330,347	$29,448,553	$8.84	539
1920	3,570,141	37,543,840	10.52	515
1921	2,532,153	24,895,370	9.83	520
Percentage of increase or decrease in 1921	−29	−34	−6.6	+1

[a] The value given represents the value of bulk lime f. o. b. at point of shipment and does not include cost of barrel or package.

Lime sold in the United States in 1920 and 1921, by States.

1920.

State.	Rank of State by quantity.	Short tons.	Percentage of total quantity.	Value.	Rank of State by value.	Average value per ton.	Number of plants in operation.
Alabama	6	151,595	4.2	$1,175,518	11	$7.75	12
Arizona	22	12,990	.4	184,850	22	14.23	3
Arkansas	23	11,479	.3	135,399	25	11.80	5
California	19	48,571	1.4	653,075	18	13.45	9
Colorado	39	1,914	.1	23,628	39	12.34	3
Connecticut	17	(a)	(a)	(a)	16	14.32	5
Florida	25	(a)	(a)	(a)	24	15.35	2
Georgia	40	(a)	(a)	(a)	40	11.57	1
Hawaii	38	2,120	.1	44,953	32	21.20	1
Idaho	37	(a)	(a)	(a)	36	13.48	2
Illinois	15	87,903	2.5	982,743	14	11.18	12
Indiana	9	134,672	3.7	1,348,819	10	10.02	7
Iowa	26	(a)	(a)	(a)	27	10.80	2
Kansas	42	(a)	(a)	(a)	42	15.04	1
Kentucky	40	1,757	(a)	18,063	41	10.28	4
Maine	12	101,503	2.8	1,495,625	8	14.73	4
Maryland	13	100,914	2.8	951,588	15	9.43	23
Massachusetts	10	129,108	3.6	1,753,110	6	13.58	11
Michigan	8	140,813	3.9	1,386,760	9	9.85	7
Minnesota	21	30,120	.8	356,906	20	11.85	6
Missouri	4	209,113	5.9	2,319,285	3	11.09	19
Montana	35	2,638	.1	30,020	35	11.38	3
Nevada	29	(a)	(a)	(a)	31	11.60	1
New Jersey	32	3,301	.1	27,407	38	8.30	7
New Mexico	33	3,034	.1	34,680	34	11.43	4
New York	14	92,357	2.6	1,047,261	13	11.34	15
North Carolina	27	(a)	(a)	(a)	26	17.04	1
Ohio	2	558,892	15.7	6,238,908	2	11.16	29
Oklahoma	36	(a)	(a)	(a)	37	11.39	2
Oregon	34	(a)	(a)	(a)	29	18.29	1
Pennsylvania	1	784,083	21.9	7,519,147	1	9.59	162
Porto Rico	31	3,392	.1	41,998	33	12.38	26
Rhode Island	30	(a)	(a)	(a)	28	15.54	1
South Dakota	28	(a)	(a)	(a)	30	11.29	2
Tennessee	11	119,034	3.3	1,098,603	12	9.23	17
Texas	16	56,489	1.6	569,135	19	10.08	8
Utah	24	9,797	.3	151,700	23	15.48	9
Vermont	18	50,192	1.4	716,137	17	14.27	9
Virginia	3	256,568	7.2	2,201,724	4	8.58	35
Washington	20	31,033	.9	324,042	21	10.44	7
West Virginia	5	193,490	5.4	1,813,666	5	9.37	10
Wisconsin	7	144,590	4.0	1,539,027	7	10.64	25
Wyoming	43	(a)	(a)	(a)	43	23.61	2
Undistributed		96,679	2.8	1,360,063			
		3,570,141	100.0	37,543,840		10.52	515

[a] Included under "Undistributed."

Lime sold in the United States in 1920 and 1921, by States—Continued.

1921.

State.	Rank of State by quantity.	Short tons.	Percentage of total quantity.	Value.	Rank of State by value.	Average value per ton.	Number of plants in operation.
Alabama	8	109,256	4.3	$847,629	9	$7.76	10
Arizona	22	11,783	.5	162,647	22	13.80	3
Arkansas	24	8,958	.3	93,499	25	10.44	3
California	17	42,115	1.7	577,366	15	13.71	7
Colorado	28	5,783	.2	56,956	28	9.85	3
Connecticut	18	(a)	(a)	(a)	13	16.66	5
Florida	23	(a)	(a)	(a)	23	11.93	2
Georgia	27	(a)	(a)	(a)	27	9.71	1
Hawaii	35	1,985	.1	50,690	29	25.54	1
Idaho	41	(a)	(a)	(a)	39	15.07	1
Illinois	14	58,222	2.3	610,197	14	10.48	12
Indiana	11	90,542	3.6	826,311	10	9.13	8
Iowa	29	(a)	(a)	(a)	30	8.67	2
Kentucky	39	1,524	.1	11,551	41	7.58	3
Maine	10	90,585	3.6	1,392,850	5	15.38	4
Maryland	13	64,835	2.6	558,785	16	8.62	17
Massachusetts	4	124,183	4.9	1,890,512	3	15.22	10
Michigan	15	48,164	1.9	445,386	19	9.25	6
Minnesota	20	22,109	.9	232,037	20	10.50	5
Missouri	3	159,194	6.3	1,656,560	4	10.41	17
Montana	38	(a)	(a)	(a)	37	13.40	2
Nevada	31	(a)	(a)	(a)	31	10.64	1
New Jersey	37	1,818	.1	14,365	40	7.90	7
New Mexico	32	3,044	.1	33,660	34	11.06	4
New York	12	67,685	2.7	759,299	11	11.22	16
North Carolina	26	(a)	(a)	(a)	26	10.00	1
Ohio	2	471,053	18.6	4,224,579	2	8.97	31
Oklahoma	34	(a)	(a)	(a)	38	9.98	2
Oregon	40	(a)	(a)	(a)	36	21.44	1
Pennsylvania	1	509,891	20.1	4,247,509	1	8.33	183
Porto Rico	33	2,740	.1	44,113	33	16.10	23
Rhode Island	36	(a)	(a)	(a)	35	17.63	1
South Dakota	30	(a)	(a)	(a)	32	10.34	2
Tennessee	9	93,397	3.7	733,639	12	7.86	17
Texas	16	44,404	1.7	452,078	18	10.18	8
Utah	25	7,972	.3	104,605	24	13.12	10
Vermont	19	32,782	1.3	460,318	17	14.04	9
Virginia	7	111,518	4.4	1,005,677	7	9.02	36
Washington	21	17,710	.7	209,761	21	11.84	7
West Virginia	6	119,716	4.7	1,015,690	6	8.48	13
Wisconsin	5	124,078	4.9	999,407	8	8.05	24
Wyoming	42	(a)	(a)	(a)	42	20.98	2
Undistributed		85,107	3.3	1,177,694			
		2,532,153	100.0	24,895,370		9.83	520

a Included under "Undistributed."

The high price of coal was still an obstacle to economical operation but there was less complaint of shortage of labor in 1921 than for several years. The cost of production, was generally reported to have been less than in 1920, but decreases in costs only partly account for decreases in selling prices at plants, as considerable lime was sold at a loss in order to keep plants in operation. High freight rates were perhaps the greatest obstacle to the industry, as they closed the more distant markets to firms whose output could not all be absorbed by local markets and caused a rise in the prices at points of delivery that many potential consumers could not meet. These prohibitive freight rates prompted consideration of building new plants to supply local trade; nevertheless some large producers made extensive repairs and improvements in their plants in anticipation of the eventual revival of the lime industry, and the greater economy attained under normal conditions by operating relatively few large plants at strategic industrial points. Conditions improved in the fall, but the general demand for lime was below normal.

Prices were unstable but on the whole decreased throughout the country, especially in the last half of the year. In one district the average price per ton of quicklime was $9.80 from January to June and $7.30 from July through November. The corresponding prices of hydrated lime were $12.30 and $9.80. The average value for all lime sold in the United States, however, decreased only 69 cents in 1921. A striking fact is that the average value of quicklime ($10.05) exceeded that of hydrated lime ($9.36). Where both kinds of lime have been sold by one producer the price of hydrated lime at some plants has hitherto been a dollar or more higher than that of quicklime. The average for a State, however, may have shown a smaller difference and may even have shown that the price of quicklime was somewhat the greater, because the quicklime sold to meet exacting requirements, was of a higher degree of purity and called for more care both in quarrying and in subsequent handling. The greater general average price of quicklime in 1921, however, was due to the desire of some of the larger companies to keep their plants in operation by selling their hydrated lime at a very low price.

USES.

Lime sold in the United States in 1920 and 1921, by uses.

Use.	Percentage of total quantity.	Short tons.	Value.	
			Total.	Average.
1920.				
Building	36.6	1,305,412	$15,269,683	$11.70
Agricultural	9.9	351,851	3,096,705	8.80
Chemical:				
Paper mills	10.2	365,897	3,844,084	10.51
Glass works	1.5	54,747	551,945	10.08
Sugar factories	.4	14,145	175,798	12.43
Tanneries	1.7	61,162	668,999	10.94
Metallurgy	9.7	344,921	2,836,474	8.22
Other uses [a]	28.0	1,000,550	10,304,049	10.30
Total chemical	51.5	1,841,422	18,381,349	9.98
Dealers	2.0	71,456	796,103	11.14
	100.0	3,570,141	37,543,840	10.52
Hydrated lime (included in totals)		853,116	9,287,562	10.89
1921.				
Building	49.0	1,239,486	13,258,443	10.70
Agricultural	11.2	284,722	2,237,510	7.86
Chemical:				
Paper mills	9.3	235,855	2,207,938	9.36
Glass works	1.7	43,851	367,796	8.39
Sugar factories	.5	12,225	161,931	13.25
Tanneries	1.9	47,841	481,372	10.06
Metallurgy	6.5	164,245	1,232,748	7.51
Other uses [a]	18.0	456,087	4,372,991	9.59
Total chemical	37.9	960,104	8,824,776	9.19
Dealers	1.9	47,841	574,641	12.01
	100.0	2,532,153	24,895,370	9.83
Hydrated lime (included in totals)		792,970	7,421,637	9.36
Percentage of decrease of hydrated lime in 1921		7	20	14

[a] Details of distribution shown in following table.

Chemical lime sold for "other uses" in 1920 and 1921.

Use.	1920		1921	
	Short tons.	Value.	Short tons.	Value.
Refractories	316,293	$3,732,522	107,664	$1,113,010
Alkalies	104,250	687,907	[a] 1,589	[a] 14,190
Water purification	90,533	926,294	74,201	741,264
Sanitation	([b])	([b])		
Calcium carbide	88,465	801,882	19,597	173,849
Manufacture of acids	48,361	485,449	38,143	345,833
Bleaching powder	24,030	283,084	12,551	131,863
Calcium acetate	22,241	248,797	3,776	32,791
Silica brick	20,372	205,391	7,127	61,738
Sand-lime brick	19,520	208,984	5,464	50,851
Ammonia works	10,041	102,934	8,167	75,266
Lubricating grease manufacture	([b])	([b])	9,584	102,942
Coal and water gas purification	1,164	5,603	2,408	24,951
Coke-oven by-products	8,740	85,100	3,660	33,257
Gas-plant by-products	1,207	13,025	3,582	35,978
Oil, fat, and soap manufacture	3,238	35,224		
Soap maufacture	18,607	171,912	14,249	119,322
Glue manufacture	5,641	67,065	4,014	37,429
Spraying	6,141	68,798	6,800	70,689
Cyaniding	4,295	50,115	5,185	50,737
Paint manufacture	1,954	18,528	[c] 1,443	[c] 15,530
Wood distillation	1,474	14,538	2,472	19,508
Sewage purification	1,361	14,842	3,422	33,412
Corn products	2,428	26,788	1,117	9,978
Explosives	([b])	([b])		
Gelatine manufacture	1,183	14,884	1,287	15,892
Dairy products	1,207	34,227	735	2,922
Rubber manufacture	([b])	([b])	723	10,455
Correction of acidity of oils	([b])	([b])	387	3,917
Salt refining	921	9,913	1,072	10,647
Flour mills	313	3,861	([b])	([b])
Disinfectant	205	2,231	1,182	10,223
Manufacture of candles	114	1,067	180	1,701
Undistributed [d]	17,347	206,423	10,814	101,573
Unspecified	178,904	1,776,661	103,492	921,273
	1,000,550	10,304,049	456,087	4,372,991

[a] All noncommercial production omitted and included in report on stone as limestone.
[b] Included under "Undistributed."
[c] Includes kalsomine.
[d] Includes in 1920: Lime used in the manufacture of gypsum products, rubber, lubricating grease, polishing and buffing compounds, cyanide, pottery, textiles, explosives, cyanamid, phenol, barium products, basic magnesium carbonate, nitrates, alcohol, oxygen, dyes, for correcting the acidity of oils, for kalsomine, wire coating, purification of blast furnace gases, and for sanitation; in 1921: Lime used in the manufacture of precipitated calcium carbonate, indigo, graphite products, varnish, nitrates, food products, polishing and buffing compounds, magnesia, pottery, textiles, dyes, oxygen, medicine, for the renovation of grease, neutralization of acid waters, distillation and dehydration of alcohol, separation of ores, use in flour mills, and for mixture with wood ashes.

Lime sold in the United States in 1921, by States and uses.

State.	Building.		Agriculture.		Chemical uses.					
					Paper mills.		Glass works.		Sugar factories.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama	32,397	$296,550	(a)	(a)	(a)	(a)			(a)	(a)
Arizona	8,887	119,607	(a)	(a)			(a)	(a)		
Arkansas	8,523	88,656	(a)	(a)						
California	29,111	399,892	559	$4,988	(a)	(a)	(a)	(a)	(a)	(a)
Colorado	2,196	21,565							(a)	(a)
Connecticut	(a)	(a)	(a)	(a)						
Florida	(a)	(a)								
Georgia	(a)	(a)								
Hawaii	399	9,904	75	1,500					1,511	$39,286
Idaho	(a)	(a)								
Illinois	25,404	287,471			8,905	$86,894	(a)	(a)	(a)	(a)
Indiana	24,875	236,582	1,182	11,328	24,516	215,846	893	$8,558		
Iowa	(a)	(a)			(a)	(a)				
Kentucky	(a)	(a)	(a)	(a)						
Maine	51,732	955,515	8,207	51,978	23,588	282,632			(a)	(a)
Maryland	5,620	48,469	50,543	441,085	505	4,472				
Massachusetts	82,917	1,483,705	2,902	15,082	26,975	290,743				
Michigan	8,275	81,105	(a)	(a)	8,406	78,540			(a)	(a)
Minnesota	21,619	226,853								
Missouri	46,916	469,144	(a)	(a)	6,326	60,203	(a)	(a)	(a)	(a)
Montana	(a)	(a)								
Nevada	(a)	(a)	(a)	(a)						
New Jersey	(a)	(a)	(a)	(a)						
New Mexico	1,094	12,760								
New York	17,603	207,829	3,917	30,334	18,200	202,838	(a)	(a)	342	3,972
North Carolina	(a)	(a)								
Ohio	351,194	3,060,829	16,969	125,844	10,621	86,279	39,151	325,698		
Oklahoma	(a)	(a)								
Oregon										
Pennsylvania	137,139	1,261,494	152,667	1,183,361	46,977	390,334	2,690	21,734	(a)	(a)
Porto Rico	744	7,950	357	5,651					1,607	30,158
Rhode Island	(a)	(a)	(a)	(a)						
South Dakota	(a)	(a)								
Tennessee	61,053	508,092	614	5,217	18,874	128,906			(a)	(a)
Texas	30,832	318,809	(a)	(a)	(a)	(a)			610	6,729
Utah	6,377	88,026								
Vermont	14,557	238,430	1,278	7,687	6,675	81,752				
Virginia	51,011	531,633	21,793	161,653	8,493	70,389	(a)	(a)	(a)	(a)
Washington	9,750	121,437	(a)	(a)	2,925	25,876			2,144	27,511
West Virginia	(a)	(a)	17,746	136,982	(a)	(a)				
Wisconsin	111,938	897,157	145	666	9,496	72,084				
Wyoming	(a)	(a)								
Undistributed	97,323	1,278,979	5,768	54,154	14,373	130,150	1,117	11,806	6,011	54,275
	1,239,486	13,258,443	284,722	2,237,510	235,855	2,207,938	43,851	367,796	12,225	161,931

[a] Included under "Undistributed."

Lime sold in the United States in 1921, by States and uses—Continued.

State.	Chemical uses—Continued.						Dealers.		Total.	
	Tanneries.		Metallurgy.		Other chemical uses.					
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama	(a)	(a)	(a)	(a)	20,887	$182,201			109,256	$847,629
Arizona	(a)	(a)	(a)	(a)	1,967	28,605			11,783	162,647
Arkansas					(a)	(a)			8,958	93,499
California	478	$7,090	300	$3,602	10,245	135,817			42,115	577,366
Colorado			(a)	(a)	3,507	34,557			5,783	56,956
Connecticut									(a)	(a)
Florida					(a)	(a)			(a)	(a)
Georgia									(a)	(a)
Hawaii									1,985	50,690
Idaho									(a)	(a)
Illinois	5,339	54,162	(a)	(a)	16,187	160,901			58,222	610,197
Indiana	(a)	(a)	(a)	(a)	35,882	323,360			90,542	826,311
Iowa									(a)	(a)
Kentucky									1,524	11,551
Maine	(a)	(a)	855	11,321	3,460	56,383			90,585	1,392,850
Maryland	(a)	(a)	(a)	(a)	6,067	48,909			64,835	558,785
Massachusetts			1,205	14,241	10,184	86,741			124,183	1,890,512
Michigan	1,972	20,765	(a)	(a)	28,736	257,550	(a)	(a)	48,164	445,386
Minnesota			(a)	(a)					22,109	232,037
Missouri	(a)	(a)	4,676	39,546	51,878	510,214	(a)	(a)	159,194	1,656,560
Montana									(a)	(a)
Nevada			(a)	(a)	(a)	(a)			(a)	(a)
New Jersey									1,818	14,365
New Mexico					1,950	20,900			3,044	33,660
New York	4,336	62,196	5,808	67,347	17,286	182,614	(a)	(a)	67,685	759,299
North Carolina	(a)	(a)							(a)	(a)
Ohio	47	448	4,354	44,499	48,717	580,982			471,053	4,224,579
Oklahoma									(a)	(a)
Oregon							(a)	(a)	(a)	(a)
Pennsylvania	6,003	50,073	59,572	432,897	103,737	898,882	(a)	(a)	509,891	4,247,509
Porto Rico					32	354			2,740	44,113
Rhode Island					(a)	(a)			(a)	(a)
South Dakota					(a)	(a)			(a)	(a)
Tennessee	3,656	26,142			5,337	38,022	(a)	(a)	93,397	733,639
Texas	(a)	(a)	(a)	(a)	9,252	92,168			44,404	452,078
Utah			1,595	16,579					7,972	104,605
Vermont	4,097	53,837			6,092	77,574	83	$1,038	32,782	460,318
Virginia	5,607	45,595	2,703	19,877	21,161	170,530			111,518	1,005,677
Washington			(a)	(a)	1,600	20,503			17,710	209,761
West Virginia	(a)	(a)	25,472	191,480	44,748	383,884			119,716	1,015,690
Wisconsin	1,277	10,641			1,222	18,859			124,078	999,407
Wyoming									(a)	(a)
Undistributed	15,029	150,423	57,705	391,359	5,953	62,481	47,758	573,603	85,107	1,177,694
	47,841	481,372	164,245	1,232,748	456,087	4,372,991	47,841	574,641	2,532,153	24,895,370

[a] Included under "Undistributed."

BUILDING LIME.

Lime for building, which decreased only 5 per cent in quantity, was benefited by a conspicuous though not great revival in construction work in the last part of the year. Owing to the general business depression the resumption of building activity which had been subnormal during and since the war period, was further delayed, but it became evident as soon as prices of building materials in general began to decline. The demand for lime, however, varied locally. A few producers reported that the demand in 1921 was equal to or greater than in 1920, but many reported that it was much less, their decreases in sales ranging from 20 to 75 per cent.

Maine and Massachusetts were the only States to make any considerable increase in sales of lime for building. Ohio and Alabama made small increases, and Tennessee made practically no change. Unusually large proportionate decreases were recorded for Illinois, Maryland, Michigan, Minnesota, and Missouri. California, Minnesota, and to a less extent Illinois and Missouri were exceptional in that their total decreases in sales of lime were largely in lime for building.

CHEMICAL LIME.

Lime sold for chemical uses decreased nearly 48 per cent in 1921 and reflected the state of the metallurgical and chemical manufacturing industries throughout the year. Furnaces and smelters that ordinarily use lime and dead-burned dolomite were closed for a great part of the year, and all States supplying these plants showed marked decreases in sales. Pennsylvania was the only State whose decrease did not exceed one-half. In the leading States that furnish lime for paper mills and glass factories sales decreased from one-fifth to two-thirds. Lime for sugar mills decreased as a whole, although Washington showed a marked increase. Lime for tanning decreased in six and increased in four States. Pennsylvania, for example, showed a large decrease, whereas Virginia practically trebled its sales and nearly equaled those of Pennsylvania. Sales of lime for other chemical uses are shown in the table on page 159. Three widely separated States, California, Colorado, and Maine, showed increases in these sales, but all others of the more important States showed moderate to very large decreases. This group of uses accounts largely for the decreases in total sales in four of the most important States—Pennsylvania, Ohio, and the Virginias.

During this discouraging period, however, investigations of the requirements of chemical lime and limestone have been continued by the Interdepartmental Conference on Lime, which represents interested bureaus of the Federal Government, the American Society for Testing Materials, and the National Lime Association. The first two of these organizations have been working on specifications for lime and limestone for different uses. The differences of opinion expressed by consumers in interviews or correspondence in the course of these investigations have shown that little systematic attention has heretofore been given to this subject and have lengthened the investigations considerably. Specifications have been adopted by the Interdepartmental Conference on Lime for the paper and glass industries and have been published by the Bureau of Standards.[1] Other specifications that are practically complete and awaiting publication cover limestone, dolomite, and lime used in the manufacture of sulphite pulp; lime used in water purification, in causticizing, and in the unhairing of hides; and limestone (whiting) for use in the ceramic industry. A method (Scaife modified) for the quick determination of available calcium oxide has also been developed.[2] Tentative or final specifications adopted by the American Society for Testing Materials will be found in the annual reports of that society. One effect of this work is the necessity of more careful and complete anal-

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[1] Recommended specifications for quicklime and hydrated lime for use in the cooking of rags and for manufacture of paper: Bur. Standards Cir. 96, June 15, 1920.
Recommended specifications for limestone, quicklime, and hydrated lime for use in the manufacture of glass: Bur. Standards Cir. 118, Dec. 8, 1921.

[2] Whitson, A. I., Determination of available lime in quicklime and hydrated lime: Chem. and Met. Eng., vol. 25, p. 740, Oct. 19, 1921.

yses of limes and limestones and more careful surveys of limestone deposits to insure adequate supplies of readily quarried stone that will fulfill the requirements of standard specifications.

The National Lime Association, besides cooperating with the other two organizations, is conducting researches on the chemical and physical properties of lime and limestone. This work is designed to promote a more intelligent manufacture and use of lime by recognition of the salient characteristics of different varieties.

AGRICULTURAL LIME.

Total sales of lime for agriculture decreased 19 per cent in quantity in 1921. West Virginia and Ohio were the only important States to show an increase; Maryland, Pennsylvania, and Virginia sold three-fourths to four-fifths as much as in 1920. Some producers reported decreases of nine-tenths in quantity. It was reported that in some districts the farmers were buying more lime because of the high price of other fertilizers, but that in other districts they were waiting for decrease in freight rates before buying.

There has been a general decrease in the quantity of burned lime used on the land since the introduction of pulverized limestone for this purpose about 1909, and in 1921 the sales of burned lime were less than in 1906, when the first figures of quantity were collected by the United States Geological Survey. The aggregate demand for all forms of agricultural lime decreased, however, in 1920 and 1921. Sales of pulverized limestone decreased 4 per cent in 1921, those of calcareous marl 39 per cent, and those of oyster shell lime 37 per cent, as shown below.

Different kinds of agricultural lime sold in 1919–1921.

	Short tons.		Value.	
	Gross.	Effective lime content.	Total.	Average.
1919.				
Lime from:				
Limestone—				
Quicklime	240,467	202,000	$1,560,929	$6.49
Hydrated	198,165	138,700	1,784,110	9.00
Oyster shells	34,251	28,800	364,202	10.63
Limestone (pulverized)	1,392,914	599,000	2,409,460	1.73
Calcareous marl	91,437	40,600	327,294	3.58
1920.				
Lime from:				
Limestone—				
Quicklime	202,870	170,400	1,570,755	7.74
Hydrated	148,981	104,300	1,525,950	10.24
Oyster shells	38,506	32,300	311,695	8.09
Limestone (pulverized)	1,364,260	587,000	2,724,209	2.00
Calcareous marl	97,487	42,000	322,339	3.31
1921.				
Lime from:				
Limestone—				
Quicklime	142,140	119,400	940,318	6.62
Hydrated	142,582	99,800	1,297,192	9.10
Oyster shells	24,315	20,400	197,092	8.11
Limestone (pulverized)	1,311,520	564,000	2,355,339	1.80
Calcareous marl	59,730	25,700	195,743	3.28

The effective lime content is that portion which may be effective in increasing crop yield within five or six years. In the preceding table figures of effective lime content are based on the average chemical composition of each material as found on the market and on certain physical limitations as explained below. According to J. A. Slipher, of the National Lime Association,[3] material that will pass a No. 50 screen (approximately 50 mesh) may be regarded as fully effective. The efficiency of lime oxides in lump quicklime is decreased 10 to 15 per cent, chiefly by imperfect slaking preparatory to application on the land. Loss of efficiency of ground and granular quicklime, on the other hand, is negligible. The average effective lime content of quicklime from limestone and oyster shells is therefore placed at 84 per cent. Hydrated lime is produced as an extremely fine powder, and all of its lime content is effective. This content in pure high-calcium hydrate would be 74 per cent, or 1,480 pounds to the ton; in pure high-magnesium hydrate it would be about 80 per cent, or 1,600 pounds to the ton, and an average based on sales of the two varieties would be about 75 per cent. Allowance for insoluble impurities, however, would reduce this average to 70 per cent.

Pure high-calcium limestone and calcareous marl would contain 56 per cent of available oxides, and pure dolomite or high-magnesium limestone, 52 per cent; but the presence of insoluble impurities in the stones marketed reduces the average content to about 50 per cent, and failure to grind the entire product to pass a No. 50 screen reduces it still further. Sizes ranging between a No. 20 screen (approximately 20 mesh) and a No. 50 screen may be regarded as having only half the efficiency of properly ground stone, and sizes coarser than a No. 10 screen (approximately 10 mesh) have almost no effect on the soil within five or six years. In the foregoing table the average content of effective lime in limestone and calcareous marl is placed at 43 per cent, on the assumption that well-ground stone of more than average purity will offset any poorly ground or impure stone.

Detailed statistics of pulverized limestone sold for agriculture in 1921 will be found in the annual chapter on stone.

Nearly all the calcareous marl sold in the United States in 1921 was used for liming the soil. Some was used as a filler in patent fertilizers. Nearly 57 per cent of the total output—33,978 short tons—was produced in Virginia, and was valued at $105,821. The other producing States were Arkansas, California, Maryland, New York, North Carolina, Ohio, Pennsylvania, South Carolina, and West Virginia. Newly developed deposits were reported in Michigan and Wisconsin. The material reported from Arkansas was chalk.

The burning of lime from oyster shells is an industry of minor importance in Maryland, Virginia, Pennsylvania, and New Jersey. The production in Virginia in 1921 was 15,730 short tons, valued at $129,258, and in Maryland 5,745 short tons, valued at $50,584. This lime is sold almost entirely for agriculture, but some of it is also sold to chemical works.

Notwithstanding the general decrease in the use of land lime in its various forms, studies conducted by the National Lime Association have shown that the total quantities sold represent but a small fraction of the quantities needed by soils in many States, especially

[3] Written communication.

in the Southeast. As the work of bringing this matter to the attention of those engaged in tilling the soil progresses, a substantial increase in the use of land lime may be expected. Whether the increase will be more in one form of lime than in another should depend on a careful determination of the ultimate cost to the consumer, after consideration of the price of the material delivered at the farm and the percentage of readily available lime it contains.

HYDRATED LIME.

In presenting the output of hydrated lime it is the intention of the United States Geological Survey to include only the product made in hydrating machines and to omit hand-slaked lime. There were ten plants reporting hydrated lime in 1921 that did not manufacture in 1920 and three plants operating in 1920 that were idle in 1921.

Hydrated lime decreased 7 per cent in quantity and 20 per cent in value in 1921. There was no marked decrease in sales for different uses, except in the lime sold to dealers and for unclassified chemical uses. The decline in value was due to the selling of this material at a low price in order to maintain a market and prevent the closing of some of the larger plants.

Hydrated lime sold in the United States, 1919–1921.

Year.	Short tons.	Value.		Number of plants in operation.
		Total.	Average.	
1919	777,408	$7,061,146	$9.08	93
1920	853,116	9,287,562	10.89	98
1921	792,970	7,421,637	9.36	105

Hydrated lime sold in the United States in 1920 and 1921, by uses.

Use.	1920		1921	
	Short tons.	Value.	Short tons.	Value.
Building	562,153	$6,220,895	539,550	$4,996,718
Agriculture	148,981	1,525,950	142,582	1,297,192
Chemical:				
Paper mills	7,237	87,382	4,840	48,270
Sugar factories	4,111	42,131	4,633	38,628
Tanneries	14,828	163,941	14,872	153,336
Glass factories	3,232	36,529	1,299	12,934
Metallurgy	1,521	16,198	2,453	21,921
Other uses	85,819	951,841	69,612	718,285
Total chemical	116,748	1,298,022	97,709	993,374
Dealers	25,234	242,695	13,129	134,353
	853,116	9,287,562	792,970	7,421,637

Hydrated lime sold in the United States in 1920 and 1921, by States.

State.	1920		1921	
	Short tons.	Value.	Short tons.	Value.
Alabama	8,491	$109,890	7,030	$66,480
Arizona	(a)	(a)	(a)	(a)
California	(a)	(a)	(a)	(a)
Connecticut	(a)	(a)	(a)	(a)
Florida	(a)	(a)	(a)	(a)
Georgia	(a)	(a)	(a)	(a)
Hawaii	150	3,750	164	4,264
Illinois	(a)	(a)	11,034	115,505
Indiana	37,997	404,356	29,605	276,665
Maine	(a)	(a)	(a)	(a)
Maryland	38,422	386,056	33,553	320,600
Massachusetts	4,699	63,780	(a)	(a)
Michigan	(a)	(a)	(a)	(a)
Minnesota	(a)	(a)	(a)	(a)
Missouri	51,987	584,283	45,903	487,169
Nevada	(a)	(a)	(a)	(a)
New Jersey	(a)	(a)	(a)	(a)
New York	(a)	(a)	(a)	(a)
Ohio	321,570	3,420,781	344,669	2,991,407
Pennsylvania	169,639	1,884,787	135,917	1,311,678
Rhode Island	(a)	(a)	(a)	(a)
South Dakota	(a)	(a)	(a)	(a)
Tennessee	29,525	308,381	25,719	233,266
Texas	22,116	221,845	19,634	205,885
Utah	(a)	(a)	(a)	(a)
Vermont	(a)	(a)	(a)	(a)
Virginia	(a)	(a)	11,159	101,009
Washington	(a)	(a)	(a)	(a)
West Virginia	55,807	547,762	38,335	319,874
Wisconsin	31,719	348,303	15,411	151,794
Undistributed	80,994	1,003,588	74,837	836,041
	853,116	9,287,562	792,970	7,421,637

a Included under "Undistributed."

CONSUMPTION.

Only four States of comparatively small population—Connecticut, Rhode Island, Florida, and the District of Columbia—showed an increase in per capita consumption of lime in 1921. It may be inferred that these increases were due to local activity in building. An approximate idea of the causes of decreased consumption in the other States may be made by comparing the accompanying table of lime consumed with that of production by uses on pages 160–161. Where the greater part of the lime sold is used within the producing State, its uses and the cause of its decline are readily inferred. For States that obtain most of their lime from other States it would be necessary to consider their relative activity in the different industries using lime before an adequate idea of the local consumption of lime could be formed.

Lime consumed in the United States in 1921, by States, in short tons.

State.	Sales.	Shipments from State.	Shipments into State.	Consumption.					Population Jan. 1, 1922 (Census estimate).
				Quicklime.	Hydrated lime.	Total.	Per capita (estimated).		
							1920	1921	
Alabama	109,256	30,094	1,886	78,180	2,868	81,048	0.05	0.03	2,391,453
Alaska			36	36		36	.0008	.0006	[a] 55,036
Arizona	11,783	9,851	2,256	4,051	137	4,188	.02	.01	360,903
Arkansas	8,958	3,058	3,341	7,571	1,670	9,241	.006	.005	1,788,823
California	42,115	2,024	13,985	46,997	7,079	54,076	.017	.015	3,643,028
Colorado	5,783	603	8,332	11,675	1,837	13,512	.014	.014	968,595
Connecticut	([b])	([b])	18,413	27,749	8,659	36,408	.023	.025	1,435,404
Delaware			17,494	10,109	7,385	17,494	.169	.077	227,264
District of Columbia			13,373	7,289	6,084	13,373	.026	.031	[a] 437,571
Florida	([b])	([b])	12,604	11,095	10,630	21,725	.018	.021	1,012,937
Georgia	([b])	([b])	14,720	9,152	9,768	18,920	.01	.006	2,954,897
Hawaii	1,985		2,950	4,272	663	4,935	.02	.018	269,096
Idaho	([b])	([b])	683	791	21	812	.005	.002	453,759
Illinois	58,222	20,823	133,302	131,504	39,197	170,701	.036	.025	6,659,705
Indiana	90,542	52,376	33,810	37,322	34,654	71,976	.03	.02	2,977,673
Iowa	([b])	([b])	19,662	14,495	10,406	24,901	.01	.01	2,440,948
Kansas			23,245	13,808	9,437	23,245	.01	.01	1,785,390
Kentucky	1,524	120	15,735	10,394	6,745	17,139	.01	.007	2,442,737
Louisiana			22,207	14,185	8,022	22,207	.02	.01	1,827,788
Maine	90,585	55,869	19,761	48,979	5,498	54,477	.12	.07	773,297
Maryland	64,835	26,630	37,558	37,967	37,796	75,763	.095	.05	1,481,452
Massachusetts	124,183	96,517	55,016	68,627	14,055	82,682	.03	.02	3,952,464
Michigan	48,164	5,514	76,793	72,617	46,826	119,443	.06	.03	3,845,217
Minnesota	22,109	8,123	12,873	16,637	10,222	26,859	.016	.011	2,451,280
Mississippi			8,907	7,853	1,054	8,907	.0056	.005	[a] 1,790,618
Missouri	159,194	103,145	9,434	46,088	19,395	65,483	.026	.019	3,426,864
Montana	([b])		([b])	3,501	708	4,209	.008	.007	584,495
Nebraska			8,667	5,576	3,091	8,667	.01	.006	1,317,829
Nevada	([b])	([b])	922	3,122		3,122	.067	.04	[a] 77,407
New Hampshire			14,469	13,065	1,404	14,469	.05	.03	445,660
New Jersey	1,818		100,571	49,948	52,441	102,389	.04	.03	3,283,365
New Mexico	3,044	460	883	2,974	493	3,467	.009	.009	367,159
New York	67,685	17,751	197,610	166,798	80,746	247,544	.03	.02	10,647,190
North Carolina	([b])	([b])	40,766	31,901	13,227	45,128	.02	.017	2,631,809
North Dakota			1,661	1,155	506	1,661	.004	.002	661,254
Ohio	[c] 456,032	311,578	38,447	83,287	99,614	182,901	.053	.03	5,963,810
Oklahoma	([b])	([b])	14,020	10,017	5,458	15,475	.009	.007	2,104,737
Oregon	([b])	([b])	4,614	3,889	1,205	5,094	.006	.006	806,177
Pennsylvania	[c] 467,794	108,691	107,494	353,565	113,032	466,597	.078	.05	8,937,336
Porto Rico	2,740			2,740		2,740	.003	.002	1,337,260
Rhode Island	([b])	([b])	9,264	8,994	1,870	10,864	.003	.018	617,125
South Carolina			9,126	5,551	3,575	9,126	.0096	.005	1,718,400
South Dakota	([b])	([b])	3,288	5,359	1,672	7,031	.01	.01	647,395
Tennessee	[c] 71,675	49,168	4,929	19,554	7,882	27,436	.018	.011	2,369,423
Texas	44,404	9,755	547	18,640	16,556	35,196	.009	.007	4,821,172
Utah	7,972	1,533	20	5,908	551	6,459	.017	.013	465,062
Vermont	32,782	27,278	734	5,851	387	6,238	.025	.018	[a] 352,428
Virginia	111,518	68,242	23,873	47,875	19,274	67,149	.079	.03	2,360,189
Washington	17,710	8,418	1,358	9,031	1,619	10,650	.02	.008	1,400,837
West Virginia	119,716	111,632	37,251	32,063	13,272	45,335	.04	.03	1,513,675
Wisconsin	124,078	77,085	33,898	68,132	12,759	80,891	.04	.03	2,693,499
Wyoming	([b])		([b])	866	656	1,522	.01	.007	204,380
Undistributed	85,107	32,528	3,676						
	[c] 2,453,313	[d] 1,238,866	1,236,464	1,698,805	752,106	2,450,911	.033	.022	[e] 110,202,230

[a] Population Jan. 1, 1920; no later estimate made.
[b] Included under "Undistributed."
[c] Four producers in the United States failed to report shipments by States, and their output is omitted.
[d] Includes 60 tons shipped to South America, 60 tons to China, 99 tons to the Philippine Islands, and 2,183 tons to Canada.
[e] Estimate for continental United States as published by the Bureau of the Census, plus population of Alaska, Hawaii, and Porto Rico as shown above.

EXPORTS AND IMPORTS.[4]

Lime exported from the United States, 1919–1921.

Year.	Short tons.	Value.	
		Total.	Average.
1919	6,372	$108,370	$17.01
1920	5,921	128,296	21.67
1921	5,192	109,769	21.14

Lime exported from the United States in 1920–21, by countries.

Country.	1920		1921	
	Short tons.	Value.	Short tons.	Value.
North America:				
Canada	3,034	$50,646	2,465	$34,116
Newfoundland and Labrador	1	47	13	317
Mexico	735	17,014	788	20,733
Central America:				
British Honduras	7	188	6	133
Guatemala	15	359		
Honduras	379	9,139	493	14,485
Nicaragua	10	241	88	2,410
Panama	115	3,248	138	5,536
West Indies:				
British—				
Barbados	35	720		
Bermuda	(a)	14	10	460
Jamaica	11	393	4	115
Trinidad and Tobago	2	60		
Other British West Indies	16	513	21	440
Cuba	175	4,743	40	1,211
Dominican Republic	366	11,534	460	12,404
French West Indies	3	130		
Virgin Islands of the United States	80	1,700	32	807
South America:				
Brazil	61	1,326		
Colombia	5	138	5	162
Peru	376	12,644	460	12,672
Europe:				
Denmark	(a)	5		
England	49	2,209	6	400
Netherlands	107	2,943		
Portugal	3	156		
Sweden			2	66
Asia:				
China	132	2,640	51	810
Japan	28	1,455	(a)	10
Philippine Islands	169	3,888	110	2,475
Oceania:				
Other British Oceania	2	65		
French Oceania	5	138	(a)	7
	5,921	128,296	5,192	109,769

[a] Less than 1 ton.

Lime imported and entered for consumption in the United States, 1919–1921.[a]

Year.	Short tons.	Value.	
		Total.	Average.
1919	8,679	$128,519	$14.81
1920	22,688	392,137	17.28
1921	10,811	234,798	21.72

[a] Most of the lime imported into the United States comes from Canada.

[4] Statistics of exports and imports compiled by J. A. Dorsey, of the United States Geological Survey, from records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

SULPHUR AND PYRITES.

By H. A. C. Jenison and H. M. Meyer.[1]

GENERAL SITUATION.

The general economic depression of 1921 affected the sulphur and pyrites industry so deeply that there was no revival during the year. The market was weak and the price low; nor does the situation at the time of present writing (November, 1922) appear to promise any marked change immediately. There were, however, several noteworthy occurrences during 1921, among which was the hurricane on the night of June 21, 1921, that did considerable damage to the Texas Gulf Sulphur Co.'s derricks and equipment and injured also the Freeport Sulphur Co.'s plant.

The Texas Co., of Houston, Tex., began work late in the year on the sulphur deposit at Hoskins Mound, in Brazoria County, and has developed a reserve said to contain more than 10,000,000 tons of sulphur.[2] According to the same authority,[2] plans are being perfected for the organization of a subsidiary operating company to be capitalized at $5,000,000.

In western Texas the situation in sulphur fields changed from one of optimism to disappointment. The Texas Sulphur Co.,[3] of El Paso, Tex., was placed in the hands of a receiver, and the Great Southern Sulphur Co., of New Orleans, La., which in 1920 made lavish promises, accomplished little during the year.

It is reported[4] that the Anglo-American Sulphur Co. (Ltd.), of London, has purchased 1,280 acres of patented sulphur and oil lands in eastern Culberson County, Tex. The tract adjoins the property of the Consolidated Sulphur Co., of Cleveland, Ohio, in the Rustler Hills district, about 22 miles west of Orla, Tex., on the Santa Fe Railway. The company is reported to have contracted to pay about £60,000 for the property and to have made a cash payment of £10,000. An operating company, for the purpose of developing the oil and sulphur resources of the tract, has probably been organized in London by the time of writing. The property was favorably reported upon by C. F. Z. Caracristi to the late owners, O. W. Dunlap and J. D. Smith.

Nothing noteworthy occurred in the pyrites industry during the year that is not apparent from the statistics of production. The foreign situation changed very little, and the relation between the domestic industry and its foreign competitors was not modified. During the year an unsuccessful effort was made to have an import

[1] The pressure of other duties has made it impossible for Philip S. Smith to continue as specialist in charge of sulphur and pyrites, and the subject has been assigned, on very short notice, to the present writers, who in consequence have been unable to give the industry the extended study it deserves; hence this report for 1921 consists of little but statistical tables.

[2] Chem. and Met. Eng., vol. 26, No. 2, p. 94, Jan. 11, 1922.

[3] Eng. and Min. Jour., vol. 112, No. 22, p. 868, Nov. 26, 1922.

[4] Eng. and Min. Jour., vol. 111, No. 13, p. 559, Mar. 26, 1921.

duty placed on pyrites. The opponents of the proposed duty pointed out that the serious competition faced by producers of domestic pyrites comes rather from American sulphur than from imported pyrites, and also that American sulphur has displaced pyrites to so great an extent that less than one-fourth of the pre-war quantity of pyrites is now being imported. It was further shown that the price of sulphur has declined so much that foreign pyrites can not compete with it except at points that are favorably placed with reference to transportation; it was stated that a tariff on pyrites would prevent further imports of pyrites, but that sulphur, on account of its low cost, would be substituted for pyrites, unless sulphur operators took advantage of the situation and greatly increased the price of sulphur; and it was shown that the American sulphur industry occupies so strong a position that Sicilian sulphur has not only been displaced in America but is being displaced by American sulphur in the important Scandinavian, English, French, and German markets.

The effort to increase the use of sulphur in agriculture has not so far notably affected the consumption of sulphur, but the use of sulphur in fertilizers is still under study and development.

By arrangement with the Department of Commerce the statistics of production of sulphuric acid will henceforth be collected and published by the Bureau of the Census.

SULPHUR.

DOMESTIC PRODUCTION.

In 1921 sulphur was produced by six mines, one each in Colorado, Louisiana, Nevada, and Utah and two in Texas. More than 99.5 per cent of the output of sulphur was produced by the mines of the Texas Gulf Sulphur Co., at Big Hill, Matagorda, Tex.; the Freeport Sulphur Co., at Freeport, Brazoria County, Tex.; and the Union Sulphur Co., at Sulphur, Calcasieu Parish, La. These three companies have furnished 99.5 per cent of the sulphur production since 1919, and prior to that time the Freeport Sulphur Co. and Union Sulphur Co. furnished 99 per cent of the production.

The domestic production of sulphur in 1921 increased 623,901 long tons over the production in 1920 and was the largest ever reached in the United States, being 525,625 tons larger than that in 1918, the former peak year. Shipments, however, dropped 37 per cent and were only about one-half as large as the production. The stocks of sulphur at the end of 1921 were consequently very large, 2,000,000 tons being held at the mines.

Sulphur produced and shipped in the United States, 1917–1921.

Year.	Mined (long tons).	Shipped.	
		Long tons.	Approximate value.
1917	1,134,412	1,120,378	$23,987,000
1918	1,353,525	1,266,709	27,868,000
1919	1,190,575	678,257	10,252,000
1920	1,255,249	1,517,625	30,000,000
1921	1,879,150	954,344	17,000,000

IMPORTS AND EXPORTS.[5]

The imports of crude sulphur in 1921 amounted to only 4 long tons, valued at approximately $57 a ton, as compared with 44 long tons in 1920, valued at approximately $39 a ton.

Crude sulphur imported into the United States in 1921.

Country.	Port of entry.	Long tons.	Value.
Canada	St. Lawrence		$1
	Montana and Idaho	1	74
Chile	San Francisco		4
Japan	Hawaii		12
	San Francisco		2
	Los Angeles	3	133
		4	226

As Canada does not produce crude sulphur, the ore shown above. as coming from Canada must have originated in some other country,

In addition to the crude sulphur, 35 long tons of refined sulphur, valued at $2,311, and 11 tons of all other kinds, valued at $3,341, were imported, making a total of 50 tons, valued at $5,878, as compared with 136 tons in 1920, valued at $26,828.

In 1921 the exports of sulphur were, 191,688 tons less than in 1920 but were otherwise the largest so far recorded.

Sulphur exported from the United States, 1917–1921.

Year.	Long tons.	Value.
1917	152,736	$3,500,819
1918	131,092	3,626,638
1919	224,712	6,325,552
1920	477,450	8,994,350
1921	285,762	4,524,768

Although the customs districts from which crude sulphur was cleared in 1920 are distributed around the entire border of the country, practically all the sulphur exported was produced by the large mines in Texas and Louisiana.

Sulphur exported from the United States in 1921, in long tons, by ports of clearance.

Destination.	New York City and Maryland.	Maine, New Hampshire, Massachusetts, Vermont.	St. Lawrence, Buffalo, Rochester, Michigan.	Dakota, Minnesota, Idaho, Montana.	California and Arizona.	Texas, Louisiana, and Mobile.	Total.
North America	248	4,036	20,533	1,635	3,386	39,293	69,131
South America	187				4	5,991	6,182
Europe	18					135,242	135,260
Asia and Oceania	763				534	64,382	65,679
Africa	300					9,210	9,510
	1,516	4,036	20,533	1,635	3,924	254,118	285,762

[5] Figures compiled from the records of the Bureau of Foreign and Domestic Commerce.

Of the sulphur exported to North American countries and the adjacent islands, 59,487 tons went to Canada, 8,321 tons to Mexico, 1,133 tons to Cuba, and smaller quantities to the West Indies and Central America; of that exported to European countries, 55,304 tons went to France, 23,049 tons to Germany, 14,897 tons to England, 13,331 tons to Sweden, and smaller quantities to Belgium, Denmark, Finland, Netherlands, Norway, Portugal, and Spain; of that sent to South American countries, 6,151 tons went to Argentina and insignificant quantities to Brazil, Chile, Colombia, Peru, and Venezuela; of that sent to Africa, 5,000 tons went to British East Africa and 4,510 tons to Portuguese Africa; of that sent to Asia and Oceania, 54,938 tons went to Australia, 2,192 tons to New Zealand, 4,634 tons to Japan, 3,250 tons to British India, and the remainder to the Dutch East Indies, Philippine Islands, Straits Settlements, and French Oceania.

PYRITES.

DOMESTIC PRODUCTION.

The domestic production of pyrites decreased 49 per cent in quantity and 55 per cent in value in 1921. The lower cost of producing sulphur as compared with that of producing pyrites and the large quantity of sulphur available has caused the tremendous decrease in the production of pyrites, resulting in the smallest output since 1897, when it was 143,000 tons.

The following table shows the production of pyrites in 1921 by 14 mines in 8 States, compared with 25 mines in 10 States in 1920:

Pyrites produced in the United States in 1921, by States.

State.	Lump.		Fines.		Total.	
	Long tons.	Value.	Long tons.	Value.	Long tons.	Value.
California	(a)	(a)	(a)	(a)	98,252	$467,958
Colorado	7,290	$18,475			7,290	18,475
Other States [b]	[c]7,622	[c]21,737	[c]142,206	[c]$671,220	51,576	224,999
	14,912	40,212	142,206	671,220	157,118	711,432

[a] Included under "Other States." Output of lump and fines not shown separately, as there are less than three producers of one or the other class.
[b] Includes Georgia, New York, Pennsylvania, Tennessee, Virginia, and Wisconsin.
[c] Includes California.

California still ranks first in the production of pyrites, with 98,252 long tons, or 63 per cent of the total. New York ranks second and Wisconsin third.

The total sulphur content of the lump ore was equivalent to 5,226 tons of sulphur, which would indicate an average content of 35 per cent. The sulphur content of the fines was equivalent to 61,898 tons of sulphur, which would indicate an average content of 44 per cent. The average value per ton of the lump ore was $2.70 and that of the fines $4.72. According to these figures the average value per unit of sulphur in the lump ore was 7⅗ cents and of that in the fines or concentrates 10¾ cents.

Pyrites produced in the United States, 1917–1921.

Year.	Long tons.	Value.
1917	482,662	$2,593,035
1918	464,494	2,644,515
1919	420,647	2,558,172
1920	310,777	1,596,961
1921	157,118	711,432

IMPORTS.

The imports of pyrites decreased from 332,606 long tons in 1920 to 216,229 tons in 1921 and were the smallest recorded since 1896. The continuous decrease in imports has been due to the same cause that has affected production—large quantities of native sulphur made available more cheaply than pyrites could be.

Imports of sulphur ore as pyrites, containing more than 25 per cent of sulphur, in 1921, by countries and districts of entry.[a]

Country.	Long tons.	Value.	District of entry.	Long tons.	Value.
Canada	7,000	$31,500	Chicago	7,000	$31,500
Cuba	16,250	103,484	Maryland	16,250	103,484
Bermuda	1,460	1,081	do	1,460	1,081
Italy	4	32	Philadelphia	4	32
Spain	191,515	682,755	Georgia	3,566	18,799
			Maryland	49,829	193,360
			Virginia	7,114	36,816
			New York	26,680	83,771
			Philadelphia	104,326	350,009
	216,229	818,852		216,229	818,852

[a] Figures compiled from the records of the Bureau of Foreign and Domestic Commerce.

A comparison of the foregoing table with the similar table for 1920 shows that imports of pyrites from Canada decreased 94,000 tons, those from Cuba 13,000 tons, and those from Spain 9,000 tons. The value of imports in 1921 decreased over 50 per cent from the value in 1920, and the average value was $3.79 a ton, as against $4.99 in 1920. The average value of the ore imported from Canada was $4.50, as against $5.06 in 1920, and the average value of the Spanish ore in 1921 was $3.57, as compared with $4:52 in 1920. The average sulphur content of the pyritic ore imported from Spain is 48 per cent, which would make the average value per unit of sulphur a little less than 7½ cents. The Canadian ore, on the other hand, generally carries a much smaller content of sulphur, believed to average not over 42 per cent. The average value per unit of sulphur for ores imported from Canada and Spain was about 9 cents.

STONE.

By G. F. Loughlin and A. T. Coons.

PRODUCTION.

SUMMARY.

The stone sold in the United States in 1921 showed a decrease of 19 per cent in quantity and 20 per cent in value. The quantity was the smallest in six years, but the total value ranked next to the record value of 1920. The only kinds of stone showing increase were the varieties included under "miscellaneous" and used chiefly for road metal, concrete, and ballast. The production of granite was about the same as in 1920 and was upheld by the increased use of granite for street work and concrete, as there was a large decrease in monumental stone and a smaller decrease in building stone.

The tables of this report give values f. o. b. quarry or mill.

PRODUCTION BY KINDS AND USES.

Stone sold in the United States, 1919–1921, by kinds.

Year.	Granite.		Basalt and related rocks (trap rock).		Sandstone.		Marble.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1919	4,221,220	$19,345,714	7,410,770	$8,944,686	2,623,270	$5,283,842	333,400	$8,042,297
1920	4,760,000	24,954,908	9,219,200	12,260,148	3,343,000	7,310,290	431,500	11,069,585
1921	4,752,180	20,592,217	8,524,480	11,450,899	2,640,460	6,425,339	315,400	8,580,416
Percentage of change in 1921	−0.2	−17	−8	−7	−21	−12	−27	−22

Year.	Limestone.		Miscellaneous.[a]		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
1919	49,759,800	$53,171,701	1,190,540	$1,920,903	65,539,000	$96,709,143
1920	59,290,000	75,655,260	1,483,300	2,291,769	78,527,000	133,541,960
1921	45,621,000	57,749,594	1,685,220	2,163,801	63,538,740	106,962,266
Percentage of change in 1921.	−23	−24	+14	−6	−19	−20

[a] Includes mica schist used for furnace lining, conglomerate, argillite, and various light volcanic rocks used mainly for crushed stone, which can not be properly classified in any of the main groups.

Producers all over the country stated that both wages and prices showed a downward tendency with a decrease in cost of production. High freight rates contributed to the general depression in the industry, although that was somewhat relieved in certain districts during the year. A movement was started in many sections of the country to introduce into the different quarry and stone cutting districts what was called the American plan of employment of labor, which is more or less a return to the open shop and the training of apprentices to take the place of men who left on account of dissatisfaction with wages and other conditions.

Stone sold in the United States, 1920–21, by uses.

Use.	1920		1921	
	Quantity.	Value.	Quantity.	Value.
Building stone.....cubic feet..	15,870,530	$18,948,588	17,006,210	$18,975,819
Approximate equivalent in short tons......	1,266,380	....	1,368,650	....
Monumental stone.....cubic feet..	4,549,430	17,488,765	2,772,000	10,353,105
Approximate equivalent in short tons......	383,910	....	230,000	....
Paving blocks.....number..	35,959,200	2,898,459	41,588,860	3,593,373
Approximate equivalent in short tons......	389,980	....	453,130	....
Curbing.....cubic feet..	1,508,480	1,297,058	2,255,770	1,859,926
Approximate equivalent in short tons......	127,710	....	183,600	....
Flagging.....cubic feet..	688,890	463,718	791,660	471,837
Approximate equivalent in short tons......	56,460	....	65,100	....
Rubble.....short tons..	501,570	791,177	445,210	601,208
Riprap.....do....	2,211,170	2,431,723	1,813,590	1,694,206
Crushed stone.....do....	40,365,860	50,846,693	43,202,840	51,717,478
Furnace flux (limestone and marble).long tons..	22,402,100	26,635,977	9,525,900	9,457,946
Equivalent in short tons.....	25,090,350	....	10,669,000	....
Refractory stone [a].....short tons..	1,735,440	2,393,537	496,150	643,638
Manufacturing industries (limestone and marble).....short tons..	4,592,280	4,591,559	2,883,090	3,801,162
Other uses.....do....	[b] 1,805,890	[b] 4,754,706	[b] 1,728,380	[b] 3,792,568
Total (quantities approximate, in short tons).....	78,527,000	133,541,960	63,538,740	106,962,266

[a] Ganister, mica schist, and dolomite. [b] Chiefly agricultural limestone.

The decrease in output of stone was largely due to the depression in the metal industries. Stone used for fluxing material decreased 57 per cent, and stone for refractories 71 per cent.

Limestone and marble used in various chemical and manufacturing industries decreased 37 per cent. Monumental stone decreased 40 per cent, but as this high-priced product is less than 1 per cent of the total the decrease did not appreciably affect the quantity sold, although it contributed noticeably to the general decrease in value of stone sold.

Paving blocks were in good demand, increasing over 16 per cent in total output. Increases were also shown in sales of curbing and flagging, suggesting a revival in municipal street work. The campaign begun for the betterment of suburban and country roads contributed to the increase of 12 per cent in the sales of crushed stone for road metal and concrete, but on account of the decreased use of railroad ballast the increase in the total sales of crushed stone was only 7 per cent.

Building stone showed an increase of about 8 per cent in quantity sold. The increase was mainly in sawed and cut building stone, but sales of basalt and miscellaneous stone, which are used principally for crushed stone and to a less extent for rough construction, also increased. Some of this increase was more apparent than real. The Geological Survey's figures for 1920 were not collected in so great detail as those for 1921, and it is probable that in 1920 the figures of rough stone included some of the sawed stone now separately classified. In the following table sales of building stone according to grading of the stone are shown for the first time.

Building stone sold in the United States in 1920 and 1921.

	Rough.				Dressed.				Total.	
	Constructional.		Architectural.		Sawed. [a]		Cut. [a]			
	Cubic feet.	Value.	Cubic feet.	Value.	Cubic feet.	Value.	Cubic feet.	Value.	Cubic feet.	Value.
1920.										
Granite	3,804,000	$715,258	604,720	$687,396	(b)	(b)	b 487,160	b $3,089,828	4,895,880	$4,492,482
Sandstone	(b)	(b)	b 1,343,700	b 858,821	(b)	(b)	b 468,880	b 760,903	1,812,580	1,619,724
Limestone	(b)	(b)	b 5,955,320	b 4,239,912	(b)	(b)	b 1,586,830	b 3,957,954	7,542,150	8,197,866
Marble			842,080	2,146,642	(b)	(b)	b 322,820	b 2,423,449	1,164,900	4,570,091
Basalt	292,520	31,096							292,520	31,096
Miscellaneous	162,500	37,329							162,500	37,329
	(b)	(b)	b 13,004,840	b 8,716,454	(b)	(b)	b 2,865,690	b 10,232,134	15,870,530	18,948,588
1921.										
Granite	3,130,840	559,104	443,860	480,934	a 63,850	a $116,425	a 413,100	a 3,049,883	4,051,650	4,206,346
Sandstone	1,387,000	166,049	572,360	329,690	777,760	879,330	79,120	236,970	2,816,240	1,612,039
Limestone	2,153,000	253,786	2,458,780	1,699,783	2,078,630	2,195,397	1,329,290	3,737,620	8,019,700	7,886,586
Marble			845,290	1,686,796	273,160	1,233,858	353,770	2,275,453	1,472,220	5,196,107
Basalt	346,400	24,679							346,400	24,679
Miscellaneous	300,000	50,062							300,000	50,062
	7,317,240	1,053,680	4,320,290	4,197,203	3,193,400	4,425,010	2,175,280	9,299,926	17,006,210	18,975,819

a For granite, sawed stone corresponds to dressed stone for construction work (walls, foundations, bridges) and cut stone to architectural stone for high-class buildings.
b No separation in 1920.

Granite was the only stone that showed decreased sales for building. It was reported that in 1921 contracts that originally specified the use of granite were changed to specify marble or limestone, which could be produced at less cost.

Prior to 1921 there was a scarcity of competent stone cutters, so that in 1921, with more labor available and with promoters better able to finance their operations, there was a considerable demand for finished material for speculative building work.

According to the statistics of construction compiled by the F. W. Dodge Co., there were more contracts let in 1921 for buildings of the classes that might call for stone work than in 1920. Contracts for educational, religious, social and recreational structures, hospitals, and residences increased from 18 to 55 per cent, but contracts for structures for business and industrial use, for public buildings, public works and utilities, and military and naval structures, which had previously been the most active, decreased from 20 to 70 per cent.

PRODUCTION BY STATES.

Stone sold in the United States in 1920, by States.

State.	Number of plants.	Quantity (approximate).		Value.	
		Short tons.	Percentage of total.	Total.	Percentage of total.
Pennsylvania	443	[a] 14,296,630	18.2	[a] $20,615,316	15.4
Ohio	130	9,105,630	11.5	10,856,468	8.1
Vermont	47	301,980	.4	10,065,759	7.5
Indiana	84	2,382,200	3.0	9,228,755	6.9
New York	112	5,969,730	7.6	8,014,446	6.0
Michigan	31	9,812,780	12.5	6,054,276	4.5
Illinois	65	5,103,700	6.5	5,673,831	4.2
California	116	4,424,640	5.6	5,618,777	4.2
Massachusetts	87	1,294,770	1.6	5,397,782	4.0
Wisconsin	107	1,564,940	2.0	3,729,236	2.8
Georgia	31	508,370	.6	3,651,415	2.7
Missouri	111	1,457,960	1.8	3,518,387	2.6
West Virginia	37	2,459,030	3.1	3,155,942	2.4
Minnesota	55	685,810	.9	3,149,751	2.3
Tennessee	46	1,098,660	1.4	2,962,725	2.2
New Jersey	58	1,679,720	2.1	2,777,018	2.0
Alabama	25	1,355,170	1.7	2,544,334	1.9
North Carolina	29	[a] 672,810	.8	[a] 2,088,266	1.6
New Hampshire	27	122,980	.1	2,033,113	1.5
Maine	41	192,440	.2	1,924,990	1.4
Connecticut	33	1,284,440	1.6	1,796,724	1.3
Virginia	56	1,466,920	1.9	1,796,620	1.3
Kentucky	82	1,422,530	1.8	1,756,176	1.3
Maryland	36	[a] 811,500	1.0	[a] 1,273,741	.9
Oklahoma	28	875,560	1.1	1,056,136	.8
Oregon	47	805,950	1.0	1,030,220	.8
Kansas	40	699,190	.9	1,013,891	.8
Arkansas	21	[a] 643,000	.8	[a] 908,969	.7
Texas	23	680,450	.9	890,316	.7
South Carolina	18	272,460	.3	860,000	.6
Washington	26	712,680	.9	821,842	.6
Colorado	39	553,040	.7	810,590	.6
Rhode Island	16	[a] 123,470	.2	[a] 786,815	.6
Iowa	34	612,150	.8	749,692	.6
Idaho	13	254,490	.3	616,066	.5
Utah	14	304,290	.4	509,740	.4
South Dakota	8	196,880	.2	489,753	.4
Hawaii	6	289,550	.4	479,279	.4
Nebraska	9	220,530	.3	453,179	.3
Florida	9	340,470	.4	430,130	.3
Arizona	14	431,390	.5	329,264	.2

[a] Output of certain kinds of stone included under "Undistributed" to conform to other tables.

Stone sold in the United States in 1920, by States—Continued.

State.	Number of plants.	Quantity (approximate). Short tons.	Percentage of total.	Value. Total.	Percentage of total.
New Mexico	3	331,690	0.4	$297,271	0.2
Montana	15	275,150	.3	296,019	.2
Wyoming	10	123,100	.1	230,556	.2
Alaska	1	(b)	(b)	(b)	(b)
Nevada	2	(b)	(b)	(b)	(b)
Louisiana	2	(b)	(b)	(b)	(b)
Porto Rico	7	54,670	.1	93,276	.1
Delaware	1	(b)	(b)	(b)	(b)
District of Columbia	4	5,050	(b)	11,900	(b)
Mississippi	2	(b)	(b)	(b)	(b)
Undistributed	....	246,450	1.1	693,208	1.0
	2,301	78,527,000	100.0	133,541,960	100.0

b Included under "Undistributed."

Stone sold in the United States in 1921, by States.

State.	Number of plants.	Quantity (approximate). Short tons.	Percentage of total.	Value. Total.	Percentage of total.
Pennsylvania	356	9,022,650	14.2	$12,378,202	11.6
Indiana	88	2,489,890	3.9	8,985,036	8.4
New York	144	5,809,140	9.1	8,705,331	8.1
Ohio	126	7,229,150	11.4	8,563,522	8.0
Vermont	41	202,630	.3	7,322,843	6.8
California	108	4,071,770	6.4	4,795,771	4.5
Massachusetts	88	1,446,130	2.3	4,582,941	4.3
Illinois	66	4,330,620	6.8	4,352,960	4.1
Michigan	37	5,506,710	8.7	3,657,862	3.4
Wisconsin	103	a 1,743,770	2.7	a 3,569,929	3.3
Missouri	102	1,385,250	2.2	2,978,575	2.8
Georgia	29	362,630	.6	2,924,035	2.7
Tennessee	45	a 940,170	1.5	a 2,707,025	2.5
New Jersey	54	a 1,680,940	2.6	a 2,634,738	2.5
North Carolina	23	730,690	1.1	2,087,879	2.0
Minnesota	48	a 362,850	.6	a 2,034,368	1.9
Kentucky	71	1,573,750	2.5	1,877,487	1.8
West Virginia	35	1,609,200	2.5	1,702,097	1.6
Virginia	47	1,379,300	2.2	1,557,668	1.5
Connecticut	32	1,252,860	2.0	1,529,746	1.4
Maine	40	201,490	.3	1,477,522	1.4
Maryland	37	896,520	1.4	1,457,937	1.4
New Hampshire	25	89,460	.2	1,338,277	1.3
Alabama	22	576,610	.9	1,304,965	1.2
Texas	27	1,045,320	1.6	1,242,806	1.2
Oregon	138	804,550	1.3	1,074,596	1.0
Oklahoma	24	a 878,350	1.4	a 1,023,514	1.0
South Carolina	10	427,140	.7	882,267	.8
Arkansas	17	a 715,610	1.1	a 821,169	.8
Washington	28	542,490	.9	789,364	.7
Kansas	38	378,680	.6	675,145	.6
Rhode Island	15	a 126,590	.2	a 609,999	.6
Colorado	35	333,840	.5	559,605	.5
Iowa	36	417,890	.7	516,730	.5
Utah	15	a 374,010	.6	a 483,773	.4
Idaho	19	a 273,490	.4	a 478,730	.4
Florida	9	a 564,240	.9	a 471,895	.4
Hawaii	9	204,720	.3	411,340	.4
South Dakota	14	181,600	.3	386,906	.4

a Output of certain kinds of stone included under "Undistributed" to conform to other tables.

Stone sold in the United States in 1921, by States—Continued.

State.	Number of plants.	Quantity (approximate).		Value.	
		Short tons.	Percentage of total.	Total.	Percentage of total.
Wyoming	11	112,340	0.2	$239,525	0.2
Nebraska	8	148,880	.2	202,266	.2
Nevada	1	(b)	(b)	(b)	(b)
Delaware	2	(b)	(b)	(b)	(b)
Arizona	8	a 256,510	.4	a 132,797	.1
Porto Rico	10	77,260	.1	126,088	.1
Montana	15	a 95,520	.1	a 108,022	.1
Louisiana	2	(b)	(b)	(b)	(b)
Alaska	1	(b)	(b)	(b)	(b)
New Mexico	5	39,640	(b)	52,356	(b)
District of Columbia	5	12,360	(b)	12,087	(b)
Mississippi	2	(b)	(b)	(b)	(b)
Undistributed	....	633,530	1.1	1,134,570	1.1
	2,271	63,538,740	100.0	106,962,266	100.0

a Output of certain kinds of stone included under "Undistributed" to conform to other tables.
b Included under "Undistributed."

EXPORTS AND IMPORTS.[1]

Stone exported from the United States, 1917–1921.

Kind.	1917	1918	1919	1920	1921
Marble and stone, unmanufactured	$572,097	$552,261	$770,392	$774,442	$576,905
All other, manufactured	1,108,185	1,208,164	1,508,997	2,158,764	1,697,570
	1,680,282	1,760,425	2,279,389	2,933,206	2,274,475

Stone (including marble) exported from the United States in 1920 and 1921.

Country.	1920		1921	
	Manufactured.	Unmanufactured.	Manufactured.	Unmanufactured.
Europe:				
Belgium	$1,080	....	$5,413	....
Denmark	1,261	....	3,895	....
France	3,631	$360	10,046	$2,600
Germany	2,048	....	7,732	....
Italy	7,020	....	23,236	2,000
Netherlands	1,321	....	13,090	....
Norway	462	3,961	34,219	....
Portugal	877	....	793	....
Spain	844	....	5,331	....
Sweden	5,824	....	13,473	....
Switzerland	205	....	422	....
United Kingdom—				
England	10,652	465	83,945	1
Scotland	830	593	3,570	108
Ireland	98	....	268	....
Other Europe	925	....	1,693	....
	37,078	5,379	207,126	4,709

[1] The tables of exports and imports were compiled by J. A. Dorsey, of the United States Geological Survey, from the records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Stone (including marble) exported from the United States in 1920 and 1921—Continued.

Country.	1920		1921	
	Manufactured.	Unmanufactured.	Manufactured.	Unmanufactured.
North America:				
British West Indies—				
Barbados			$1,869	
Bermuda	$9		2,753	
Jamaica	476		8,600	
Trinidad and Tobago			6,734	
Other	903		5,013	$40
Canada	211,867	$702,017	723,385	439,568
Central America	5,710	60	14,371	86
Cuba	62,981	24,213	91,418	27,750
Dominican Republic	11,257	352	15,172	220
Dutch West Indies		8	1,550	
French West Indies	851		55	
Haiti	391		497	
Mexico	12,905	31,975	69,532	97,584
Newfoundland and Labrador	4,004	132	8,531	671
Panama	2,681		19,063	5,005
Virgin Islands of the United States	909		908	
	314,944	758,757	969,451	570,924
South America:				
Argentina	25,441	1,194	43,645	
Brazil	1,310		12,589	
Chile	12,293		105,368	
Colombia	2,857	132	8,178	
Ecuador	1,114		1,370	
Peru	2,211	322	9,646	
Venezuela	1,042	97	4,194	
Other South America	2,023		5,390	
	48,291	1,745	190,380	
Asia:				
British India			49,498	
China	1,529	275	22,760	10
Dutch East Indies	1,200		21,230	
Japan	4,035	10	75,656	782
Other Asia	1,032		11,649	
	7,796	285	180,793	792
Oceania:				
Australia	6,593	1,871	38,754	480
New Zealand	1,751		20,453	
Philippine Islands	3,346	6,330	36,665	
Other Oceania	156	75	1,457	
	11,846	8,276	97,329	480
Africa:				
British South Africa	2,660		46,377	
Other Africa	1,707		6,114	
	4,367		52,491	
Total exports	424,322	774,442	1,697,570	576,905
Grand total	1,198,764		2,274,475	

Stone imported for consumption in the United States in 1920–1921.

Kind.	1920		1921	
	Quantity.	Value.	Quantity.	Value.
Marble:				
In blocks, rough, etc........cubic feet..	468,845	$1,258,192	388,731	$810,850
Sawed........do....	102	922	(a)	105
Slabs or paving tiles........square feet..	49,013	27,097	112,470	44,333
All other manufactures........	....	83,768	....	103,273
Mosaic cubes of marble or onyx:				
Loose........	....	18,221	....	30,865
Attached to paper........	....	63	....	581
	....	1,388,263	....	990,007
Onyx:				
In blocks, rough, etc........cubic feet..	6,395	36,840	1,010	4,115
Slabs or paving tiles........square feet..	4,200	4,009	10,470	3,832
All other manufactures........	....	2,960	....	9,990
	....	43,809	....	17,937
Granite:				
Dressed........	....	108,193	....	108,219
Rough........cubic feet..	43,805	42,162	32,525	27,258
	....	150,355	....	135,477
Stone (other):				
Dressed........	....	17,622	....	30,419
Rough (monumental or building stone).cubic feet..	110,940	98,327	53,116	54,181
Rough (other)........	....	97,199	....	25,938
	....	213,148	....	110,538
Grand total........	....	1,795,575	....	1,253,959

[a] Quantity not given.

General imports of marble and onyx, rough and manufactured, into the United States in 1920 and 1921.

Country.	1920				1921			
	Rough marble, breccia, and onyx.		Manufactured.	Total value.	Rough marble, breccia, and onyx.		Manufactured.	Total value.
	Cubic feet.	Value.			Cubic feet.	Value.		
Belgium........	12,686	$22,046	$5,156	$27,202	15,298	$26,822	$10,840	$37,662
France........	22,607	37,336	16,892	54,228	16,962	42,740	43,067	85,807
Germany........	1,424	2,400	2,224	4,624	4,842	5,279	6,815	12,094
Greece........	8,891	32,594	....	32,594	2,221	8,281	....	8,281
Italy........	422,990	1,163,482	100,039	1,263,521	348,307	725,687	115,841	841,528
Netherlands........	....	....	152	152	1,044	1,734	94	1,828
Spain........	....	....	367	367	....	....	2,082	2,082
England........	....	....	4,867	4,867	....	....	4,682	4,682
Other Europe [a]........	47	84	898	982	....	....	1,266	1,266
Total Europe........	468,645	1,257,942	130,595	1,388,537	388,674	810,543	184,687	995,230
Canada........	....	....	663	663	....	....	4,454	4,454
Cuba........	....	....	16	16	22	38	....	38
Mexico........	7,846	43,878	173	44,051	2,245	9,191	137	9,328
Guatemala........	200	250	....	250	....	....	....	....
Total North America..	8,046	44,128	852	44,980	2,267	9,229	4,591	13,820
China........	....	....	3,112	3,112	....	....	262	262
Japan........	....	....	688	688	....	....	374	374
Other countries [b]........	....	....	1,247	1,247	35	269	2,981	3,250
	....	....	5,047	5,047	35	269	3,617	3,886
Grand total........	476,691	1,302,070	136,494	1,438,564	390,976	820,041	192,895	1,012,936

[a] 1920: Austria, Gibraltar, Poland and Danzig, Switzerland, and Turkey in Europe; 1921: Austria, Czechoslovakia, Norway, Sweden, Switzerland, and Scotland.

[b] 1920: Peru, British India, Hongkong, Straits Settlements, Australia, and other British East Indies: 1921: Dominican Republic, Chile, Peru, Uruguay, British India, Dutch East Indies, Hongkong, and Palestine and Syria.

The United States Geological Survey, at the request of several importers and architectural societies, has for the last few years been endeavoring to classify the imports of granite and marble according to the country in which the stone originated and also according to the trade name of the stone. The statistics on stone imports given by the Department of Commerce show the total imports from the country from which the material was last shipped but not necessarily the country of origin, and they do not indicate the names by which the stones are known to the trade. The information which the Geological Survey has gathered, mostly from the invoices of shipments filed at the ports of New York and Boston, relates to dressed granite, marble in rough blocks, sawed stone, slabs, tiles, and cubes and chips for mosaic and terrazzo. The following paragraphs are not offered as complete, but they give some idea of the different varieties of stone imported.

MARBLE.

It has been extremely difficult to get the desired figures for imports of marble. The invoices at the United States custom house give the port of shipment and generally tell the country of origin, but the name of the stone, in which dealers, architects, and builders are particularly interested, is either not recorded or is concealed under the trade-marks of the importers and quarrymen. Only the importers, therefore, can give the exact information desired, and some of them are reluctant to do so. It is not the purpose of the Geological Survey to give individual figures or publish individual shipments, and it is hoped that realization of this fact will bring out better figures for 1922. The following table includes the stone imported by all the larger importers, but it is not complete. The greater part of the marble was entered at the port of New York, but some was entered also at Baltimore, New Orleans, Philadelphia, and San Francisco.

Marble and stone imported into the United States in 1921, by varieties.

	Cubic feet.
Italy:	
Alps Green, Alps Red	2,509
Botticino (Brescia)	71,157
Carrara white marbles (White Italian, Italian Veined, Statuary, Statuary Veined, English Veined, Brèche Blanc, Blanc Clair, Blanc P., Sicilian)	155,151
Levanto (Rosso, Verde)	2,910
Portoro (Black and Gold)	15,093
Tavernelle	66,039
Travertino	18,450
Other— Chiampo (Vicenza); Curly Green; Fior di Persica (Fleur de Pêche); Firenze; Istrani, including Jerome Fleuri (Pietra di San Stefano), Jerome Fossil (Nabrasina Mandorlato), Jerome Claire (Pietra Fior delle Isole), and Jerome Caen (Pietra di Marzana); Nabrasina; Paonazzo; Rosato; Siena, including Old Convent, Old Convent Fleuri, Silver Gray, and Yellow; Traniville; Vert Moresque.	14,555
	345,864
Belgium:	
Belge Noir	10,770
Bleu Belge	1,354

	Cubic feet.
France:	
Caen (limestone)	4,717
Other (Brèche d'Alep, Escalette, Jaune Fleuri, Monte Azuro, Pierre Champville, Pierre d'Hauteville, Pierre Simili Hauteville, Rouge Antique, Rouge Jaspé (Rose du Var)	12,205
Germany: Famosa, Schupbach	4,296
Mexico: Onyx	5,115
Undistributed, including Algeria (Onyx), England (Bath Stone), Greece (Tinos, Skyros), Spain, and Switzerland (Cipolin)	8,114
	392,435

Marble mosaic cubes and chips for terrazzo imported into the United States in 1921.

	Short tons.
Belgium (Belge Noir Fin, Belge Granitos Noir, Rouge Royal)	122
France (Blanc St. Nimes(?), Jaune Lyon, Rouge Chagny, Rouge Cuit, Rouge Français, Vert Trejus)	14
Italy:	
White Carrara (White Italian, Statuary Italian, Granitos White Italian)	286
Botticino, Alps Green, Dove Tarquin (Bleu Tarquin), Verona (Red and Yellow), and Siena (Yellow)	26
	448

GRANITE.

The table below shows the total imports of dressed granite classified by country of origin. Most of the Swedish granite was partly or entirely cut and polished at Aberdeen, Scotland, and reshipped to the United States.

Granite imported into the United States in 1921, by countries of origin.

Country.	Cubic feet.	Value.
England and Scotland	473	$5,689
Finland	1,774	23,395
Germany	512	1,896
Norway	406	4,857
Sweden	5,349	69,144
Shipped from Aberdeen, Scotland; origin not known	2,780	29,182
	11,294	134,163

The values given include duty and ocean freight. The trade names of the granites from the countries included above are as follows:

England: Light Shap.

Scotland: Corrennie, Hill o'Fare, Kenmay (Silver White), Linn o'Dee, Peterhead (Red Scotch), Rubislaw. Victoria Red, Victoria Gray, and Ben Cruachan were also names given to imported granites from Scotland, but no figures of imports were given.

Germany: Red Meissen (Rose de Saxe). Also shipments from Hamburg and Munich, but origin of stone was not stated.

Finland: Balmoral Red.

Norway: Blue Pearl, Emerald Pearl.

Sweden: Adelphia Red, Beers Red, Black Swede, Bon Accord Black (Bon Black), Bon Accord Gray (Bon Gray), Bon Accord Red (Bon Red), Carnation Red, Ebony Black, Green Swede, J. B. Pink, Magna Red, Purple Swede, Red Swede, Rose Swede. There was also a quantity of Swedish granite reported shipped from Germany and from Vestervik, Sweden, for which no trade name or description was given.

The individual kinds of which the largest shipments were reported were the Balmoral Red (1,774 cubic feet), from Finland; the Beers Red (1,737 cubic feet), from Sweden; and the Magna Red (1,103 cubic feet), from Sweden.

Few of the imported pieces contained more than 15 cubic feet each, and the average was from 5 to 10 cubic feet for dies, 2 to 6 cubic feet for bases, and 2 cubic feet or less for markers. The most common size for dies appeared to be 2 feet 8 inches by 2 feet 8 inches by 1 foot; for bases 1 foot 10 inches by 3 feet 4 inches by 1 foot 8 inches; for markers 1 foot by 1 foot by 1 foot 8 inches. There were very few pieces reported with caps. A few monuments were reported, but they were not large. More than 1,200 of the smaller pieces were entered at the port of Boston. Some of the granite that entered at New York was consigned to San Francisco and to various places in the interior of the country. Some granite intended for Boston entered at Portland, Oreg. A very small quantity of this material was reported as rough stone, but the greater portion was polished or partly dressed material.

PRODUCTION, BY STATES AND KINDS.

GRANITE.

Granite showed a decrease of less than 1 per cent in quantity but of more than 17 per cent in value in 1921 as compared with 1920. Granite for building decreased 18 per cent in quantity and was the only variety of stone to show a decrease for this use. Granite for monumental work decreased 43 per cent in quantity after a period of 5 years in which its output varied not more than 8 per cent and in some years less than 1 per cent. In 1921 it represented less than 4 per cent of the total quantity of granite sold. Granite for riprap also decreased in 1921, whereas granite for rubble more than doubled. Crushed granite for road metal, for all kinds of concrete work, and for railroad ballast increased nearly 3 per cent. Paving blocks increased 15 per cent in number of blocks sold, and stone for curbing and flagging also showed appreciable increases.

Granite sold in the United States in 1920, and 1921, by uses.

Use.	1920		1921	
	Quantity.	Value.	Quantity.	Value.
Building stone (rough and dressed)........cubic feet..	4,895,880	$4,492,482	4,051,650	$4,206,346
Approximate equivalent in short tons...............	411,170	....	336,500	....
Monumental stone...........................cubic feet..	3,379,330	11,543,255	1,956,720	7,253,276
Approximate equivalent in short tons...............	283,910	....	161,230	....
Paving.............................number of blocks..	32,230,270	2,582,934	37,201,360	3,222,007
Approximate equivalent in short tons...............	351,260	....	408,800	....
Curbing and flagging.....................linear feet..	997,950	755,540	1,171,990	857,799
Approximate equivalent in short tons...............	62,100	....	72,790	....
Rubble.....................................short tons..	90,760	154,036	182,730	219,129
Riprap..do....	525,470	478,128	469,250	269,159
Crushed stone...................................do....	3,016,960	4,831,776	3,096,410	4,447,087
Other stone.....................................do....	18,370	116,757	24,470	117,414
Total (quantities approximate, in short tons).....	4,760,000	24,954,908	4,752,180	20,592,217

Granite sold in the United States, 1919–1921, by States.

State.	1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Arizona	323,800	$155,889	226,300	$109,600	150,730	$46,957
Arkansas	6,770	13,270	49,800	74,609	22,030	33,544
California	852,080	935,716	1,366,500	2,118,300	1,406,760	1,910,345
Colorado	2,800	142,993	4,200	201,406	2,670	146,380
Connecticut	52,730	205,124	17,750	197,760	11,060	193,599
Delaware	88,730	148,267	(a)	(a)	(a)	(a)
District of Columbia	5,700	15,627	5,050	11,900	12,360	12,087
Georgia	209,560	866,922	234,490	934,182	189,420	1,023,081
Idaho			(a)	(a)	41,800	57,500
Maine	149,820	1,274,474	154,100	1,824,652	163,240	1,386,660
Maryland	138,360	355,889	133,600	327,033	139,450	348,262
Massachusetts	383,760	2,477,938	383,340	3,370,562	387,410	2,619,266
Minnesota	75,590	1,765,308	126,480	2,118,784	77,650	1,292,650
Missouri	(a)	(a)	11,000	114,663	12,010	81,389
Montana	570	12,401	1,940	40,483	400	19,706
New Hampshire	104,690	1,443,204	120,600	2,007,465	87,460	1,322,277
New Jersey	33,740	57,198	75,740	106,858	79,540	115,102
New Mexico			(a)	(a)		
New York	49,670	94,820	78,270	204,491	62,750	232,190
North Carolina	547,350	1,542,020	561,680	1,896,210	645,310	1,899,597
Oklahoma	2,900	64,363	1,510	70,407	1,210	53,486
Oregon	(a)	(a)	(a)	(a)	(a)	(a)
Pennsylvania	215,670	444,330	174,240	472,529	125,150	330,301
Rhode Island	40,500	426,868	41,820	586,874	49,840	424,959
South Carolina	403,780	721,215	272,460	860,000	427,140	882,267
South Dakota	(a)	(a)	(a)	(a)	15,890	117,688
Texas	50,990	103,158	44,700	90,943	7,960	131,396
Vermont	133,630	4,031,735	127,230	4,793,935	82,500	3,835,771
Virginia	100,760	189,564	107,310	148,300	140,800	175,812
Washington	8,450	74,958	48,000	85,365	3,720	29,551
Wisconsin	229,800	1,634,895	208,700	1,808,023	316,650	1,706,095
Undistributed	9,020	147,568	183,190	379,574	89,270	164,299
	4,221,220	19,345,714	4,760,000	24,954,908	4,752,180	20,592,217

[a] Included under "Undistributed."

Granite sold in the United States in 1921, by States and uses.

State.	Number of plants.	Building.						Monumental.				Paving blocks.	
		Rough construction.		Rough architectural.		Dressed architectural.		Rough.		Dressed.			
		Short tons.	Value.	Cubic feet.	Value.	Cubic feet.	Value.	Cubic feet.	Value.	Cubic feet.	Value.	Number of blocks.	Value.
Arizona	4							(a)	(a)	(a)	(a)		
Arkansas	4			(a)	(a)			480	$1,452				
California	35			(b)	(b)	b80,840	b $464,988	19,990	50,889	24,600	$122,597	(a)	(a)
Colorado	9			(a)	(a)			6,120	16,790	13,480	116,107		
Connecticut	11	(a)	(a)	(b)	(b)	b4,300	b22,125	14,140	61,920	5,560	62,293	372,030	$28,137
Delaware	2	(a)	(a)										
District of Columbia	5	(a)	(a)										
Georgia	20	(a)	(a)	(b)	(b)	b37,450	b210,536	24,280	28,438	16,890	148,352	4,413,940	295,394
Idaho	2	750	$500										
Maine	37	(a)	(a)	c 110,860	c$164,105	(c)	(c)	85,920	97,585	9,190	43,040	10,365,600	993,939
Maryland	7	16,560	35,114	64,270	51,324	2,450	7,768	15,400	15,398			79,000	7,900
Massachusetts	49	23,620	196,199	62,310	66,564	118,160	362,770	184,700	382,848	13,460	136,345	6,276,850	667,685
Minnesota	27					31,410	174,749	38,480	100,799	98,440	810,352	850,250	98,652
Missouri	6							9,860	30,058			464,610	41,736
Montana	6					(a)	(a)	(b)	(b)	b3,030	b15,134		
New Hampshire	24			26,720	27,074	47,530	391,934	67,340	154,129	32,230	286,009	4,778,900	331,456
New Jersey	3	(a)	(a)										
New York	16	6,100	13,865	(a)	(a)	(a)	(a)			3,990	20,233	(a)	(a)
North Carolina	18	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	2,544,270	201,250
Oklahoma	6					(a)	(a)	11,160	51,200				
Oregon	2							(a)	(a)	(a)	(a)		
Pennsylvania	30	105,530	187,088	(a)	(a)			19,450	40,451	9,650	67,314	(a)	(a)
Rhode Island	10	(a)	(a)	(a)	(a)	(a)	(a)	118,080	267,395			(a)	(a)
South Carolina	10	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)			(a)	(a)
South Dakota	3			(a)	(a)	(a)	(a)			(a)	(a)		
Texas	10			1,820	3,323	(a)	(a)	c50,390	c123,053	(c)	(c)		
Vermont	26	(a)	(a)	c166,610	c1,278,112	(c)	(c)	703,690	2,006,431	49,900	530,100	(a)	(a)
Virginia	6												
Washington	4					(a)	(a)	c5,990	c21,364	(c)	(c)		
Wisconsin	21	36,800	33,480					38,100	71,580	78,650	893,808	5,565,270	458,019
Undistributed		70,510	92,858	113,050	122,468	53,030	299,402	153,930	230,719	30,150	249,093	1,490,640	97,839
	413	259,870	559,104	443,860	480,934	476,950	3,166,308	1,557,410	3,691,969	399,310	3,561,307	37,201,360	3,222,007
Average value			2.15		1.08		6.64		2.37		8.92		d 86.61

a Included under "Undistributed." b Rough stone included under dressed stone. c Dressed stone included under rough stone. d Per M.

Granite sold in the United States in 1921, by States and uses—Continued.

State.	Number of plants.	Curbing and flagging.		Rubble.		Riprap.		Crushed stone. Road metal and concrete.		Crushed stone. Railroad ballast.		Other.		Total.	
		Linear feet.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons (approximate).	Value.
Arizona	4					(a)	(a)	(a)	(a)					150,730	$46,957
Arkansas	4			(a)	(a)	(a)	(a)							22,030	33,544
California	35	2,000	$19,364	(a)	(a)	259,090	$167,431	1,133,530	$1,079,984			(a)	(a)	1,406,760	1,910,345
Colorado	9													2,670	146,380
Connecticut	11	(a)	(a)			(a)	(a)	(a)	(a)			(a)	(a)	11,060	193,599
Delaware	2							(a)	(a)					(a)	(a)
District of Columbia	5	(a)	(a)	2,550	$2,987									12,360	12,087
Georgia	20	417,560	191,894	32,630	35,168			46,050	70,644	19,010	$35,655	(a)	(a)	189,420	1,023,081
Idaho	2					300	800	40,750	56,200					41,800	57,500
Maine	37	67,200	57,220			22,200	14,187	(a)	(a)	(a)	(a)	350	$3,545	163,240	1,386,660
Maryland	7			1,190	2,505	3,050	6,144	67,110	142,983	43,840	79,126			139,450	348,262
Massachusetts	49	255,920	302,055	52,620	66,575	7,020	10,062	186,040	425,770	(a)	(a)	(a)	(a)	387,410	2,619,266
Minnesota	27			(a)	(a)			52,290	105,570			(a)	(a)	77,650	1,292,650
Missouri	6					3,180	3,595	3,000	6,000					12,010	81,389
Montana	6													400	19,706
New Hampshire	24	145,370	117,896	1,730	1,283	4,920	5,089	3,750	6,680			730	727	87,460	1,322,277
New Jersey	3							(a)	(a)					79,540	115,102
New York	16							27,310	34,006	(a)	(a)			62,750	232,190
North Carolina	18	219,750	147,419	12,060	23,867	1,670	1,650	486,150	862,202	(a)	(a)	9,710	91,601	645,310	1,899,597
Oklahoma	6			(a)	(a)	(a)	(a)							1,210	53,486
Oregon	2													(a)	(a)
Pennsylvania	30	(a)	(a)	(a)	(a)	(a)	(a)	11,210	16,012	(a)	(a)	(a)	(a)	125,150	330,301
Rhode Island	10			(a)	(a)	(a)	(a)	35,570	99,278					49,840	424,959
South Carolina	10	(a)	(a)	33,000	46,109			309,820	568,511	(a)	(a)	(a)	(a)	427,140	882,267
South Dakota	3							(a)	(a)					15,890	117,688
Texas	10			3,520	3,520									7,960	131,396
Vermont	26					(a)	(a)	(a)	(a)					82,500	3,835,771
Virginia	6							48,580	88,596	92,220	87,216			140,800	175,812
Washington	4			(a)	(a)	(a)	(a)							3,720	29,551
Wisconsin	21	(a)	(a)	(a)	(a)			169,950	212,463			4,370	12,490	316,650	1,706.095
Undistributed		34,190	21,951	43,430	37,115	167,820	60,201	149,960	257,301	170,270	212,890	9,310	9,051	89,270	164,299
	413	1,171,990	857,799	182,730	219,129	469,250	269,159	2,771,070	4,032,200	325,340	414,887	[e]24,470	[e]117,414	4,752,180	20,592,217
Average value			0.73		1.20		0.57		1.46		1.28		4.80		4.33

a Included under "Undistributed."

e Includes 10,398 tons of durax paving blocks, valued at $97,808.

BASALT AND RELATED ROCKS (TRAP ROCK).

There was a decrease of 8 per cent in the quantity of basalt and related rocks sold in 1921. Crushed stone, the principal item in these sales, decreased nearly 7 per cent. Stone for rubble, riprap, and paving blocks also decreased, but stone used for rough construction work showed a small increase, as did stone for "other" uses, which in 1921 included 52,490 short tons of granules for roofing, valued at $323,175. These granules were produced in Michigan, Minnesota, and Pennsylvania—in Michigan in Marquette County, by the Olivine Co., Marquette; the Beaver Granulithic Co., Negaunee; and the Advance Industrial Supply Co., Chicago, Ill.; in Minnesota at Ely, St. Louis County, by the Emeralite Surfacing Products Co.; and in Pennsylvania near Charmian and Maria Furnace, Adams County, by the Blue Mountain Stone Co., and the Green Roofing Stone Co., Hagerstown, Md.; the Standard Stone Products Co., Granville, N. Y., and the Advance Industrial Supply Co., Chicago, Ill. A small quantity of "greenstone" was quarried for granules in California and some serpentine in New Jersey and Pennsylvania, which together amounted to 1,903 short tons, valued at $20,560. These basalt and "greenstone" granules as surfacing for prepared roofing enter into competition with the red, green, and gray slate granules of New York, Vermont, Pennsylvania, Tennessee, and Georgia. The production of slate granules in 1921 amounted to 231,770 short tons, valued at $1,397,886.

Basalt and related rocks (trap rock) sold in the United States, 1920 and 1921, by uses.

Use.	1920		1921	
	Quantity.	Value.	Quantity.	Value.
Building stone.....cubic feet..	292,520	$31,096	346,400	$24,679
Approximate equivalent in short tons.....	26,650	....	31,180	....
Paving blocks.....number..	129,350	11,049	55,000	3,650
Approximate equivalent in short tons.....	1,070	....	590	....
Rubble.....short tons..	37,900	38,752	37,240	39,851
Riprap.....do....	250,450	305,761	114,120	138,231
Crushed stone.....do....	8,881,510	11,800,483	8,285,680	10,913,073
Other.....do....	21,620	73,007	55,670	331,415
Total (quantities approximate, in short tons).....	9,219,200	12,260,148	8,524,480	11,450,899

Basalt and related rocks (trap rock) sold in the United States, 1919–1921, by States.

State.	1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
California.....	1,269,980	$922,979	1,939,200	$1,946,791	1,541,380	$1,414,582
Colorado.....	....	....	....	....	1,720	4,276
Connecticut.....	1,203,760	1,226,943	1,248,000	1,547,509	1,227,340	1,296,466
Hawaii.....	183,730	250,538	289,550	479,279	201,430	403,946
Idaho.....	(a)	(a)	(a)	(a)	186,760	341,608
Maryland.....	342,590	496,760	359,530	565,101	352,150	525,071
Massachusetts.....	577,060	787,333	668,550	1,028,698	726,210	898,658
Michigan.....	(a)	(a)	33,500	84,273	46,450	173,620
Minnesota.....	142,250	137,490	(a)	(a)	(a)	(a)
Montana.....	....	....	....	....	1,110	2,650
New Jersey.....	1,194,790	1,916,694	1,216,810	2,140,845	1,342,040	2,194,729
New York.....	527,910	619,799	(a)	(a)	112,640	201,677
Oregon.....	486,570	630,540	498,910	559,106	749,970	1,040,107
Pennsylvania.....	1,134,400	1,497,526	1,161,260	1,704,185	1,117,940	1,738,890
Texas.....	(a)	(a)	(a)	(a)	(a)	(a)
Virginia.....	(a)	(a)	(a)	(a)	(a)	(a)
Washington.....	210,680	252,435	545,250	521,179	506,510	637,947
Wisconsin.....	(a)	(a)	(a)	(a)	(a)	(a)
Undistributed.....	137,050	205,649	1,258,610	1,683,182	410,830	576,672
	7,410,770	8,944,686	9,219,200	12,260,148	8,524,480	11,450,899

[a] Included under "Undistributed."

Basalt and related rocks (trap rock) sold in the United States in 1921, by States and uses.

State.	Number of plants.	Building, rough construction.		Rubble and riprap.		Crushed stone.				Other.		Total.	
						Concrete and road metal.		Railroad ballast.					
		Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
California	29			4,490	$1,826	1,418,700	$1,295,811	118,190	$116,945			1,541,380	$1,414,582
Colorado	1					1,720	4,276					1,720	4,276
Connecticut	15	16,680	$7,664			1,179,810	1,257,023	30,850	31,779			1,227,340	1,296,466
Hawaii	8			35,650	38,486	165,680	364,710			(a)	(a)	201,430	403,946
Idaho	9					186,760	341,608					186,760	341,608
Maryland	7	8,330	8,611			185,410	309,663	158,410	206,797			352,150	525,071
Massachusetts	17	(a)	(a)	(a)	(a)	711,980	880,229	(a)	(a)			726,210	898,658
Michigan	6					17,640	22,174			28,810	$151,446	46,450	173,620
Minnesota	2	(a)	(a)	(a)	(a)	(a)	(a)			(a)	(a)	(a)	(a)
Montana	1					1,110	2,650					1,110	2,650
New Jersey	33	(a)	(a)			1,167,400	1,941,993	170,380	241,681	(a)	(a)	1,342,040	2,194,729
New York	3					88,640	170,677	24,000	31,000			112,640	201,677
Oregon	42			48,400	51,086	698,810	983,243	(a)	(a)	(a)	(a)	749,970	1,040,107
Pennsylvania	29	4,060	6,098			725,110	1,086,630	366,680	489,491	22,090	156,671	1,117,940	1,738,890
Texas	1					(a)	(a)	(a)	(a)			(a)	(a)
Virginia	1					(a)	(a)					(a)	(a)
Washington	18			60,620	84,936	442,080	549,511	3,810	3,500			506,510	637,947
Wisconsin	2					(a)	(a)					(a)	(a)
Undistributed		2,110	2,306	2,200	1,748	367,380	530,220	55,130	51,462	5,360	26,948	410,830	576,672
	224	b 31,180	24,679	151,360	178,082	7,358,230	9,740,418	927,450	1,172,655	c 56,260	c 335,065	8,524,480	11,450,899
Average value			0.79		1.18		1.32		1.26		5.96		1.34

a Included under "Undistributed."
b Approximately 346,000 cubic feet.
c Includes 52,490 short tons of roofing granules, valued at $323,175 from Michigan, Minnesota, and Pennsylvania; also 55,000 paving blocks, valued at $3,650 ($66.36 per M) from New Jersey and Oregon.

MARBLE.

GENERAL CONDITIONS.

The most conspicuous features of the marble industry in 1921 were a large decrease in the rough monumental stone and a smaller increase in the cut and sawed monumental stone sold by the quarrymen. The increase in quantity of building stone was noteworthy, and this product also showed a considerable increase in dressed stone. The total building stone increased 26 per cent, and monumental stone decreased 30 per cent. The combined total for building and monumental stone decreased 2 per cent, and sales of crushed stone and other by-products decreased more than 47 per cent. The average value per cubic foot decreased for building stone 10 per cent and for monumental stone 25 per cent. In general the demand for marble during the year was not good. Although wages remained unchanged in some districts the general trend was from 9 to 50 per cent lower than in 1920. The average drop was probably about 20 per cent. Prices changed in about the same average ratio as the wages and were from 10 to 20 per cent lower than in 1920. The only strike reported was that of stone cutters in the Carthage district, Missouri, which began about the first of July and continued for the remainder of the year. Strikes in the building trades were more hurtful than strikes at quarries or stone-cutting plants, and high freight rates were also a restraint on the trade.

The figures in the following table include, besides marble, the serpentine (verde antique) sold for interior and exterior building, dimension stone and by-products. (See pp. 196–197.)

Marble sold in the United States in 1920 and 1921, by uses.

Use.	1920			1921		
	Quantity.	Value.		Quantity.	Value.	
		Total.	Average.		Total.	Average.
Building stone:						
Rough—						
Exterior............cubic feet..	147,090	$295,162	$2.01	147,420	$221,888	$1.51
Interior..................do....	694,990	1,851,480	2.66	697,870	1,464,908	2.10
Dressed—						
Exterior..................do....	101,420	569,395	5.61	176,253	877,988	4.98
Interior..................do....	221,400	1,854,054	8.37	450,679	2,631,323	5.84
Total exterior..............do....	248,510	864,557	3.48	323,673	1,099,876	3.40
Total interior..............do....	916,390	3,705,534	4 04	1,148,549	4,096,231	3.57
Total building stone.......do....	[a]1,164,900	[a]4,570,091	3.92	[a]1,472,222	[a]5,196,107	3.53
Monumental stone:						
Rough.......................do....	640,660	2,187,469	3.41	114,154	154,836	1.36
Dressed......................do....	529,440	3,758,041	7.10	701,124	2,944,993	4.20
Total monumental stone..do....	[a]1,170,100	[a]5,945,510	5.08	[a]815,278	[a]3,099,829	3.80
Total building and monumental {cubic feet...............	2,335,000	10,515,601	4.50	2,287,500	8,295,936	3.63
{approximate short tons..	200,000	....	....	193,770	....	....
Marble for other uses (by-products) ....short tons..	231,500	553,984	2.39	121,630	284,480	2.34
Total marble sold (approximate) ....short tons..	431,500	11,069,585	....	315,400	8,580,416	....

[a] Building stone figures may be somewhat less than given and monumental stone somewhat more, as some of the Tennessee producers were unable to divide their product according to use.

Marble sold in the United States, 1919–1921, by States.

State.	1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama	[a] 70,280	[a] $395,195	53,160	$557,026	35,040	$530,711
Alaska	([b])	([b])	[c] 6,460	[c] 278,890	([b])	([b])
Arkansas	([a])	([a])	[c] 4,700	[c] 97,977	[d] 2,460	[d] 57,608
California	2,060	66,670	2,130	60,310	4,060	108,024
Georgia	41,430	1,574,687	81,700	2,255,557	30,160	1,545,158
Maryland	[a] 16,100	[a] 38,328	[c] 13,280	[c] 55,041	10,300	39,295
Massachusetts	7,680	123,978	18,420	222,916	12,400	265,230
Michigan	([b])	([b])			([b])	([b])
Missouri	22,060	360,287	23,500	616,550	23,700	627,729
Montana			([c])	([c])		
Nevada	([b])	([b])	([c])	([c])		
New Mexico	([a])	([a])	([c])	([c])	([d])	([d])
New York	24,050	250,244	24,900	220,773	32,090	255,530
North Carolina			([c])	([c])	([b])	([b])
Pennsylvania	([a])	([a])	([c])	([c])		
Tennessee	45,700	1,069,333	67,330	1,530,896	65,420	1,599,856
Texas	([a])	([a])	([c])	([c])	([d])	([d])
Utah			([c])	([c])	([b])	([b])
Vermont	100,600	4,083,866	135,920	5,173,649	95,000	3,390,430
Washington			([c])	([c])		
Undistributed	3,440	79,709			4,770	160,845
	333,400	8,042,297	431,500	11,069,585	315,400	8,580,416

[a] Alabama includes Arkansas, New Mexico, and Texas; Maryland includes Pennsylvania.
[b] Included under "Undistributed."
[c] Alaska includes Montana, Nevada, Utah, and Washington; Arkansas includes New Mexico and Texas; Maryland includes North Carolina and Pennsylvania.
[d] Arkansas includes New Mexico and Texas.

WASTE.

Besides the reports on marble sold in 1921, the producers were asked to give an approximate statement of the quantity of waste stone obtained in the different quarrying, sawing, and finishing processes. There are so many conditions that affect the operation of quarries, and these conditions vary so greatly for the same quarries at different times, that it is difficult to arrive at any very definite figures. Forty per cent of the operators replied to these questions. According to these replies the quantity of waste stone ranged from 10 to 90 per cent of the volume quarried. In general, it was evident that the quantity of stone that had to be quarried was three or four times that actually shipped. The waste reported in sawing and dressing was from 5 to 44 per cent for the sawed slabs or blocks and from 8 to 55 per cent for the cut stone. The average was about 20 per cent waste for both sawed and finished or cut stone. In the quarrying of rough stone the percentage of waste depends largely upon the ability of the quarryman to take advantage of some features of geologic structure and to avoid others, so as to obtain most economically the greatest number of blocks of the shapes, sizes, and qualities demanded by the building and monumental trade. Waste in sawing stone is due to the shaping of the irregular blocks to required dimensions and to the unexpected development of flaws in marble that appeared perfectly sound in the rough. In the cutting of stone the shaping of the pattern and unexpected flaws or discolorations cause the greater part of the waste. In considering the figures of production given below, it must, therefore, be taken into account that to produce the building and monumental marble sold in 1921 (nearly 194,000 tons) more than 600,000 tons had to be quarried. Many quarry operators regularly sell a part of their waste material for terrazzo and stucco chips, flux, crushed and pulverized stone. Besides the quantity of these by-products shown in the accompanying table (under "Marble for other uses"), about 68,000 short tons was either burned into lime or used in chemical and other manufacturing industries and for convenience is included in the chapter on lime, or in the section of this chapter which deals with limestone (p. 197). The remainder of the waste, about 217,000 tons, lies on the dumps.

PRODUCING LOCALITIES.

There are so few producers of marble in many of the States that any table of production by States is unsatisfactory, but the following brief notes will reflect the condition of the marble industry in the different States in 1921. Development work on marble deposits in Arizona, Montana, Nevada, Virginia, Washington, and in certain localities in the producing States was also reported.

Alabama.—The marble marketed in Alabama was the output of three companies in Talladega County—the Alabama Marble Co., at Gantts Quarry, and the Moretti-Harrah Marble Co. and Madras Marble Co. (Inc.), at Sylacauga. The greater part of the stone was sold for interior building work, and a small part for monuments. Part of the waste material was sold for terrazzo, mosaics, riprap, and furnace flux. Trade names for some of this stone are Madre Cream, Madre Veined, and Alabama Marble.

Alaska.—The Vermont Marble Co., of Proctor, Vt., was the only operator of marble quarries in Alaska in 1921. The property is near Tokeen, and the stone was used chiefly for interior work.

Arkansas.—The Pfeiffer quarries at Batesville, Independence County, Ark., operated by the Pfeiffer Stone Co., of St. Joseph, Mo., were the only marble quarries operated in Arkansas. The stone is a crystallized oolitic limestone and is used for exterior building work, and a small quantity is sold for riprap. It is known generally as Batesville stone.

California.—Marble was produced in four localities in California during 1921—at Keeler, Inyo County, by the Inyo Marble Co., for exterior building, terrazzo, and crushed stone; at Columbia, Tuolumne County, by the Columbia Marble Co. and the Bell Marble Quarries, of Columbia, for interior and exterior building work; near Sonora, Tuolumne County, by the Tuolumne National Marble Co., for monumental stone; and at Warners Springs, San Diego County, for interior work and crushed stone products, by the Veruga Marble Co., San Diego. The last-named quarry was new. (See also Serpentine.) A small quantity of onyx marble was produced in Los Angeles and Solano counties.

Colorado.—The property of the Colorado-Yule Marble Co., near Marble, Gunnison County, which for some years prior to 1916 was operated extensively, was sold by sheriff's sale in 1919. In 1921 the company was reorganized as the Yule Marble Co. of Colorado, but no stone was sold. It was reported that two other marble companies had begun operations at the same place and that the railroad which was closed down at the time the quarries were closed was again being put in order for use.

Georgia.—The Georgia Marble Co., whose quarries are near Tate, Pickens County, Ga., was the only operator of quarries in that State for building and monumental stone in 1921. The marble is sold under the trade names Kenesaw, Silver Gray, Cherokee, Etowah (Georgia Pink), Mezzotint, and Creole. The greater part of the waste stone of this company is crushed and marketed by the Georgia Mineral Products Co., Tate. The North Georgia Marble Products Co. and the Alden Marble Co., Whitestone, and the Willingham Stone Co., Atlanta, are also selling various crushed-marble products from quarries in Pickens County. In 1921 what was said to be the largest block of marble ever quarried and shipped in one piece in the United States was taken from the Tate quarries. This block was for the statue of "Civic Virtue" in City Hall Park, New York City.

Maryland.—The quarries on the property of the Beaver Dam Marble Co., at Cockeysville, Baltimore County, Md., were the only marble quarries operated in Maryland in 1921. The product is used for exterior building and interior decoration. The Cardiff Green Marble Co. operated serpentine quarries for interior building and terrazzo. (See Serpentine.)

Massachusetts.—The quarries of the Lee Marble Works and of the White Marble & Terrazzo Co., Lee, Berkshire County, Mass., produced in 1921 building and monumental stone and stone for stucco and terrazzo. The quarries of D. U. Smith, at Ashley Falls, and of the Hoosac Marble Co., at North Adams, produced only crushed and pulverized stone for chemical use, poultry grit, stucco, and terrazzo. The Westfield Marble & Sandstone Co. quarried serpentine. (See Serpentine.)

Michigan.—(See Serpentine.)

Missouri.—Marble sold in Missouri in 1921 included that from the quarries of the Phenix Marble Co., Phenix, Greene County, and the better grade of stone quarried at Carthage, Jasper County. The stone from Phenix is known to the trade as Napoleon Gray Marble and Phenix Stone. It is characterized by fossil shells and fine wavy stylolites or "crow feet," which resemble those in the Tennessee marbles. It is widely used for interior building in the form of tiles, wainscoting, and slabs and is also used for exterior building work. The quantity of this stone sold in this region during the last five years has been as follows:[2] 1917, 117,615 cubic feet; 1918, 86,508 cubic feet; 1919, 106,621 cubic feet; 1920, 138,775 cubic feet; 1921, 135,084 cubic feet. The output of marble and limestone quarried at Carthage is shown on page 205.

New Mexico.—In New Mexico the marble property now operated by the Alamoro Marble Co. at Alamogordo, Otero County, has been worked to a small extent for many years. Extended development work was done in 1921, and rough blocks were shipped for use in interior work. The stone is marketed as Alamoro Golden Veine, Alamoro Golden Fleuri, Alamoro Gray Veine, and Alamoro Gray Fleuri.

New York.—The active marble quarries in New York in 1921 were those of the Vermont Marble Co., of Proctor, Vt., at Plattsburg, Clinton County; the South Dover Marble Co., of New York City, at Wingdale, Dutchess County; the Gouverneur Marble Co., at Gouverneur, St. Lawrence County; and Finch, Pruyn & Co., at Glens Falls,

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[2] Published by permission of the Phenix Marble Co.

Warren County. These quarries furnished stone for exterior and interior building and for monumental work, waste stone for use in paper mills, and crushed stone for ballast and lime burning. The Kapailo Manufacturing Co. and the Benedict Stone Co. use the marble at Tuckahoe, Westchester County, mainly for the manufacture of architectural concrete stone and stucco. The Plattsburg stone is sold as Lepanto, the South Dover stone as South Dover White, and the Glens Falls stone as Glens Falls Black.

North Carolina.—The Regal Blue Marble Co., of Atlanta, Ga., operated its quarry at Regal, Cherokee County, N. C., (post office Murphy) in 1921. The product is used entirely for monumental work and is sold as Regal Blue.

Pennsylvania.—(See Serpentine.)

Tennessee.—The marble operations in Blount, Knox, and Union counties, Tenn., continued to be the second largest in the United States. The companies operating in 1921 are given below.

Blount County:
- John J. Craig Co., Friendsville (address, Knoxville).
- Light Pink Marble Co., Louisville.
- Tennessee Producers Marble Co., Friendsville (address, Knoxville).

Knox County (all at Knoxville):
- Appalachian Marble Co.
- Cedar Bluff Marble Co.
- Consolidated Marble Co.
- Gray Knox Marble Co.
- Thrasher Marble Co.
- Gray Eagle Marble Co.
- Holston Marble Co.
- Knoxville Marble Co.
- Ross-Republic Marble Co.
- Tennessee Producers Marble Co.

Union County:
- Ross-Republic Marble Co., Luttrell (address, Knoxville).

The Tennessee marble is used chiefly for interior building work, but it is used also for monumental work and for exterior building. A considerable quantity of the waste stone is sold to lime manufacturers in the neighborhood of Knoxville. The marbles from this State are of various shades of gray, pink, brown, and red brown. Nearly all the gray and pink marbles have very distinctive black markings (stylolites, or "crow feet") and are generally known to the trade by the name of the quarry qualified by the color of the stone.

Texas.—The only marble produced in Texas in 1921 came from the quarries of the Vermont Marble Co., at San Saba, San Saba County, office at Proctor, Vt. All this marble, which is of a buff monotone color, is similar to the Italian Botticino and Tavernelle and is used for interior building.

Utah.—The quarries of the Mount Nebo Marble Co., at Thistle, Utah County, Utah, were not worked in 1921, but a considerable quantity of stock was sold. This marble is used entirely for interior decoration and is known as Nebo Golden Travis.

Vermont.—Vermont produces more marble than any other State, and the stone includes so many varieties that it finds use in all kinds of exterior and interior building, in tombstones, monuments, mausoleums, stucco, terrazzo, and crushed stone, and is also sold for the manufacture of lime.

The producing companies in 1921 were as follows:

Addison County:
  Middlebury Marble Co., Middlebury (address, Brandon).
Bennington County:
  Manchester Marble Co., East Dorset.
  Imperial Marble Corporation, South Dorset (address, West Rutland).
Franklin County:
  Vermont Marble Co., Swanton (address, Proctor).
Grand Isle County:
  Vermont Marble Co., Isle LaMotte (address, Proctor).
Rutland County:
  Vermont Marble Co., Brandon, Danby, Pittsford, Proctor, and West Rutland (address, Proctor).
  Clarendon Marble Co., West Rutland.
Washington County:
  Vermont Marble Co., Roxbury (address, Proctor).

The great variety of colors found in the Vermont marble quarries precludes the listing here of their trade names. A very complete list and description of these marbles may be found in a report of the State geologist.[3]

SERPENTINE.

The figures showing sales of serpentine (verde antique) in the United States for interior and exterior building, dimension stone, and by-products are included in this report under marble; but those showing sales wholly as crushed stone for road metal and ballast, riprap, foundation stone, and other low-grade material, and as especially prepared crushed stone for terrazzo, stucco, granules, and flour are included under "miscellaneous" stone. All these uses are represented in the following table:

Serpentine (verde antique) sold in the United States in 1920 and 1921.

	1920		1921	
	Quantity.	Value.	Quantity.	Value.
Building and ornamental stone.................cubic feet..	44,620	$192,310	37,370	$149,474
Rough construction, crushed, etc...............short tons..	12,940	40,163	96,960	141,494
	....	232,473	....	290,968

The States producing this material in 1921 were as follows:

California.—Serpentine has never been produced in California to any great extent. The deposit at Avalon, on Santa Catalina Island, has for several years yielded small quantities for interior building, ornamental work, and electrical switchboards. In 1921 the Harbor Department of the city of Los Angeles contracted with the Santa Catalina Island Co., the owner of the property, for the output of the quarry and used over 70,000 short tons of material for rubble and riprap. A quantity of serpentine was also crushed in Siskiyou County in 1921 and used for road work.

Maryland.—Serpentine quarried by the Cardiff Green Marble Co., at Cardiff, Harford County, Md., and known as Cardiff Green, was used for interior building work, stucco, and terrazzo, and the waste

[3] Perkins, G. H., Vermont State Geologist Ninth Rept., for 1913-14, pp. 178-218, 1914.

product was sold for ballast and dust or "flour." In other parts of the State the material has been used for road work.

Massachusetts.—The Westfield Marble & Sandstone Co., Westfield, Hampden County, Mass., quarried black and green serpentine. All of this material was sold in rough blocks, the greater part for interior building. This stone is marketed as Westfield Green.

Michigan.—Serpentine deposits at Ishpeming, Marquette County, Mich., have been in course of development for several years, but the only product shipped has been crushed stone for terrazzo. The Michigan Verde Antique Marble Co., Ishpeming, is the producing company.

New Jersey.—The serpentine reported from New Jersey in 1921 came from the Lizzie Clay & Pulp Co. quarry at Marble Hill, near Phillipsburg, Warren County, and was quarried by the Rock Products Co., of Easton, Pa. The product was sold for stucco and terrazzo. This property has also been worked for soapstone.

Pennsylvania.—Serpentine deposits at Easton, Northampton County, Pa., were worked by the Rock Products Co., of Easton, in 1921 and the product was used for terrazzo, stucco, and "flour." Serpentine from this vicinity has also been quarried and sold for interior and exterior building work, but none was reported for this purpose in 1921. The Joseph H. Brinton quarries, near West Chester, Chester County, continued to furnish a small yearly output of serpentine for exterior building work.

Vermont.—The Vermont Marble Co. furnishes the entire serpentine output for Vermont. The quarries are at Roxbury, Washington County, and the product is sold for interior building.

Wyoming.—The Wyoming Asbestos Producing Co., Casper, Wyo., reported for 1921 the production of a small quantity of serpentine from a deposit near Casper, Natrona County. This was crushed and used as aggregate in concrete stone for chimney blocks.

LIMESTONE.

GENERAL SUMMARY.

The decrease in 1921 in the output of limestone covered by this report was 23 per cent and was practically all due to the depression in the mining and manufacturing industries during the year. Stone used for flux by furnaces and smelters decreased 57 per cent, and stone used in the manufacture of miscellaneous products, such as alkalies, carbide, mineral wool, chemicals of all kinds, refractories, and whiting substitute (fillers), decreased 46 per cent. Stone sold to paper mills and glass factories also decreased. Pulverized stone used for liming land showed a small decrease—less than 4 per cent. Crushed stone used for roads and concrete and for railroad ballast increased 11 per cent, stone for building purposes increased 10 per cent, and stone for riprap 5 per cent. There was also an increase, under miscellaneous uses of limestone, of stone sold for asphalt filler, for the manufacture of carbonic acid, and for stucco.

Limestone sold in the United States in 1920 and 1921, by uses.

Use.	1920		1921	
	Quantity.	Value.	Quantity.	Value.
Building stone..........cubic feet..	7,542,150	$8,197,866	8,019,700	$7,886,586
Approximate equivalent in short tons	564,670	....	621,500	....
Curbing, flagging, and paving..........cubic feet..	41,870	22,841	33,930	33,804
Approximate equivalent in short tons	3,550	....	2,700	....
Rubble..........short tons..	274,630	425,279	188,000	280,067
Riprap..........do....	892,610	907,616	941,730	1,003,399
Crushed stone..........do....	25,807,800	30,608,799	28,720,410	32,232,438
Fluxing stone..........long tons..	22,301,060	26,475,763	9,503,830	9,428,767
Equivalent in short tons	24,977,190	....	10,644,290	....
Sugar factories..........short tons..	637,090	1,200,394	570,840	1,019,288
Glass works..........do....	196,150	400,873	118,970	232,715
Paper mills..........do....	139,880	256,278	120,460	223,601
Agriculture..........do....	1,364,260	2,724,209	1,311,520	2,355,339
Other uses [a]..........do....	4,432,170	4,435,342	2,380,580	3,053,590
Total (quantities approximate, in short tons).....	59,290,000	75,655,260	45,621,000	57,749,594

[a] See table on p. 202 for further distribution of limestone products.

Limestone sold in the United States, 1919–1921, by States.

State.	1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama	859,030	$1,090,065	1,265,320	$1,925,704	519,370	$737,513
Arizona	162,000	140,846	152,440	139,183	(a)	(a)
Arkansas	(a)	(a)	165,620	177,618	206,020	216,987
California	170,220	409,082	192,120	493,052	198,020	406,441
Colorado	493,200	532,973	506,820	531,357	301,690	367,771
Connecticut	(a)	(a)	(a)	(a)	(a)	(a)
Florida	111,240	133,747	340,470	430,130	564,240	471,895
Georgia	89,420	213,968	147,400	324,653	143,050	355,796
Hawaii	....	....	....	....	3,290	7,394
Idaho	100,420	155,716	(a)	(a)	44,580	79,392
Illinois	4,959,420	3,735,401	5,036,500	5,623,400	4,256,580	4,298,402
Indiana	1,634,950	4,945,903	2,376,200	9,223,573	2,489,890	8,985,036
Iowa	513,030	508,606	611,950	749,592	417,890	516,730
Kansas	680,400	860,851	698,590	1,013,491	377,550	672,357
Kentucky	1,200,610	1,357,618	1,395,000	1,635,785	1,523,890	1,755,505
Louisiana	(a)	(a)	(a)	(a)	(a)	(a)
Maine	23,230	52,856	38,340	100,338	38,250	90,862
Maryland	352,450	397,905	318,370	381,607	356,760	462,454
Massachusetts	53,560	269,718	52,710	311,810	43,070	278,932
Michigan	7,186,760	3,797,522	9,766,550	5,943,229	5,395,780	3,387,722
Minnesota	215,490	379,852	271,550	582,266	200,550	531,302
Mississippi	(a)	(a)	(a)	(a)	(a)	(a)
Missouri	1,115,490	1,759,029	1,413,220	2,776,936	1,349,540	2,269,457
Montana	205,190	159,079	267,550	247,946	94,010	85,666
Nebraska	203,460	280,602	220,530	453,179	148,880	202,266
Nevada	(a)	(a)	(a)	(a)	(a)	(a)
New Jersey	374,080	506,193	361,370	493,665	228,600	280,761
New Mexico	(a)	(a)	(a)	(a)	(a)	(a)
New York	3,392,950	4,406,721	5,111,370	6,103,890	5,374,910	6,989,231
North Carolina	69,220	133,198	65,250	135,675	83,560	141,882
Ohio	7,703,180	6,415,233	8,867,110	9,342,853	6,986,430	6,833,921
Oklahoma	659,450	656,843	870,160	977,949	877,140	970,028
Oregon	35,760	68,013	36,950	57,689	(a)	(a)
Pennsylvania	10,665,500	12,640,411	11,531,540	15,913,109	6,713,240	8,346,138
Porto Rico	67,000	101,186	54,670	93,276	77,260	126,088
Rhode Island	(a)	(a)	(a)	(a)	(a)	(a)
South Dakota	17,750	23,989	43,350	75,274	24,880	42,000
Tennessee	630,300	689,597	1,030,890	1,429,829	874,750	1,107,169
Texas	548,000	453,113	565,000	660,996	939,170	956,519
Utah	315,310	329,150	302,500	418,602	372,510	474,671
Vermont	38,900	103,858	38,830	98,175	25,130	96,642
Virginia	1,446,870	1,454,989	1,269,080	1,545,253	1,157,160	1,308,246
Washington	23,750	45,957	103,280	118,671	25,480	49,541
West Virginia	1,971,170	2,228,209	2,435,970	3,111,643	1,582,790	1,651,137
Wisconsin	1,141,490	1,246,837	1,002,570	1,359,631	1,223,570	1,539,891
Wyoming	104,170	185,909	112,230	202,188	107,730	224,668
Undistributed	225,380	300,956	250,630	452,043	273,790	431,181
	49,759,800	53,171,701	59,290,000	75,655,260	45,621,000	57,749,594

[a] Included under "Undistributed."

Limestone sold in the United States in 1921, by States and uses.

State.	Number of plants.	Building.						Rubble.		Riprap.		Crushed stone.			
		Rough construction.		Rough architectural.		Dressed.						Concrete and road metal.		Railroad ballast.	
		Short tons.	Value.	Cubic feet.	Value.	Cubic feet.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama	13	(a)	(a)	(a)	(a)					26,510	$25,802	80,050	$87,377		
Arizona	2											(a)	(a)		
Arkansas	5											(a)	(a)	(a)	(a)
California	15	(a)	(a)									(a)	(a)	(a)	(a)
Colorado	11									(a)	(a)			(a)	(a)
Connecticut	1											150	298		
Florida	8									(a)	(a)	389,840	271,849	156,460	$142,102
Georgia	8											102,300	165,220		
Hawaii	1														
Idaho	4														
Illinois	62	3,970	$2,900	b 4,250	b $4,248	(b)	(b)	7,990	$11,993	373,910	380,249	2,386,940	2,616,845	534,170	500,846
Indiana	88			2,253,090	1,499,135	3,055,870	$5,366,735	1,500	2,840	18,420	7,355	1,711,510	1,733,698	171,790	153,619
Iowa	36	2,270	1,626			(a)	(a)	11,940	17,141	51,130	54,885	299,890	379,913	(a)	(a)
Kansas	35	860	1,400	3,680	3,244	29,710	28,905	5,900	7,725	8,020	12,820	287,340	449,140	18,460	26,261
Kentucky	66	2,260	7,830	b 118,100	b 165,540	(b)	(b)	4,080	6,150	(a)	(a)	790,720	988,753	695,320	552,404
Louisiana	2									(a)	(a)	(a)	(a)		
Maine	3											(a)	(a)		
Maryland	17	960	2,118									226,820	327,112		
Massachusetts	3														
Michigan	25	(a)	(a)					(a)	(a)	(a)	(a)	1,265,690	889,937	37,090	28,752
Minnesota	14			37,850	36,590	80,270	242,276	6,100	9,106	18,520	17,680	164,920	217,795		
Mississippi	2														
Missouri	89	37,810	70,991	(c)	(c)	c 168,280	c 175,733	101,250	178,993	112,660	135,843	919,040	1,366,089	43,730	58,930
Montana	6											10,870	15,185	(a)	(a)
Nebraska	8									44,380	46,278	95,000	140,015		
Nevada	1														
New Jersey	13											25,960	42,070		
New Mexico	1													(a)	(a)
New York	81	78,630	79,501	(a)	(a)	(a)	(a)	100	148	7,180	8,775	4,022,850	5,089,410	559,030	575,676
North Carolina	3											57,460	81,673		
Ohio	110	18,300	31,069					4,640	6,964	19,380	21,823	4,729,970	4,741,487	747,140	659,852
Oklahoma	16	(a)	(a)					1,780	1,769	(a)	(a)	495,450	593,847	353,090	337,500
Oregon	2											(a)	(a)		
Pennsylvania	279	24,540	40,390							(a)	(a)	2,392,110	3,463,572	99,410	139,371
Porto Rico	10											71,550	108,125	3,780	4,903

a Included under "Undistributed." b Dressed stone included under rough architectural. c Rough architectural included under dressed stone.

Limestone sold in the United States in 1921, by States and uses—Continued.

State.	Number of plants.	Building.						Rubble.		Riprap.		Crushed stone.			
		Rough construction.		Rough architectural.		Dressed.						Concrete and road metal.		Railroad ballast.	
		Short tons.	Value.	Cubic feet.	Value.	Cubic feet.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Rhode Island	1														
South Dakota	3											(a)	(a)		
Tennessee	31							(a)	(a)	(a)	(a)	552,760	$649,338	245,450	$238,515
Texas	15			36,050	$21,040			(a)	(a)	131,860	$148,156	547,170	584,773	237,330	188,050
Utah	13			24,500	24,844					(a)	(a)	(a)	(a)	(a)	(a)
Vermont	7											4,700	4,380		
Virginia	38	(a)	(a)									552,810	707,974	424,430	354,387
Washington	4														
West Virginia	28									(a)	(a)	350,090	415,804	245,280	195,105
Wisconsin	62	10,920	$7,291	(a)	(a)			22,190	$23,037	16,210	19,354	1,064,600	1,279,614	(a)	(a)
Wyoming	9	100	260												
Undistributed		2,380	8,410	51,750	61,530	3,300	$2,980	20,530	14,201	113,550	124,379	387,230	492,010	162,660	172,862
	1,251	183,000	253,786	2,458,780	1,699,783	3,407,920	5,933,017	188,000	280,067	941,730	1,003,399	23,985,790	27,903,303	4,734,620	4,329,135
Average value			1.39		0.69		1.74		1.49		1.07		1.16		0.91

State.	Number of plants.	Furnace flux.		Sugar factories.		Glass factories.		Paper mills.		Agriculture.		Other.		Total.	
		Long tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons (approximate).	Value.
Alabama	13	364,040	$564,542							(a)	(a)			519,370	$737,513
Arizona	2	(a)	(a)											(a)	(a)
Arkansas	5									(a)	(a)			206,020	216,987
California	15	23,320	41,914	(a)	(a)	(a)	(a)	(a)	(a)	24,490	$74,355	35,310	$144,182	198,020	406,441
Colorado	11	216,490	242,668	58,780	$124,418									301,690	367,771
Connecticut	1									5,510	17,900			(a)	(a)
Florida	8									2,160	4,042	(a)	(a)	564,240	471,895
Georgia	8	700	2,320							21,230	42,843	18,740	145,413	143,050	355,796
Hawaii	1			3,290	7,394									3,290	7,394
Idaho	4	(a)	(a)	(a)	(a)			(a)	(a)					44,580	79,392

Illinois	62	526,070	378,964	(a)	(a)	(a)	(a)			333,960	337,324	22,630	60,515	4,256,580	4,298,402
Indiana	88	89,230	65,212	(a)	(a)	31,940	$54,033	(a)	(a)	53,410	61,943	4,730	34,991	2,489,890	8,985,036
Iowa	36	(a)	(a)	11,500	22,400					31,090	26,065			417,890	516,730
Kansas	35									(a)	(a)	53,570	141,762	377,550	672,357
Kentucky	66	(a)	(a)							13,070	18,048	(a)	(a)	1,523,890	1,755,505
Louisiana	2									(a)	(a)			(a)	(a)
Maine	3	(a)	(a)					(a)	(a)	(a)	(a)	(a)	(a)	38,250	90,862
Maryland	17	(a)	(a)							1,700	6,000	5,110	17,314	356,760	462,454
Massachusetts	3	(a)	(a)							(a)	(a)			43,070	278,932
Michigan	25	2,163,350	1,275,860	95,810	124,678			45,020	$77,850	285,960	201,251	1,240,140	785,969	5,395,780	3,387,722
Minnesota	14	(a)	(a)	(a)	(a)							1,320	7,588	200,550	531,302
Mississippi	2									(a)	(a)			(a)	(a)
Missouri	89	18,890	31,164	5,290	8,183	23,120	36,593			32,310	55,534	39,290	151,402	1,349,540	2,269,457
Montana	6	65,830	54,089	(a)	(a)							(a)	(a)	94,010	85,666
Nebraska	8	(a)	(a)							(a)	(a)	(a)	(a)	148,880	202,266
Nevada	1	(a)	(a)	(a)	(a)									(a)	(a)
New Jersey	13	174,160	213,200							(a)	(a)	(a)	(a)	228,600	280,761
New Mexico	1													(a)	(a)
New York	81	98,530	152,617			(a)	(a)	14,470	24,659	120,890	326,285	461,030	725,080	5,374,910	6,989,231
North Carolina	3	(a)	(a)							22,000	52,540	(a)	(a)	83,560	141,882
Ohio	110	1,083,940	1,078,259			(a)	(a)			29,370	51,490	214,160	225,171	6,986,430	6,833,921
Oklahoma	16					(a)	(a)							877,140	970,028
Oregon	2									(a)	(a)			(a)	(a)
Pennsylvania	279	3,510,780	4,041,152			49,570	110,351	(a)	(a)	97,090	333,354	102,320	196,138	6,713,240	8,346,138
Porto Rico	10									1,930	13,062			77,260	126,088
Rhode Island	1	(a)	(a)									(a)	(a)	(a)	(a)
South Dakota	3			(a)	(a)									24,880	42,000
Tennessee	31	(a)	(a)							40,360	101,588	22,660	109,030	874,750	1,107,169
Texas	15					(a)	(a)			(a)	(a)	(a)	(a)	939,170	956,519
Utah	13	117,550	105,804	100,820	194,629							(a)	(a)	372,510	474,671
Vermont	7	(a)	(a)							20,310	92,097	(a)	(a)	25,130	96,642
Virginia	38	35,730	38,278							34,740	64,289	105,080	143,243	1,157,160	1,308,246
Washington	4	3,230	4,184	(a)	(a)			(a)	(a)	(a)	(a)	(a)	(a)	25,480	49,541
West Virginia	28	849,720	956,074							30,820	70,279	(a)	(a)	1,582,790	1,651,137
Wisconsin	62	26,410	32,431							53,000	88,793	22,690	85,871	1,223,570	1,539,891
Wyoming	9			107,630	224,408									107,730	224,668
Undistributed		135,860	150,035	187,720	313,178	14,340	31,738	60,970	121,092	56,120	316,257	34,500	113,725	273,790	431,181
	1,251	9,503,830	9,428,767	570,840	1,019,288	118,970	232,715	120,460	223,601	1,311,520	2,355,339	d2,383,280	d3,087,394	45,621,000	57,749,594
Average value			0.99		1.79		1.96		1.86		1.80		1.30		1.27

a Included under "Undistributed."

d Includes 33,930 cubic feet (2,700 short tons) of paving and curbing, valued at $33,804, from Indiana and Wisconsin.

Limestone sold in the United States for miscellaneous uses in 1920 and 1921.

Use.	1920		1921	
	Short tons.	Value.	Short tons.	Value.
Alkali works	3,205,160	$2,229,680	1,738,280	$1,465,580
Calcium carbide works	(a)	(a)	227,260	129,641
Refractories	612,800	742,020	79,480	85,786
Whiting substitute	60,890	499,540	29,560	264,244
Magnesia works	57,300	107,107	32,050	60,648
Asphalt filler	71,970	309 075	128,120	532,621
Mineral wool	21,570	24,773	(a)	(a)
Carbolic acid works	(a)	(a)	13,520	22,293
Carbonic acid works	10,570	31,894	35,830	134,363
Poultry grit	15,970	96,310	11,780	69,055
Lime burners	17,540	33,178	(a)	(a)
Stucco	10,530	79,300	24,170	126,188
Paving and curbing	(b)	(b)	2,700	33,804
Roofing gravel	4,310	15,046	1,550	7,733
Other uses [c]	343,560	267,419	58,980	155,438
	4,432,170	4,435,342	2,383,280	3,087,394

[a] Included under "Other uses."
[b] For 1920, see general table p. 198.
[c] In 1921 includes stone sold for manufacture of sulphuric acid, phosphates, terrazzo, artificial stone, mineral wool, ammonia, nitrates, soap, baking powder, the purification of copper, filter stone, and uses not specified.

The limestone represented in this report does not include that burned into lime or made into cement. These commodities are treated in separate chapters. The total estimated decrease of all limestone quarried in the United States in 1921, including stone for these two uses, amounted to 18 per cent.

Limestone used for all purposes in the United States, 1919–1921, in short tons.

Use.	1919	1920	1921
Limestone (as given in this report)	49,759,800	59,290,000	45,621,000
Portland cement (including "cement rock")	19,864,000	24,747,000	24,400,000
Natural cement ("cement rock")	82,500	128,600	90,000
Lime	6,660,000	7,140,000	5,060,000
	76,366,300	91,305,600	75,171,000

BUILDING STONE.

Limestone (as a building stone) represented 47 per cent of the total sales of building stone in 1921. Nearly all this limestone was confined to a few special districts, whose output is given below. Figures for other years may be found in the United States Geological Survey reports on stone for 1918 and previous years.

INDIANA.

The output of building stone in Indiana was 31 per cent of all building stone sold in 1921 and 66 per cent of the total limestone sold for building. The chief producing centers in the oolitic limestone belt are in the vicinity of Bedford and Bloomington, Lawrence and Monroe counties. This stone is sold mainly for exterior building, including carved and other ornamental cornices and doorways. For interior work it is used for altars, mantels, wainscoting, benches, and stairways. It is also sold for monuments. Very little of the regular quarry run of the blue or buff stone is rubbed or polished, but the buff stone from certain beds in some quarries takes a very good polish and is marketed under the name of Wellington Cream. Coarse-grained stone with natural cavities due to the presence of unfilled fossil shells is sawed with or across the grain and sold as Indiana Travertine. It is suitable for both exterior and interior work and is offered for the same use as imported limestones and monotone marbles.

Limestone quarried and sold in the Bedford-Bloomington district, Lawrence and Monroe counties, Ind., in 1921.

County.	Number of operators.	Building stone.					
		Rough blocks.		Sawed.		Dressed.	
		Cubic feet.	Value.	Cubic feet.	Value.	Cubic feet.	Value.
Lawrence	10	1,828,262	$1,246,353	655,176	$636,851	994,489	$2,793,947
Monroe	21	424,823	252,782	1,144,479	1,246,453	250,229	639,473
	31	2,253,085	1,499,135	1,799,655	1,883,304	1,244,718	3,433,420
Average value			0.67		1.05		2.76
Total, 1920	34	(a)	(a)	a4,847,028	a3,501,194	1,496,508	3,785,485

County.	Number of operators.	Total building stone.		Other.		Total value.
		Cubic feet.	Value.	Short tons.	Value.	
Lawrence	10	3,477,927	$4,677,151	129,662	$138,396	$4,815,547
Monroe	21	1,819,531	2,138,708	11,406	8,029	2,146,737
	31	5,297,458	6,815,859	141,068	146,425	6,962,284
Average value			1.29		1.04	
Total, 1920	34	6,343,536	7,286,679	278,235	293,200	7,579,879

a In 1920 figures for rough blocks and sawed stone were not separated.

Much of the stone quarried in this district is sold by the producers to local mills, 20 per cent of the quarry product being so shipped in 1921. The shipments of these mills by States, as well as the shipments of the producers, are given in the following table. Several quarry operators also operate mills, but their entire product is included under quarry shipments. The sales from quarries to local mills not operated by quarry companies are credited to Indiana.

Indiana oolitic limestone shipped to different States and Canada in 1920 and 1921, in cubic feet.

Destination.	1920			1921		
	By milling companies.	By quarry companies.	Total.	By milling companies.	By quarry companies.	Total.
Alabama		12,801	12,801		11,013	11,013
Arkansas	31,513	39,029	70,542	2,474	9,230	11,704
California		8,688	8,688			
Colorado		17,917	17,917		6,571	6,571
Connecticut	6,890	41,618	48,508	22,366	12,389	34,755
Delaware	16,991	22,546	39,537	1,905	1,727	3,632
District of Columbia	40,221	55,455	95,676	13,346	55,671	69,017
Florida		12,314	12,314		6,839	6,839
Georgia	6,716	57,917	64,633		30,625	30,625
Idaho		4,798	4,798			
Illinois	131,065	1,142,449	1,273,514	153,379	915,470	1,068,849
Indiana	18,395	1,287,423	1,305,818	72,003	1,380,927	1,452,930
Iowa	12,959	87,125	100,084	17,207	76,429	93,636
Kansas	15,553	69,242	84,795	8,138	77,885	86,023
Kentucky	8,875	65,629	74,504	6,991	63,713	70,704
Louisiana	14,403	74,281	88,684	11,979	60,385	72,364
Maine		5,534	5,534		3,558	3,558
Maryland		31,823	31,823	85,489	13,905	99,394
Massachusetts	28,822	183,510	212,332	3,560	122,594	126,154
Michigan	158,372	442,530	600,902	96,773	506,869	603,642
Minnesota	20,720	174,783	195,503	15,580	135,408	150,988
Mississippi		6,775	6,775	1,414	14,055	15,469
Missouri	3,818	73,058	76,876	14,598	55,923	70,521
Montana		1,384	1,384			
Nebraska	156	85,067	85,223	3,049	74,543	77,592
New Hampshire	5,958		5,958	2,413		2,413
New Jersey	13,698	58,841	72,539	22,213	46,154	68,367
New Mexico					7,017	7,017
New York	77,531	533,629	611,160	100,669	491,310	591,979
North Carolina	18,583	71,265	89,848	4,556	40,245	44,801
North Dakota	1,725	4,732	6,457	950	526	1,476
Ohio	94,846	390,317	485,163	148,315	258,918	407,233
Oklahoma	8,988	117,913	126,901	270	124,168	124,438
Pennsylvania	17,755	288,566	306,321	62,470	205,070	267,540
Rhode Island	3,873	15,044	18,917	4,826		4,826
South Carolina	364	43,686	44,050	2,247	9,485	11,732
South Dakota	3,715	8,566	12,281		17,975	17,975
Tennessee	6,983	66,267	73,250	4,229	44,616	48,845
Texas	37,146	99,740	136,886	69,424	39,999	109,423
Virginia	16,357	86,671	103,028	33,737	45,607	79,344
Washington		2,736	2,736			
West Virginia	1,887	39,265	41,152	32,849	41,183	74,032
Wisconsin	7,402	202,287	209,689	8,471	155,373	163,844
Wyoming	1,758	3,303	5,061	6	3,509	3,515
Canada	2,260	307,012	309,272	2,281	190,582	192,863
	836,298	6,343,536	7,179,834	1,030,177	[a] 5,357,466	6,387,643

[a] Includes 60,008 cubic feet of stone purchased, dressed, and resold.

MISSOURI.

Next to Indiana the Carthage district, in Jasper County, Mo., furnishes the largest quantity of limestone for building. This stone is light gray, rather coarsely crystalline, and marked by fossil shells. Much of it possesses the quality of marble and is included under marble in the figures in this report. The following table gives the total production of limestone and marble in the district for 1919, 1920, and 1921.

Limestone sold in the Carthage district, Jasper County, Mo., 1919–1921.

Year.	Building stone (rough and dressed).		Monumental stone (rough and dressed).		Other.		Total.	
	Cubic feet.	Value.	Cubic feet.	Value.	Short tons.	Value.	Short tons (approximate).	Value.
1919	231,573	$399,381	62,482	$77,117	44,817	$84,025	69,500	$560,523
1920	295,341	589,213	86,791	158,440	56,292	190,529	129,700	938,182
1921	279,560	587,301	31,551	77,421	46,751	152,521	72,600	817,243

The considerable decrease in quantity of monumental stone and the increases in average value are the most evident changes for 1921. The increases in average value were evidently due to proportionate increase of dressed stone, as the producers reported little or no change in prices or wages during the year. There was a strike of stonecutters after July 1, which somewhat curtailed the output in this district during the second half of the year.

The producers of this district in 1921 were the Carthage Marble & Building Stone Co., Carthage Marble & White Lime Co., Consolidated Marble & Stone Co., Ozark Quarries Co., Spring River Stone Co., and F. W. Steadley & Co. for building and monumental stone, and the Carthage Crushed Limestone Co., Independent Gravel Co., and Webb City Stone Co. for crushed stone.

MINNESOTA.

In Minnesota the greater part of the output of building stone comes from Kasota, Le Sueur County, and Mankato, Blue Earth County.

Stone sold at Mankato and Kasota, Minn., 1919–1921.

Year.	Building stone (rough and dressed).		Other.		Total.	
	Cubic feet.	Value.	Short tons.	Value.	Short tons (approximate).	Value.
1919	57,959	$108,250	46,131	$60,007	50,760	$168,257
1920	104,865	132,170	39,564	54,485	47,900	186,655
1921	111,487	271,230	32,627	41,409	41,500	312,639

Two colors of stone, pink and yellow, are found at Kasota. The stone is furnished to the building trade sawed with the bed of the stone and sawed across the bed and is sold as Pink Kasota Fleuri, Pink Kasota Veine, Yellow Kasota Fleuri, and Yellow Kasota Veine. The stone from Mankato is sold under the name Kato Stone.

Building stone is also quarried at Mantorville, Dodge County, and near Winona, Winona County. The Winona stone is put on the market as Biesanz American Travertine and Tracon.

The quarry operators for building stone in these districts are as follows:

Mankato, Blue Earth County:
 T. R. Coughlan Co.
 Fowler & Pay.
Mantorville, Dodge County:
 Mantorville Stone Co.
Kasota, Le Sueur County:
 Babcock & Wilcox.
 Breen Stone & Marble Co.
Winona, Winona County:
 Biesanz Stone Co.
 George Haun Quarry Co.
 Union Stone Co.

KENTUCKY.

The oolitic limestone quarried in Warren County, Ky., is well known to the building trade. The following table shows the production for the county from 1918 to 1921.

Limestone sold in Warren County, Ky., 1918-1921.

Year.	Building stone (rough and dressed).		Monumental stone (rough and dressed).		Other.		Total.	
	Cubic feet.	Value.	Cubic feet.	Value.	Short tons.	Value.	Short tons (approximate).	Value.
1918	88,580	$58,732	....	....	2,470	$2,684	9,800	$61,416
1919	54,710	33,808	53,610	$67,009	7,540	10,732	16,500	111,549
1920	61,230	66,800	37,470	56,210	7,480	12,420	15,600	135,430
1921	117,000	145,790	11,000	24,750	6,230	5,840	16,800	176,380

The principal producing companies at present are the Bowling Green Quarries Co., Bowling Green, and the Caden Stone Co., Hadley. There are also a few other producers, who sell mostly for local use and do not operate regularly.

SANDSTONE.

GENERAL SUMMARY.

A decrease of 63 per cent in the production of ganister, which in 1920 represented nearly one-third of the total sandstone output, accounted in a great measure for the total decrease of 21 per cent in the production of sandstone in 1921. There were decreases of 52 and 61 per cent, respectively, in the quantities of riprap and rubble sold, but these products were much smaller parts of the total. All the products for street construction showed appreciable increases, and building stone increased 53 per cent in quantity.

Sandstone sold in the United States in 1920 and 1921, by uses.

Use.	1920		1921	
	Quantity.	Value.	Quantity.	Value.
Building stone....cubic feet..	1,812,580	$1,619,724	2,816,240	$1,612,039
Approximate equivalent in short tons	149,890	....	229,410	....
Paving blocks....number..	3,599,580	304,476	4,332,500	367,716
Approximate equivalent in short tons	37,650	....	43,740	....
Curbing....cubic feet..	718,150	518,677	1,342,840	968,323
Approximate equivalent in short tons	62,060	....	108,110	....
Flagging....cubic feet..	688,890	463,718	791,660	471,837
Approximate equivalent in short tons	56,460	....	65,100	....
Crushed stone....short tons..	1,394,270	2,043,621	1,539,470	2,215,070
Riprap....do....	455,500	602,492	216,430	211,458
Rubble....do....	86,770	153,298	33,550	56,711
Ganister....do....	1,095,390	1,582,255	404,650	522,185
Other....do....	5,010	22,029	....	....
Total (quantities approximate, in short tons)....	3,343,000	7,310,290	2,640,460	6,425,339

Sandstone sold in the United States, 1919-1921, by States.

State.	1919		1920		1921	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama	20,680	$33,852	36,690	$61,604	22,200	$36,741
Arizona	(a)	(a)	25,900	30,641	92,250	69,486
Arkansas	43,320	91,549	111,320	174,293	34,250	50,991
California	271,740	249,779	386,230	496,681	345,550	459,482
Colorado	33,800	47,464	42,020	77,827	27,760	41,178
Connecticut	23,690	44,914	(a)	(a)	(a)	(a)
Idaho	3,610	84,822	6,200	154,700	(a)	(a)
Illinois	(a)	(a)	67,200	50,431	74,040	54,558
Indiana	(a)	(a)	(a)	(a)	....	....
Iowa	....	....	(a)	(a)	....	....
Kansas	....	....	(a)	(a)	1,130	2,788
Kentucky	14,720	89,734	27,530	120,391	49,860	121,982
Maryland	(a)	(a)	....	....	(a)	(a)
Massachusetts	57,660	118,000	47,200	195,659	2,350	49,095
Michigan	19,640	24,413	(a)	(a)	(a)	(a)
Minnesota	28,710	62,512	99,980	232,901	84,650	210,416
Missouri	....	....	(a)	(a)	....	....
Montana	(a)	(a)	5,640	7,539	(a)	(a)
Nebraska	(a)	(a)	....	....	....	....
New Jersey	19,750	31,475	(a)	(a)	30,760	44,146
New Mexico	(a)	(a)	168,740	128,171	310	552
New York	[b] 65,050	[b] 384,516	[b] 61,610	[b] 547,424	[b] 156,930	[b] 901,915
North Carolina	(a)	(a)	45,880	56,381	(a)	(a)
Ohio	308,350	1,594,416	238,520	1,513,615	242,720	1,729,601
Oklahoma	(a)	(a)	(a)	(a)	(a)	(a)
Oregon	....	....	(a)	(a)	....	....
Pennsylvania	[b] 1,098,290	[b] 1,661,959	[b] 1,210,240	[b] 2,108,167	[b] 968,660	[b] 1,775,148
South Dakota	119,360	146,742	146,750	295,110	129,890	213,235
Tennessee	(a)	(a)	(a)	(a)	(a)	(a)
Texas	....	....	(a)	(a)	....	....
Utah	(a)	(a)	(a)	(a)	1,500	9,102
Virginia	64,910	28,654	75,730	77,448	(a)	(a)
Washington	(a)	(a)	(a)	(a)	6,780	72,325
West Virginia	24,040	42,409	23,060	44,299	26,410	50,960
Wisconsin	143,400	230,628	221,160	370,518	203,550	323,943
Wyoming	13,870	26,699	(a)	(a)	(a)	(a)
Undistributed	248,680	289,305	295,400	566,490	138,910	207,695
	2,623,270	5,283,842	3,343,000	7,310,290	2,640,460	6,425,339

[a] Included under "Undistributed." [b] Includes bluestone.

Sandstone sold in the United States in 1921, by States and uses.

State.	Number of plants.	Building.						Ganister.		Paving blocks.		Curbing.	
		Rough construction.		Rough architectural.		Dressed.							
		Short tons.	Value.	Cubic feet.	Value.	Cubic feet.	Value.	Short tons.	Value.	Number of blocks.	Value.	Cubic feet.	Value.
Alabama	6	(a)	(a)					14,370	$20,654				
Arizona	4			(a)	(a)								
Arkansas	4												
California	11	(a)	(a)					(a)	(a)				
Colorado	14	2,470	$4,298	2,790	$2,226	730	$1,100	12,310	15,514				
Connecticut	5	(a)	(a)	(a)	(a)								
Idaho	2			(a)	(a)								
Illinois	4							1,040	2,558				
Kansas	3	1,130	2,788										
Kentucky	5	(a)	(a)	(b)	(b)	b 88,940	b 86,244						
Maryland	2							(a)	(a)				
Massachusetts	2			(a)	(a)	(a)	(a)						
Michigan	2	(a)	(a)										
Minnesota	5			(a)	(a)	(a)	(a)			(a)	(a)	(a)	(a)
Montana	2	(a)	(a)	(a)	(a)			(a)	(a)				
New Jersey	3	(a)	(a)										
New Mexico	3	(a)	(a)	(a)	(a)								
New York	35	5,230	13,353	23,780	11,585	120,450	207,628			2,210,000	$171,066	428,000	$325,201
North Carolina	1							(a)	(a)				
Ohio	16	3,590	5,318	424,760	218,582	548,420	555,350	8,590	16,108			754,030	510,414
Oklahoma	2	(a)	(a)	(a)	(a)								
Pennsylvania	91	39,260	60,082	43,340	30,952	35,640	144,543	277,110	359,936	1,142,560	93,044	148,000	114,494
South Dakota	7	(a)	(a)	(a)	(a)			(a)	(a)	(a)	(a)		
Tennessee	1			(a)	(a)								
Utah	1									150,800	9,102		
Virginia	2	(a)	(a)										
Washington	2					34,240	64,746			58,000	5,821		
West Virginia	7	(a)	(a)									(a)	(a)
Wisconsin	18	15,080	11,972	7,680	6,881	23,100	41,598	76,620	90,254	685,550	77,953		
Wyoming	1												
Undistributed d		46,460	68,238	69,090	59,005	6,280	15,550	14,610	17,161	85,590	10,730	12,810	18,214
	261	113,220	166,049	572,360	329,690	856,880	1,116,300	404,650	522,185	4,332,500	367,716	1,342,840	968,323
Average value			1.47		0.58		1.30		1.29		c 84.87		0.72

State.	Number of plants.	Flagging.		Rubble.		Riprap.		Crushed stone.				Total.	
								Road metal and concrete.		Railroad ballast.			
		Cubic feet.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons (approximate).	Value.
Alabama	6			(a)	(a)	(a)	(a)					22,200	$36,741
Arizona	4					(a)	(a)					92,250	69,486
Arkansas	4					(a)	(a)	(a)	(a)	(a)	(a)	34,250	50,991
California	11			(a)	(a)	(a)	(a)	293,960	$377,444	33,990	$62,679	345,550	459,482
Colorado	14	(a)	(a)	1,410	$1,710	(a)	(a)	(a)	(a)	(a)	(a)	27,760	41,178
Connecticut	5					(a)	(a)					(a)	(a)
Idaho	2											(a)	(a)
Illinois	4							73,000	52,000			74,040	54,558
Kansas	3											1,130	2,788
Kentucky	5			(a)	(a)	31,690	$20,738	(a)	(a)			49,860	121,982
Maryland	2							(a)	(a)			(a)	(a)
Massachusetts	2			(a)	(a)							2,350	49,095
Michigan	2							(a)	(a)			(a)	(a)
Minnesota	5					(a)	(a)	82,750	179,847			84,650	210,416
Montana	2											(a)	(a)
New Jersey	3					(a)	(a)					30,760	44,146
New Mexico	3			(a)	(a)							310	552
New York	35	70,690	$63,115	(a)	(a)	(a)	(a)	72,460	105,732	(a)	(a)	156,930	901,915
North Carolina	1											(a)	(a)
Ohio	16	680,930	371,731	2,200	3,509	35,540	48,589					242,720	1,729,601
Oklahoma	2			(a)	(a)	(a)	(a)					(a)	(a)
Pennsylvania	91	38,000	35,477	15,600	27,738	5,930	12,065	350,450	597,423	246,480	299,394	968,660	1,775,148
South Dakota	7					5,630	5,761	112,600	191,138	(a)	(a)	129,890	213,235
Tennessee	1											(a)	(a)
Utah	1											1,500	9,102
Virginia	2									(a)	(a)	(a)	(a)
Washington	2			400	400	3,000	1,358					6,780	72,325
West Virginia	7	(a)	(a)	(a)	(a)	(a)	(a)	21,090	41,377	(a)	(a)	26,410	50,960
Wisconsin	18			1,470	1,612	2,560	1,624	98,490	92,049			203,550	323,943
Wyoming	1					(a)	(a)			(a)	(c)	(a)	(a)
Undistributed		2,040	1,514	12,470	21,742	132,080	121,323	85,610	171,073	68,590	44,914	138,910	207,695
	261	791,660	471,837	33,550	56,711	216,430	211,458	1,190,410	1,808,083	349,060	406,987	2,640,460	6,425,339
Average value			0.60		1.69		0.98		1.52		1.17		2.43

a Included under "Undistributed."

b Rough architectural stone included under dressed stone.

c Per M.

BLUESTONE.

The figures of production for bluestone, most of which is quarried in southeastern New York and northeastern Pennsylvania, are included in those of sandstone, but on account of the local importance of this stone the figures are given separately also.

Almost all the owners of land in this district have small deposits of bluestone on their property and quarry small quantities of it annually which they sell to agents of large dealers who market the stone. As it is very difficult to obtain the figures of production from these quarrymen, the figures of sales reported by dealers are used by the United States Geological Survey as more nearly representative of the industry. Any reports sent in by individual small quarrymen are valued for the information they furnish relative to the industry, but duplication of figures is avoided.

The stone is used chiefly for flagging, curbing, sills, lintels, steps, and house copings. In recent years much of this stone has been replaced by concrete, but in 1921 there was a decided increase over 1920 in all products of bluestone.

Bluestone sold in New York and Pennsylvania in 1920 and 1921.

State.	Building stone.		Curbing.		Flagging.		Other.		Total.	
	Cubic feet.	Value.	Cubic feet.	Value.	Cubic feet.	Value.	Short tons.	Value.	Short tons (approximate).	Value.
1920.										
New York	80,850	$172,768	189,210	$172,951	33,980	$25,674	5,640	$4,301	31,330	$375,694
Pennsylvania	11,100	32,756	65,000	31,199	28,000	20,145			8,530	84,100
	91,950	205,524	254,210	204,150	61,980	45,819	5,640	4,301	39,860	459,794
Average value		2.24		0.80		0.74		0.76		11.54
1921.										
New York	122,700	210,930	271,000	227,665	70,000	62,515	1,720	1,376	39,510	502,486
Pennsylvania	14,000	35,434	115,000	85,637	38,000	35,477	200	762	14,000	157,310
	136,700	246,364	386,000	313,302	108,000	97,992	1,920	2,138	53,510	659,796
Average value		1.80		0.81		0.91		1.11		12.33

MISCELLANEOUS STONE.

Practically all the material included under "miscellaneous stone" is used for road metal, concrete, and ballast. It showed an increase of 14 per cent for 1921. Stone for crushed stone, and rough building, chiefly foundations, showed a considerable increase, but sales of riprap and rubble and mica schist used for refractory lining decreased.

Miscellaneous varieties of stone[a] sold in the United States in 1920 and 1921.

Use.	1920		1921	
	Quantity.	Value.	Quantity.	Value.
Building stone ......cubic feet..	162,500	$37,329	300,000	$50,062
Approximate equivalent in short tons	14,000		25,060	
Riprap and rubble ......short tons..	98,650	157,538	75,750	77,409
Crushed stone ......do....	1,265,320	1,562,014	1,560,870	1,909,810
Refractory stone ......do....	27,250	69,262	12,020	35,667
Other ......do....	78,080	465,626	11,520	90,853
Total (quantities approximate, in short tons)...	1,483,300	2,291,769	1,685,220	2,163,801

[a] Includes light-colored volcanic rocks, conglomerate, chert, cherty limestone, mica schist used for furnace lining, serpentine used as road material, argillite, etc.

Miscellaneous varieties of stone sold in the United States in 1921, by States and uses.

State.	Number of plants.	Rough construction.		Riprap and rubble.		Crushed stone.				Other.		Total.	
						Road metal and concrete.		Railroad ballast.					
		Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.	Short tons (approximate).	Value.
Arizona	2	1,030	$3,854			12,500	$12,500					13,530	$16,354
Arkansas	3					(a)	(a)	(a)	(a)			453,310	519,647
California	13			(a)	(a)	470,800	387,903	31,600	$16,832	(a)	(a)	576,000	496,897
Florida	1					(a)	(a)					(a)	(a)
Idaho	2	350	230									350	230
Maryland	1			(a)	(a)							(a)	(a)
Massachusetts	12	(a)	(a)	(a)	(a)	274,090	471,369					274,690	471,760
Michigan	3					36,980	37,250					36,980	37,250
New Hampshire	1									2,000	$16,000	2,000	16,000
New Jersey	2	(a)	(a)							(a)	(a)	(a)	(a)
New York	3					63,540	98,745	(a)	(a)	(a)	(a)	69,820	124,788
Oregon	1							(a)	(a)			(a)	(a)
Pennsylvania	18	20,720	39,841	(a)	(a)	60,920	98,397			b15,750	b49,217	97,660	187,725
Rhode Island	4					76,750	185,040					76,750	185,040
South Dakota	1					10,940	13,983					10,940	13,983
Wyoming	1									(a)	(a)	(a)	(a)
Undistributed		2,960	6,137	75,750	$77,409	453,770	549,793	68,980	37,998	5,790	61,303	73,190	94,127
	68	c 25,060	50,062	75,750	77,409	1,460,290	1,854,980	100,580	54,830	23,540	126,520	1,685,220	2,163,801

a Included under "Undistributed."
b Includes 12,020 tons of mica schist, valued at $35,667, used for lining kilns and furnaces.
c Approximately 300,000 cubic feet.

CRUSHED STONE.

The increase of more than 2,830,000 short tons (7 per cent) in the production of crushed stone in 1921 was in accord with the activity in road building and concrete work throughout the country. Crushed stone sold for road metal and concrete work increased 12 per cent in quantity, but crushed stone for railroad ballast decreased nearly 15 per cent. These figures include a part of the stone crushed along the highways during the course of construction, but they necessarily omit a considerable quantity of stone crushed from old stone walls or heavier broken stone used for road foundation that had been blasted out near the roads. Efforts have been made to learn the quantities of such stone used from the State highway commissioners of the different States, but with little success, as the work for the building of different stretches of road is given to contractors who either buy their material or refuse to make a statement of what they crush from roadside quarries. They argue that it is not a commercial output, that the quarries are opened only for a short time and are then abandoned, and that no record is kept. As it is impossible to keep informed regarding these small temporary quarries except by continual travel over the country, many of them have necessarily been omitted in the collection of statistics.

All varieties of crushed stone except basalt and related rocks (trap rock) showed gain in production, but the increase of nearly 3,000,000 tons in crushed limestone was the most noteworthy.

There was a general decrease in 1921 all over the country in the prices of crushed stone, although the average value for the United States decreased only 6 cents a ton. The operators were handicapped by transportation difficulties, high freight rates, and shortage of fuel.

Crushed stone sold in the United States in 1920 and 1921.

	Road metal and concrete.		Railroad ballast.		Total.		
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value. Total.	Value. Average.
1920.							
Granite	2,415,480	$4,240,699	601,480	$591,077	3,016,960	$4,831,776	$1.60
Basalt and related rocks (trap rock)	7,897,300	10,540,201	984,210	1,260,282	8,881,510	11,800,483	1.33
Limestone	20,419,130	25,249,446	5,388,670	5,359,353	25,807,800	30,608,799	1.19
Sandstone	944,740	1,551,429	449,530	492,192	1,394,270	2,043,621	1.47
Miscellaneous	1,147,250	1,453,255	118,070	108,759	1,265,320	1,562,014	1.23
	32,823,900	43,035,030	7,541,960	7,811,663	40,365,860	50,846,693	......
Average value per ton	....	1.31	....	1.04	....	1.26	......
1921.							
Granite	2,771,070	4,032,200	325,340	414,887	3,096,410	4,447,087	1.44
Basalt and related rocks (trap rock)	7,358,230	9,740,418	927,450	1,172,655	8,285,680	10,913,073	1.32
Limestone	23,985,790	27,903,303	4,734,620	4,329,135	28,720,410	32,232,438	1.12
Sandstone	1,190,410	1,808,083	349,060	406,987	1,539,470	2,215,070	1.44
Miscellaneous	1,460,290	1,854,980	100,580	54,830	1,560,870	1,909,810	1.22
	36,765,790	45,338,984	6,437,050	6,378,494	43,202,840	51,717,478	......
Average value per ton	....	1.23	....	0.99	....	1.20	......
Percentage of change in 1921	+12	+5	−15	−18	+7	+2	......

Crushed stone sold in the United States in 1921, by States and uses.

State.	Concrete and road metal.		Railroad ballast.		Total.	
	Short tons.	Value.	Short tons.	Value.	Short tons.	Value.
Alabama	80,050	$87,377			80,050	$87,377
Arizona	88,660	144,614			88,660	144,614
Arkansas	644,780	718,100	34,530	$50,598	679,310	768,698
California	3,363,070	3,211,432	213,800	218,590	3,576,870	3,430,022
Colorado	a 1,720	a 4,276	(b)	(b)	11,030	18,926
Connecticut	1,180,460	1,257,821	30,850	31,779	1,211,310	1,289,600
Delaware	(b)	(b)			(b)	(b)
Florida	a 389,840	a 271,849	156,460	142,102	a 546,300	a 413,951
Georgia	148,350	235,864	19,010	35,655	167,360	271,519
Hawaii	165,680	364,710			165,680	364,710
Idaho	227,510	397,808			227,510	397,808
Illinois	2,459,940	2,668,845	534,170	500,846	2,994,110	3,169,691
Indiana	1,711,510	1,733,698	171,790	153,619	1,883,300	1,887,317
Iowa	299,890	379,913	(b)	(b)	a 299,680	a 379,913
Kansas	287,340	449,140	18,460	26,261	305,800	475,401
Kentucky	a 790,720	a 988,753	695,320	552,404	a 1,486,040	a 1,541,157
Louisiana	(b)	(b)			(b)	(b)
Maine	(b)	(b)	(b)	(b)	a 4,250	a 7,799
Maryland	508,310	852,070	202,250	285,923	710,560	1,137,993
Massachusetts	1,172,110	1,777,368	14,450	19,200	1,186,560	1,796,568
Michigan	1,344,160	996,711	37,090	28,752	1,381,250	1,025,463
Minnesota	490,760	743,814			490,760	743,814
Missouri	922,040	1,372,089	43,730	58,930	965,770	1,431,021
Montana	11,980	17,835	(b)	(b)	a 11,980	a 17,835
New Hampshire	3,750	6,680			3,750	6,680
Nebraska	95,000	140,015			95,000	140,015
New Jersey	1,227,600	2,038,865	170,380	241,681	1,397,980	2,280,546
New Mexico			(b)	(b)	(b)	(b)
New York	4,274,800	5,498,570	609,290	630,948	4,884,090	6,129,518
North Carolina	543,610	943,875	(b)	(b)	a 543,610	a 943,875
Ohio	4,729,970	4,741,487	747,140	659,852	5,477,110	5,401,339
Oklahoma	495,450	593,847	353,090	337,500	848,540	931,347
Oregon	a 698,810	a 983,243	(b)	(b)	755,390	1,002,791
Pennsylvania	3,539,800	5,262,034	713,290	929,281	4,253,090	6,191,315
Porto Rico	71,550	108,125	3,780	4,903	75,330	113,026
Rhode Island	112,320	284,318			112,320	284,318
South Carolina	309,820	568,511	(b)	(b)	c 309,820	c 568,511
South Dakota	161,420	280,621	(b)	(b)	c 161,420	c 280,621
Tennessee	552,760	649,338	245,450	238,515	798,210	887,853
Texas	a 547,170	a 584,773	a 237,330	a 188,050	a 784,500	a 772,823
Utah	(b)	(b)	(b)	(b)	67,810	69,900
Vermont	a 4,700	a 4,380			a 4,700	a 4,380
Virginia	627,110	840,007	571,650	470,233	1,198,760	1,310,240
Washington	442,080	549,511	3,810	3,500	445,890	553,011
West Virginia	371,180	457,181	a 245,280	a 195,105	a 596,620	a 613,909
Wisconsin	a 1,425,420	a 1,726,669	(b)	(b)	a 1,425,420	a 1,726,669
Wyoming			(b)	(b)	(b)	(b)
Undistributed	242,590	402,847	364,650	374,267	489,340	703,594
	36,765,790	45,338,984	6,437,050	6,378,494	43,202,840	51,717,478

a Output of certain kinds of stone included under "Undistributed" to conform to previous tables.
b Included under "Undistributed."
c Exclusive of railroad ballast, which is included under "Undistributed."

The use of crushed stone as water-bound macadam has to a large extent been superseded by increased use of concrete and asphaltic pavements, for which aggregates of sand, gravel, and slag as well as stone are available. The continued strong demand for concrete as building material and the extensive road-building programs being carried forward under Federal and State cooperation should maintain or increase the demand for crushed stone.

CEMENT.

By Ernest F. Burchard and Belle W. Bagley.[1]

PRINCIPAL HYDRAULIC CEMENTS.

The Portland, natural, and puzzolan cements marketed or shipped from the mills in the United States in 1921 decreased 1 per cent in quantity and 7 per cent in value.

Hydraulic cements shipped from factories in the United States in 1919–1921.

Class.	1919		1920		1921	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
Portland	85,612,899	$146,734,844	96,311,719	$194,439,025	95,507,147	$180,778,415
Natural, Puzzolan	528,589	583,554	767,481	1,150,890	539,402	897,025
	86,141,488	147,318,398	97,079,200	195,589,915	96,046,549	181,675,440

PORTLAND CEMENT.

PRODUCTION, SHIPMENTS, AND STOCKS.

Both the total production and the total shipments of Portland cement in the United States in 1921, as reported to the United States Geological Survey, showed a decrease of 1 per cent. The gross value of the shipments showed a decrease of 7 per cent, and the average selling price at mills decreased 13 cents a barrel, or about 6 per cent.

The statistics in the following table are arranged by States, so far as possible. By the term "producer" is meant a company manufacturing Portland cement, whether it operates one or more plants. The term "producing plant" or "active plant" as used for many years in these reports is applied to a mill or group of mills located at one place and operated by one company, but each establishment at a different place is counted as a plant.

In the table, by districts, statistics are given for groups of States, generally not more than three, that are geographically related.

Of the 27 States in which Portland cement was manufactured in 1921, 14 showed increase in shipments and 13 showed decrease, as compared with 1920. The net change for the whole country was a decrease of 1 per cent in both shipments and production. In 1921 production exceeded shipments by 3,334,902 barrels.

[1] The statistics showing imports and exports of cement were compiled by J. A. Dorsey, from records of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Portland cement produced, shipped, and in stock in the United States, 1920 and 1921, by States.

[Barrels of 376 pounds.]

State.	Production. Active plants. 1920	Production. Active plants. 1921	Production. Barrels. 1920	Production. Barrels. 1921	Production. Percentage of change.	Shipments. 1920 Barrels.	Shipments. 1920 Value.	Shipments. 1921 Barrels.	Shipments. 1921 Value.	Shipments. Percentage of change in quantity.	Average factory price per barrel. 1920	Average factory price per barrel. 1921	Stock. Barrels. 1920 (revised).	Stock. Barrels. 1921	Stock. Percentage of change.
Alabama	3	3	1,131,560	1,743,287	+54	1,117,622	$2,557,973	1,714,286	$3,466,223	+53	$2.29	$2.02	39,679	68,638	+ 73
California	9	9	7,098,084	7,302,784	+ 3	7,064,010	15,449,645	7,180,700	16,856,258	+ 2	2.19	2.35	441,138	561,175	+ 27
Illinois	4	4	5,538,558	5,587,825	+ 1	5,148,040	10,012,158	5,237,510	9,092,982	+ 2	1.94	1.74	403,643	753,954	+ 87
Iowa	4	4	4,849,228	4,590,920	− 5	4,421,783	8,742,854	4,151,439	7,439,983	− 6	1.98	1.79	553,607	993,090	+ 79
Kansas	7	7	4,340,794	3,781,494	−13	4,158,399	8,649,157	3,643,582	7,253,944	−12	2.08	1.99	399,059	536,971	+ 35
Michigan	11	11	4,891,457	5,777,533	+18	4,442,455	10,939,633	5,680,156	10,300,289	+28	2.46	1.81	666,389	760,503	+ 14
Missouri	5	5	6,017,517	4,446,091	−26	5,605,952	10,980,453	4,375,712	8,034,540	−22	1.96	1.84	571,688	641,580	+ 12
New Jersey	2	2	2,711,169	2,803,774	+ 3	2,563,453	5,096,558	2,840,699	4,820,538	+11	1.99	1.70	252,595	245,241	− 3
New York	9	8	5,885,058	5,294,188	−10	6,049,150	12,206,698	4,993,341	9,403,015	−17	2.02	1.88	488,209	790,056	+ 62
Ohio	5	5	1,780,433	2,563,773	+44	1,670,958	3,561,490	2,518,723	4,615,492	+51	2.13	1.83	193,626	238,676	+ 23
Oklahoma	3	2	1,553,652	1,631,525	+ 5	1,484,698	3,284,412	1,596,566	3,420,093	+ 8	2.21	2.14	107,685	142,644	+ 32
Pennsylvania	21	22	28,269,314	27,628,598	− 2	27,662,116	52,632,082	26,622,367	46,881,625	− 4	1.90	1.76	2,407,126	3,413,359	+ 42
Texas	5	5	2,562,208	2,668,741	+ 4	2,626,130	5,898,972	2,514,045	5,902,863	− 4	2.25	2.35	143,502	296,296	+106
Washington	4	4	1,798,953	1,678,863	− 7	1,806,025	4,096,227	1,612,891	4,080,785	−11	2.27	2.53	189,220	255,292	+ 35
Other States [a]	25	24	21,595,260	21,342,653	− 1	20,490,928	40,330,713	20,825,130	39,209,785	+ 2	1.97	1.88	1,975,901	2,489,889	+ 26
	117	115	100,023,245	98,842,049	− 1	96,311,719	194,439,025	95,507,147	180,778,415	− 1	2.02	1.89	8,833,067	12,187,364	+ 38

[a] Colorado, Georgia, Indiana, Kentucky, Maryland, Minnesota, Montana, Nebraska, Oregon, Tennessee, Utah, Virginia, and West Virginia.

The following table shows production, shipments, and stocks by months as estimated on information furnished in part by the Portland Cement Association and in part by individual cement manufacturers in a canvass begun by the Geological Survey in 1921. Although the figures are not quite complete and therefore only approximate the totals shown in other tables of this report that are based on final annual returns from the producers, they reflect the fluctuations in the industry during the year.

Estimated production, shipments, and mill stocks of Portland cement by months in 1921, in barrels.[a]

Month.	Production.	Shipments.	Stocks on last day of the month.
January	4, 098, 000	2, 539, 000	10, 300, 000
February	4, 379, 000	3, 331, 000	11, 400, 000
March	6, 763, 000	6, 221, 000	12, 000, 000
April	8, 651, 000	7, 919, 000	12, 600, 000
May	9, 281, 000	9, 488, 000	12, 450, 000
June	9, 296, 000	10, 577, 000	11, 150, 000
July	9, 568, 000	10, 301, 000	10, 414, 000
August	10, 244, 000	12, 340, 000	8, 280, 000
September	10, 027, 000	11, 329, 000	6, 953, 000
October	10, 506, 000	12, 114, 000	5, 348, 000
November	8, 921, 000	5, 195, 000	9, 091, 000
December	6, 559, 000	3, 697, 000	11, 938, 000

[a] Based in part on statistics compiled by the Portland Cement Association.

As shown in the accompanying table, there was an increase in the production of Portland cement in six districts and an increase in the shipments in five districts in 1921, as compared with 1920.

Portland cement produced, shipped, and in stock in the United States, 1920 and 1921, by districts.

Commercial district.	Production.					Shipments.							Stock.		
	Active plants.		Barrels.		Percentage of change.	1920		1921		Percentage of change in quantity.	Average factory price per barrel.		Barrels.		Percentage of increase.
	1920	1921	1920	1921		Barrels.	Value.	Barrels.	Value.		1920	1921	1920 (revised).	1921	
Eastern Pennsylvania, New Jersey, and Maryland	22	22	27,137,594	25,571,726	− 6	26,629,217	$51,473,529	24,841,973	$44,110,573	− 7	$1.93	$1.78	2,241,160	3,000,486	34
New York	9	8	5,885,058	5,294,188	−10	6,049,150	12,206,698	4,993,341	9,403,015	−17	2.02	1.88	488,209	790,056	62
Ohio, western Pennsylvania, and West Virginia	9	10	7,988,934	9,501,895	+19	7,519,129	14,623,740	9,185,858	15,947,184	+22	1.94	1.74	835,004	1,151,041	38
Michigan	11	11	4,891,457	5,777,533	+18	4,442,455	10,939,633	5,680,156	10,300,289	+28	2.46	1.81	666,389	760,503	14
Illinois, Indiana, and Kentucky	11	10	16,886,831	17,050,741	+ 1	15,871,121	29,762,420	16,423,356	28,468,092	+ 3	1.88	1.73	1,467,839	2,095,306	43
Virginia, Tennessee, Alabama, and Georgia	7	7	3,567,890	5,065,854	+42	3,390,909	7,331,414	4,916,245	9,879,466	+45	2.16	2.01	224,978	374,105	66
Eastern Missouri, Iowa, and Minnesota	9	9	11,728,062	9,951,283	−15	10,883,306	20,999,548	9,432,573	16,805,272	−13	1.93	1.78	1,199,744	1,717,969	43
Western Missouri, Nebraska, Kansas, and Oklahoma	12	11	6,967,129	6,351,747	− 9	6,611,565	13,971,290	6,100,391	12,503,617	− 8	2.11	2.05	622,378	873,734	40
Texas	5	5	2,562,208	2,668,741	+ 4	2,626,130	5,898,972	2,514,045	5,902,863	− 4	2.25	2.35	143,502	296,296	106
Colorado and Utah	5	5	2,392,741	1,860,573	−22	2,315,219	5,208,600	1,806,931	4,330,333	−22	2.25	2.40	165,266	215,727	31
California	9	9	7,098,084	7,302,784	+ 3	7,064,010	15,449,645	7,180,700	16,856,258	+ 2	2.19	2.35	441,138	561,175	27
Oregon, Washington, and Montana	8	8	2,917,257	2,444,984	−16	2,909,508	6,573,536	2,431,578	6,271,453	−16	2.26	2.58	337,460	350,966	4
	117	115	100,023,245	98,842,049	− 1	96,311,719	194,439,025	95,507,147	180,778,415	− 1	2.02	1.89	8,833,067	12,187,364	38

Portland cement shipped from mills in the United States, 1916–1921.

Year.	Barrels.	Value.	Year.	Barrels.	Value.
1916	94,552,296	$104,258,216	1919	85,612,899	$146,734,844
1917	90,703,474	122,775,088	1920	96,311,719	194,439,025
1918	70,915,508	113,316,275	1921	95,507,147	180,778,415

The stock of Portland cement reported on hand at the mills at the end of 1921 showed an increase of nearly 38 per cent and was larger than that reported to the Geological Survey at the end of any year since 1914, when it was 12,773,463 barrels. The reports of stocks at a few mills in 1920 were revised by the producers. The totals by States and districts are shown in preceding tables.

The summary of stocks in the following table shows that in three of the last six years the gross volume of finished cement on hand has fallen below 9,000,000 barrels. The average of stocks for the last six years is 9,240,461 barrels.

Finished Portland cement in stock in the United States, December 31, 1916 to 1921.

	Barrels.		Barrels.
1916	8,360,552	1919	5,256,900
1917	10,353,838	1920	8,833,067
1918	10,451,044	1921	12,187,364

DOMESTIC CONSUMPTION OF PORTLAND CEMENT.

An estimate of the total consumption of Portland cement in the United States may be made by adding the imports to the shipments and subtracting the exports from the sum. Of course a variable but considerable stock of cement is at all times in transit, in warehouses at distributing points, and awaiting use at jobs, so that the estimate thus made is at best only approximate. Still another uncertain element in this estimate is the fact that as the cement imported and exported is classed as hydraulic cement the records do not discriminate between Portland and other cements and probably also include some plaster. Portland cement, however, constitutes by far the greater part of the exports, and, as the tables show, the imports are small. The apparent domestic consumption in 1921 showed an increase of slightly more than 0.6 per cent, as compared with the consumption in 1920.

Apparent domestic consumption of Portland cement, 1916–1921, in barrels.

Year.	Shipments.	Imports.	Exports.	Apparent consumption.
1916	94,552,296	1,836	2,563,976	91,990,156
1917	90,703,474	2,323	2,586,215	88,119,582
1918	70,915,508	305	2,252,446	68,663,367
1919	85,612,899	8,931	2,463,573	83,158,257
1920	96,311,719	524,604	2,985,807	93,850,516
1921	95,507,147	122,322	1,181,014	94,448,455

The estimates of consumption of Portland cement are of course only approximate, as they represent only the records of shipments by manufacturers into the several States. The shipments of cement into a State during a year may not equal the consumption in that State during the same year, but shipments for a long period should afford a very fair index to the consumption.[2]

The simplest available common index is the estimated consumption per capita in barrels, which is obtained by comparing the shipments into States with the population for the States in 1920 and 1921.

The estimates of population in the following table were furnished by the Bureau of the Census.

There is a discrepancy between the official figures of the Bureau of Foreign and Domestic Commerce for exports of cement, as given on page 227, and the exports reported by manufacturers, as given in the following table, owing to the fact that cement shipped from mills destined for foreign countries is reported by the shipper as exported, whether or not it leaves the country during that calendar year, but the Bureau of Foreign and Domestic Commerce bases its export figures on the cement that actually leaves the country, according to its records. The exports given by that bureau include all other hydraulic cement exported, whereas the table of per capita consumption relates only to Portland cement.

Estimated per capita consumption of Portland cement in Continental United States in 1920 and 1921.

State.	1920			1921		
	Population (estimated as of Jan. 1, 1921).	Consumption (shipments to States).	Estimated consumption per capita.	Population (estimated as of Jan. 1, 1922).	Consumption (shipments to States).	Estimated consumption per capita.
		Barrels.	*Barrels.*		*Barrels.*	*Barrels.*
Alabama	2,369,814	770,382	0.32	2,391,453	604,535	0.25
Arizona [a]	347,533	645,077	1.86	360,903	514,919	1.43
Arkansas [a]	1,770,514	530,482	.30	1,788,823	604,554	.34
California	3,534,945	5,832,977	1.65	3,643,028	6,173,132	1.69
Colorado	954,112	883,300	.93	968,595	802,718	.83
Connecticut [a]	1,408,018	1,328,277	.94	1,435,404	1,044,174	.73
Delaware [a]	225,134	301,706	1.34	227,264	313,344	1.38
District of Columbia [a]	[b] 437,571	357,572	.82	[b] 437,571	445,578	1.02
Florida [a]	990,704	554,966	.56	1,012,937	663,583	.66
Georgia	2,925,365	1,209,422	.41	2,954,897	881,560	.30
Idaho [a]	442,813	366,516	.83	453,759	244,945	.54
Illinois	6,572,493	7,407,388	1.13	6,659,705	6,366,563	.96
Indiana	2,954,032	2,935,056	.99	2,977,673	3,397,130	1.14
Iowa	2,422,485	3,360,089	1.39	2,440,948	3,118,469	1.28
Kansas	1,777,324	2,341,323	1.32	1,785,390	2,292,363	1.28
Kentucky	2,429,684	880,106	.36	2,442,737	1,010,815	.41
Louisiana [a]	1,813,149	836,148	.46	1,827,788	681,538	.37
Maine [a]	770,656	393,123	.51	773,297	399,626	.52
Maryland	1,465,556	1,326,692	.91	1,481,452	1,394,415	.94
Massachusetts [a]	3,902,409	2,650,264	.68	3,952,464	2,164,183	.55
Michigan	3,756,814	5,142,945	1.37	3,845,217	6,112,986	1.59
Minnesota	2,419,202	3,109,243	1.29	2,451,280	3,090,803	1.26
Mississippi [a]	[b] 1,790,618	262,656	.15	[b] 1,790,618	377,657	.21
Missouri	3,415,459	2,525,087	.74	3,426,864	2,236,368	.65
Montana	566,691	403,807	.71	584,495	309,165	.53
Nebraska	1,307,100	1,575,471	1.21	1,317,829	1,050,058	.80
Nevada [a]	[b] 77,407	97,792	1.26	[b] 77,407	84,473	1.09
New Hampshire [a]	444,371	335,632	.76	445,660	348,475	.78
New Jersey	3,219,632	3,639,810	1.13	3,283,365	3,723,051	1.13
New Mexico [a]	363,754	201,827	.55	367,159	188,765	.51
New York	10,516,208	8,663,051	.82	10,647,190	10,301,525	.97
North Carolina [a]	2,595,466	993,999	.38	2,631,809	1,171,885	.45
North Dakota [a]	654,063	251,642	.38	661,254	250,180	.38
Ohio	5,861,602	6,330,910	1.08	5,963,810	6,737,835	1.13
Oklahoma	2,066,510	1,688,310	.82	2,104,737	1,656,143	.79

[a] Non cement-producing States.

[b] Population Jan. 1, 1920; no later estimate made.

[2] Data on per capita consumption of Portland cement by States, beginning with the year 1914, are available in preceding volumes of Mineral Resources.

Estimated per capita consumption of Portland cement in Continental United States in 1920 and 1921—Continued.

State.	1920			1921		
	Population (estimated as of Jan. 1, 1921).	Consumption (shipments to States).	Estimated consumption per capita.	Population (estimated as of Jan. 1, 1922).	Consumption (shipments to States).	Estimated consumption per capita.
		Barrels.	*Barrels.*		*Barrels.*	*Barrels.*
Oregon	794,783	795,292	1.00	806,177	824,950	1.02
Pennsylvania	8,828,676	8,582,057	.97	8,937,336	9,268,804	1.04
Rhode Island [a]	610,761	358,895	.59	617,125	341,599	.55
South Carolina [a]	1,701,062	587,824	.35	1,718,400	474,136	.28
South Dakota [a]	641,971	587,562	.92	647,395	471,626	.73
Tennessee	2,353,654	925,393	.39	2,369,423	827,457	.35
Texas	4,742,200	2,450,278	.52	4,821,172	2,303,573	.48
Utah	457,229	649,086	1.42	465,062	442,863	.95
Vermont [a]	[b] 352,428	217,021	.62	[b] 352,428	208,725	.59
Virginia	2,334,688	1,369,287	.59	2,360,189	1,322,447	.56
Washington	1,378,729	1,834,019	1.33	1,400,837	1,483,420	1.06
West Virginia	1,488,688	1,220,198	.82	1,513,675	1,350,384	.89
Wisconsin [a]	2,662,783	3,484,720	1.31	2,693,499	3,849,216	1.43
Wyoming [a]	199,391	336,917	1.69	204,380	286,486	1.40
Unspecified		16,879			72,803	
	[c] 107,125,729	93,548,476	.87	108,521,880	94,286,002	.87
Exports reported by manufacturers but not included above		2,763,243			1,221,145	
Total shipped from cement plants		96,311,719			95,507,147	

[a] Non cement-producing States. [b] Population Jan. 1, 1920; no later estimate made.
[c] Total for continental United States as published by the Bureau of the Census.

The per capita consumption shown by the table necessarily falls short of the total apparent consumption by the quantity of the imports. These, however, were insignificant until 1920, when 524,604 barrels was imported. This quantity increased the consumption in certain States near the Canadian border—Michigan, New York, North Dakota, Ohio, Vermont, and Washington—but it increased the general average per capita consumption by less than 0.005 barrel.

The highest per capita consumption in 1921 was that of California, 1.69 barrels. There were 17 States in which the per capita consumption was 1 barrel or more, 8 of them east and 9 of them west of Mississippi River; none of them were in the South. Arizona, which held the record in 1920, 1.86 barrels, decreased to 1.43 barrels in 1921. There were changes in all the States except New Jersey and North Dakota, and 28 decreases were recorded. The general average consumption, 0.87 barrel, was the same in 1921 as in 1920.

LOCAL SUPPLIES OF PORTLAND CEMENT.

In connection with the study of consumption of cement it is of interest to compare the shipments from the mills within a State or group of States with the estimated consumption in the same area and thus to ascertain the extent of the surplus or deficiency in the supply of cement locally available. The following table has been arranged with that end in view. Data for 1916 to 1920 will be found in the chapters on cement in Mineral Resources for 1917 to 1920.

The surplus in the following table was distributed, by years, as follows: In 1921, to non cement-producing States, 15,129,667 barrels; to foreign countries, 1,221,145 barrels; unspecified, 72,803 barrels;

in 1920, to non cement-producing States, 15,680,618 barrels; to foreign countries, 2,763,243 barrels; unspecified, 16,879 barrels.

Among the cement-producing States there are, of course, fewer deficiencies than surpluses, and certain of the deficiencies indicated are due to local conditions that did not change materially from 1920 to 1921. For instance, in 1921 Ohio showed a deficiency of more than 4,219,000 barrels, which was largely supplied from Pennsylvania's surplus of more than 17,350,000 barrels and from Indiana. New York, though a large producer, had a deficiency of more than 5,300,000 barrels, which was mostly supplied from the Lehigh district in Pennsylvania. In Maryland, New Jersey, and West Virginia there was a shortage of more than 1,581,000 barrels, probably supplied in large part from the Lehigh district. The quantities consumed in the nonproducing States are of interest in comparison with the other data. Between 500,000 and 700,000 barrels was consumed in 1921 in each of the States of Arizona, Arkansas, Florida, and Louisiana. Connecticut consumed more than 1,044,000 barrels, Massachusetts more than 2,164,000 barrels, North Carolina more than 1,171,000 barrels, and Wisconsin more than 3,849,000 barrels.

Estimated surplus or deficiency in local supply of Portland cement in cement-producing States, 1920–1921, in barrels.

State or division.	1920			1921		
	Shipments from mills.	Estimated consumption.	Surplus or deficiency.	Shipments from mills.	Estimated consumption.	Surplus or deficiency.
Alabama	1,117,622	770,382	+ 347,240	1,714,286	604,535	+ 1,109,751
California	7,064,010	5,832,977	+ 1,231,033	7,180,700	6,173,132	+ 1,007,568
Illinois	5,148,040	7,407,388	− 2,259,348	5,237,510	6,366,563	− 1,129,053
Iowa	4,421,783	3,360,089	+ 1,061,694	4,151,439	3,118,469	+ 1,032,970
Kansas	4,158,399	2,341,323	+ 1,817,076	3,643,582	2,292,363	+ 1,351,219
Michigan	4,442,455	5,142,945	− 700,490	5,680,156	6,112,986	− 432,830
Missouri	5,605,952	2,525,087	+ 3,080,865	4,375,712	2,236,368	+ 2,139,344
New York	6,049,150	8,663,051	− 2,613,901	4,993,341	10,301,525	− 5,308,184
Ohio	1,670,958	6,330,910	− 4,659,952	2,518,723	6,737,835	− 4,219,112
Pennsylvania	27,662,116	8,582,057	+19,080,059	26,622,367	9,268,804	+17,353,563
Texas	2,626,130	2,450,278	+ 175,852	2,514,045	2,303,573	+ 210,472
Colorado, Montana, Oregon, Utah, and Washington	5,224,727	4,565,504	+ 659,223	4,238,509	3,863,116	+ 375,393
Georgia, Kentucky, Tennessee, and Virginia	2,805,242	4,384,208	− 1,578,966	3,826,659	4,042,279	− 215,620
Indiana, Minnesota, Nebraska, and Oklahoma	13,499,863	9,308,080	+ 4,191,783	13,923,377	9,194,134	+ 4,729,243
Maryland, New Jersey, and West Virginia	4,815,272	6,186,700	− 1,371,428	4,886,741	6,467,850	− 1,581,109
	96,311,719	77,850,979	+18,460,740	95,507,147	79,083,532	+16,423,615

PRICES.

Average prices of Portland cement sold in bulk at the factories, as reported to the Geological Survey, are shown in the tables of shipments by States and districts during 1920 and 1921. According to these figures the average prices for the States and groups of States appearing in the tables ranged in 1921 from $1.70 a barrel in New Jersey to $2.58 a barrel in the Oregon-Washington-Montana district, as compared with a range from $1.88 a barrel in the Illinois-Indiana-Kentucky district to $2.46 a barrel in Michigan in 1920. The general average price for the whole country showed a decrease of about 6 per cent. Average prices in all the States, except the States included in the districts of Texas, Colorado-Utah, California, and Oregon-Washington-Montana, showed a decrease.

Average factory price per barrel in bulk of Portland cement, 1910–1921.

1910	$0.891	1914	$0.927	1918	$1.598
1911	.844	1915	.860	1919	1.71
1912	.813	1916	1.103	1920	2.02
1913	1.005	1917	1.354	1921	1.89

The average factory prices given in this report and based on reports received directly from producers are considerably lower than the wholesale prices in the principal cities of the United States and Canada that are quoted in technical and trade journals.

MANUFACTURING CONDITIONS.

PLANTS.

Portland cement was manufactured at 115 plants in 1921, as compared with 117 plants in 1920. Six plants that were formerly active manufactured no cement during the year—one each in Indiana, Michigan, New Jersey, New York, Oklahoma, and Virginia—but some of the idle plants shipped cement from stock. Two new plants produced Portland cement in 1921, the Petoskey, at Petoskey, Mich., and the Bessemer, at Bessemer, Pa. These new plants are equipped as follows:

Petoskey Portland Cement Co., plant at Petoskey, Emmet County, Mich. Wet process; limestone and shale; clinker burned with coal; two 10 by 150 foot kilns; daily clinker capacity, 2,000 barrels.

Bessemer Limestone & Cement Co., plant at Bessemer, Lawrence County, Pa. Wet process; limestone and shale; clinker burned with coal; three 10 by 235 foot kilns; daily clinker capacity, 3,000 barrels.

KILNS.

The total number of rotary kilns reported in plants that operated in 1921 was 740, compared with 753 in 1920. An improvement has been noted in the data on kilns and kiln capacities reported to the Geological Survey, and it is hoped that these items in the reports will be even more complete in the next canvass.

Number of rotary cement kilns of different lengths in active plants in the United States, 1918–1921.

Length (feet).	Number of kilns.				Length (feet).	Number of kilns.			
	1918	1919	1920	1921		1918	1919	1920	1921
40 to 60	77	71	74	74	126 to 149	63	63	63	64
61 to 99	90	87	87	87	150 to 199	63	66	73	76
100 to 109	105	98	98	91	200 to 260	15	19	23	29
110	65	55	66	56					
120	88	95	97	99		749	720	753	740
125	183	166	172	164					

KILN FUELS.

Portland cement burned by different fuels in 1920 and 1921.

Fuel.	1920				1921			
	Number of plants.	Number of kilns.	Barrels of cement.	Percentage of total.	Number of plants.	Number of kilns.	Barrels of cement.	Percentage of total.
Coal	96	629	81,265,667	81.2	92	607	80,557,675	81.5
Coal and crude oil	1	24	6,676,029	6.7	3	31	5,536,128	5.6
Coal and gas	1	6			1	6		
Crude oil	16	79	9,495,798	9.5	16	81	10,123,781	10.2
Crude oil, coal and gas	2	9	2,585,751	2.6	2	9	2,624,465	2.7
Natural gas	1	6			1	6		
	117	753	100,023,245	100.0	115	740	98,842,049	100.0

CAPACITY.

The total annual manufacturing capacity of all the plants, either active or only temporarily closed, according to manufacturers' reports, decreased about 1.4 per cent. According to these figures the total production of cement in 1921 (98,842,049 barrels) was 68.5 per cent of the total capacity, whereas the production in 1920 represented 68.3 per cent of the apparent total capacity in that year.

From the reported data, the following table of estimated capacities by districts has been prepared, and these figures, compared with the respective figures of production, give the apparent percentage of capacity utilized in 1920 and 1921.

Portland cement manufacturing capacity of the United States, by commercial districts, 1920 and 1921.

District.	Estimated capacity (barrels).		Percentage of capacity utilized.	
	1920	1921	1920	1921
Eastern Pennsylvania, New Jersey, and Maryland	42,577,000	41,751,000	63.7	61.2
New York	8,320,000	8,450,000	70.7	62.7
Ohio, western Pennsylvania, and West Virginia	11,626,000	12,110,000	68.7	78.5
Michigan	7,011,000	8,006,000	69.8	72.2
Illinois, Indiana, and Kentucky	24,645,000	21,372,000	68.5	79.8
Virginia, Tennessee, Alabama, and Georgia	6,550,000	7,000,000	54.5	72.4
Eastern Missouri, Iowa, and Minnesota	13,836,000	13,975,000	84.8	71.2
Western Missouri, Nebraska, Kansas, and Oklahoma	9,650,000	9,790,000	72.2	64.9
Texas	3,600,000	4,050,000	71.2	65.9
Colorado and Utah	2,935,000	2,850,000	81.5	65.3
California	11,415,000	10,317,000	62.2	70.8
Oregon, Washington, and Montana	4,235,000	4,683,000	68.9	52.2
	146,400,000	144,354,000	68.3	68.5

RECOVERY OF POTASH.[3]

In 1921 the production of potash (K_2O) as a by-product of the manufacture of Portland cement amounted to 1,037 short tons. On the basis of the small quantity sold the value of the whole would be $165,692. In 1920 the production was 1,147 short tons, valued at $239,344.

[3] For complete statistics of the production of potash salts see the chapter on potash in Mineral Resources for 1921.

NATURAL AND PUZZOLAN CEMENTS.

Since 1916 only one manufacturer has reported an output of puzzolan or slag-lime cement, and in order that this quantity may be included in the cement totals for the United States without revealing confidential information it is added to the statistics of natural cement. The puzzolan cement plant is at Birmingham, Ala.

The apparent decrease in shipments of these cements is due largely to the fact that the output of natural cement in 1921 has been expressed in barrels of 376 pounds, whereas in former years these barrels ranged from 240 to 300 pounds each. There was probably very little change in the actual quantity shipped. The decrease in total value in 1921 therefore represents a real decrease in value per unit of quantity.

Natural cement was produced in 1921 in eight plants, distributed in seven States—near Rosedale, N. Y.; Siegfried, Pa.; Lisbon, Ohio; Speeds, Ind.; Utica, Ill.; Fort Scott, Kans.; and Austin and Mankato, Minn.

The next table gives such statistics as may be presented concerning the output of natural and puzzolan cements in 1920 and 1921.

Natural and puzzolan cement shipped, 1920 and 1921.

State.	1920			1921		
	Producing plants.	Barrels.	Value.	Producing plants.	Barrels.	Value.
Alabama [a]	1			1		
Illinois	1	425,108	$631,340	1	304,218	$528,587
Indiana	1			1		
Kansas	1			1		
Minnesota	2			2		
New York	1	342,373	519,550	1	235,184	368,438
Ohio	1			1		
Pennsylvania	1			1		
	9	767,481	1,150,890	9	539,402	897,025

[a] Puzzolan only.

FOREIGN TRADE IN CEMENT.[4]

EXPORTS.

In 1921 the hydraulic cement exported to foreign countries, including the Philippines and the Canal Zone, most of it Portland cement, decreased 60 per cent in quantity and 57 per cent in value. The quantity exported in 1921 was slightly over 1 per cent of the total production of hydraulic cement in that year.

The exports were sent to the West Indies, 550,000 barrels; South America, 291,000 barrels; Mexico, 193,000 barrels; Central America, 117,000 barrels; Canada, 6,000 barrels; and other countries, 24,000 barrels. The export trade varies considerably from year to year. The decreases, which were general, were especially noteworthy in South America and the West Indies.

[4] Statistics of exports and imports taken from reports of the Bureau of Foreign and Domestic Commerce.

Hydraulic cement exported from the United States in 1920 and 1921, by countries.

Destination.	1920		1921	
	Barrels.	Value.	Barrels.	Value.
Argentina	271,844	$861,217	22,870	$114,472
Azores and Madeira Islands	600	1,800	169	592
Belgian Kongo	....	....	484	1,832
Belgium	495	1,546	214	1,419
Bermuda	2,234	8,514	1,811	6,078
Bolivia	8,779	28,380	24,646	92,892
Brazil	501,413	1,555,124	38,095	134,780
British East Africa	30	120	....	....
British East Indies:				
British India	5,590	17,094	701	3,714
Straits Settlements	884	3,798	701	4,472
British Guiana	7,452	25,529	990	4,227
British Honduras	2,676	8,625	445	1,824
British Oceania:				
Australia	4,689	20,758	570	3,593
New Zealand	735	3,809	253	1,377
Other	1,106	5,047	275	1,403
British South Africa	112	433	261	1,645
British West Africa	4,414	12,678	....	....
British West Indies:				
Barbados	503	1,962	8	27
Jamaica	33,914	132,291	7,076	26,140
Trinidad and Tobago	16,310	57,135	2,803	9,593
Other	24,742	82,486	10,287	34,432
Bulgaria	1,500	4,545	....	....
Canada	31,483	125,834	5,984	26,968
Canary Islands	2,710	8,260	1,330	4,955
Chile	97,609	314,977	10,274	38,686
China	902	4,710	982	4,426
Colombia	160,567	557,012	79,581	276,034
Costa Rica	14,718	55,533	4,224	15,796
Cuba	912,698	3,036,916	447,706	1,599,362
Dominican Republic	146,687	527,363	55,506	199,511
Dutch East Indies	9,703	41,810	5,405	31,790
Dutch Guiana	7,181	22,318	990	3,680
Dutch West Indies	16,181	56,934	10,383	38,888
Ecuador	27,443	85,548	6,383	21,504
England	2,017	11,062	1,377	7,470
France	135	400	....	....
French Africa	536	1,663	....	....
French Guiana	4,507	15,313	2,305	7,947
French Oceania	2,129	8,554	988	4,056
French West Indies	11,343	38,148	1,635	6,014
Germany	....	....	2	11
Greece	1,600	5,045	50	375
Guatemala	20,345	78,884	8,917	35,302
Haiti	18,083	66,341	13,983	43,713
Honduras	28,701	112,080	19,797	70,267
Hongkong	40	248	79	428
Ireland	80	478	....	....
Japan	1,268	5,178	915	6,142
Kamerun, etc	120	360	....	....
Liberia	1,590	4,346	50	200
Mexico	207,750	823,243	192,817	690,556
Miquelon, Langley, and St. Pierre islands	....	....	164	499
Netherlands	118	609	23	116
Newfoundland and Labrador	253	780	1,000	3,500
Nicaragua	9,627	37,536	5,332	21,708
Norway	386	1,640	132	872
Oceania (not otherwise specified)	439	1,857	600	2,850
Panama	118,014	354,428	61,626	207,924
Peru	107,466	335,065	76,504	255,735
Philippine Islands	26,300	96,872	3,389	11,591
Portugal	101	487	2,000	8,000
Portuguese Africa	700	3,015	214	666
Salvador	32,444	127,013	16,410	65,985
Scotland	135	541	100	690
Siam	18	100	....	....
Spain	873	4,012	127	967
Turkey in Asia	312	1,050	....	....
Turkey in Europe	2,000	6,060	....	....
Uruguay	15,904	55,765	4,320	28,335
Venezuela	46,853	150,739	23,944	85,948
Virgin Islands of the United States	5,716	26,351	807	3,007
	2,985,807	10,045,369	1,181,014	4,276,986

Domestic cement shipped to Alaska, Hawaii, and Porto Rico, in 1920 and 1921.

	1920		1921	
	Barrels.	Value.	Barrels.	Value.
Alaska	18,216	$83,355	10,015	$41,239
Hawaii	204,760	725,070	170,579	574,946
Porto Rico	229,633	806,082	116,082	395,046
	452,609	1,614,507	296,676	1,011,231

Hydraulic cement exported from the United States, 1916–1921.

Year.	Barrels.	Value.	Percentage of total shipments.	Year.	Barrels.	Value.	Percentage of total shipments.
1916	2,563,976	$3,828,231	2.7	1919	2,463,573	$7,513,389	2.9
1917	2,586,215	5,328,536	2.8	1920	2,985,807	10,045,369	3.1
1918	2,252,446	5,912,166	3.2	1921	1,181,014	4,276,986	1.2

IMPORTS.

The following tables show the quantities of foreign cement imported for consumption in the United States during the years 1914 to 1921, inclusive. The quantities given include all kinds of hydraulic cement. Some of the imported cement evidently was not manufactured in the country from which it came to the United States.

The large increase in imports in 1920, which came mostly from Portland cement mills in Canada, was not maintained in 1921, but the imports in 1921 were much larger than in any other year since 1914.

Foreign cement imported for consumption in the United States, 1914–1921.

Year.	Barrels.[a]	Year.	Barrels.[a]
1914	120,906	1918	305
1915	42,218	1919	8,931
1916	1,836	1920	524,604
1917	2,323	1921	122,322

[a] Barrels of 376 pounds in 1920–21, and 380 pounds in earlier years.

Roman, Portland, and other hydraulic cements imported into the United States in 1921, by countries.

[General imports.]

Country.	Barrels.	Value.
Belgium	19,389	$88,802
Canada	53,648	159,264
Cuba	19	35
Denmark	11,464	24,106
Dominican Republic	3,231	16,870
England	2,570	10,872
France	621	1,475
Germany	1,318	4,540
Hongkong	110	362
Italy	4	18
Japan	4,720	15,203
Mexico	170	1,279
Netherlands	1,215	6,000
Norway	3,148	11,800
Panama	7	71
Poland and Danzig	11,316	20,705
Spain	2	10
Switzerland	([a])	5
Virgin Islands of the United States	9,365	27,411
Country not given	[b] 5	[b] 14
	122,322	388,842

[a] 100 pounds. [b] White, nonstaining cement, quantity estimated.

MINERAL WATERS.

By W. D. Collins.[1]

SCOPE OF REPORT.

The term mineral water as here used applies to water that is bottled and sold in its natural state or only slightly altered from its natural state. It includes (*a*) natural carbonated waters that have lost part of their carbon dioxide; (*b*) natural waters that have been artificially carbonated; and (*c*) waters from which iron has been removed. It does not include artificial waters or natural waters that have been essentially modified in chemical character.

The statistics in this report refer only to domestic mineral waters that have been sold. Water that is given away, including water furnished free for drinking or bathing to guests at hotels or to patients at sanitariums, has been omitted even where data are available to show the quantity of water so used. Hence, as actual sales fall far short of the total quantity used, particularly of such waters as are drunk at resorts for their medicinal value, the totals do not represent the full magnitude of the trade.

Three uses of mineral waters are recognized in this report—table use, medicinal use, and use in manufacture of soft drinks—but the quantity and value of water used in the manufacture of soft drinks are not included in the totals.

The distinction for statistical purposes between table and medicinal waters is entirely arbitrary and is based on the reports furnished by the owners and operators of springs stating the uses for which the waters are sold.

MINERAL-WATER TRADE IN 1921.

OUTPUT AND VALUE.

Both the number of mineral springs utilized commercially and the quantity of water sold were less in 1921 than in 1920, but the value of the water sold in 1921 was slightly greater.

[1] The statistics were compiled by Miss B. H. Stoddard, of the United States Geological Survey.

Sales of mineral waters in the United States in 1920 and 1921, by States.

State.	1920			1921				
	Commercial springs.	Gallons.	Value.	Commercial springs.	Gallons.	Value.	Percentage of increase (+) or decrease (−). Quantity.	Percentage of increase (+) or decrease (−). Value.
Alabama	3	1,461	$916	4	892	$690	−39	−25
Arkansas	7	900,597	41,359	5	313,322	31,984	−65	−23
California	33	2,674,086	326,295	31	3,260,609	367,313	+22	+13
Colorado	10	227,208	67,538	9	234,560	70,925	+ 3	+ 5
Connecticut	27	1,275,451	72,797	20	866,253	50,679	−32	−30
Florida	3	268,470	27,120	4	321,472	28,365	+20	+ 5
Georgia	8	343,888	31,868	9	306,637	22,757	−11	−29
Illinois	9	301,953	17,211	9	351,277	21,871	+16	+27
Indiana	10	571,293	183,939	9	541,190	158,790	− 5	−14
Iowa	6	38,877	3,419	3	21,100	2,105	−46	−38
Kansas	10	422,069	57,361	8	421,294	55,982	− .2	− 2
Kentucky	9	256,959	39,600	8	255,475	37,174	− 1	− 6
Louisiana	2	(a)	(a)	2	(a)	(a)	(a)	(a)
Maine	20	732,810	301,851	19	744,775	309,757	+ 2	+ 3
Maryland	6	986,379	95,565	7	888,948	87,138	−10	− 9
Massachusetts	32	1,277,708	105,008	30	1,088,921	72,792	−15	−31
Michigan	9	1,227,485	122,010	8	1,344,900	154,401	+10	+27
Minnesota	12	2,357,991	136,632	12	2,266,578	132,127	− 4	− 3
Mississippi	7	136,175	31,312	6	140,600	31,945	+ 3	+ 2
Missouri	28	323,628	50,892	24	176,541	45,670	−45	−10
Montana	2	(a)	(a)	2	(a)	(a)	(a)	(a)
Nebraska	1	(b)	(b)	1	(b)	(b)	(b)	(b)
Nevada	1	(a)	(a)	1	(a)	(a)	(a)	(a)
New Hampshire	2	(a)	(a)	4	225,720	9,599	(a)	(a)
New Jersey	8	702,867	68,036	8	250,295	25,960	−64	−62
New Mexico	2	(a)	(a)	2	(a)	(a)	(a)	(a)
New York	38	5,242,047	671,066	40	5,965,049	736,173	+14	+10
North Carolina	8	115,315	15,545	7	87,052	13,561	−25	−13
North Dakota	2	(a)	(a)	3	585,000	8,100	(a)	(a)
Ohio	22	2,337,437	169,400	20	2,219,149	161,208	− 5	− 5
Oklahoma	8	1,437,810	49,287	10	1,319,895	45,078	− 8	− 9
Oregon	3	2,360	701	3	2,150	653	− 9	− 7
Pennsylvania	20	641,440	66,945	23	730,252	74,490	+14	+11
Rhode Island	6	370,315	21,946	6	327,352	21,391	−12	− 3
South Carolina	6	246,418	51,112	5	124,055	18,489	−50	−64
South Dakota	2	(a)	(a)	2	(a)	(a)	(a)	(a)
Tennessee	16	1,265,286	73,570	15	1,150,585	72,227	− 9	− 2
Texas	11	597,233	91,983	10	366,429	67,410	−39	−27
Vermont	4	88,398	11,079	3	4,500	468	−95	−96
Virginia	27	1,248,382	147,600	29	902,034	122,283	−28	−17
Washington	2	(a)	(a)	2	(a)	(a)	(a)	(a)
West Virginia	6	392,950	39,180	6	412,595	37,205	+ 5	− 5
Wisconsin	28	5,259,447	1,601,075	26	5,665,797	1,726,333	+ 8	+ 8
Wyoming	3	8,576	1,350	1	(a)	(a)	(a)	(a)
Undistributed c	....	1,937,491	68,347	....	897,985	53,352	−12	+ 2
	479	36,218,260	4,860,915	456	34,781,238	4,876,445	− 4	+ .3

a Included under "Undistributed."
b Manufacture of soft drinks only and therefore not included in totals.
c 1920: Louisiana, Montana, Nevada, New Hampshire, New Mexico, North Dakota, South Dakota, and Washington; 1921: Louisiana, Montana, Nevada, New Mexico, South Dakota, Washington, and Wyoming.

Value of medicinal and table waters sold in the United States in 1921.

State.	Medicinal waters.	Table waters.	Total.	State.	Medicinal waters.	Table waters.	Total.
Alabama	$690	....	$690	New Jersey	$100	$25,860	$25,960
Arkansas	30,201	$1,783	31,984	New York	64,057	672,116	736,173
California	154,750	212,563	367,313	North Carolina	5,840	7,721	13,561
Colorado	3,485	67,440	70,925	North Dakota	....	8,100	8,100
Connecticut	286	50,393	50,679	Ohio	8,691	152,517	161,208
Florida	5,282	23,083	28,365	Oklahoma	1,575	43,503	45,078
Georgia	5,137	17,620	22,757	Oregon	153	500	653
Illinois	43	21,828	21,871	Pennsylvania	5,796	68,694	74,490
Indiana	130,200	28,590	158,790	Rhode Island	72	21,319	21,391
Iowa	600	1,505	2,105	South Carolina	9,364	9,125	18,489
Kansas	46,225	9,757	55,982	Tennessee	23,468	48,759	72,227
Kentucky	26,299	10,875	37,174	Texas	67,410	....	67,410
Maine	72,433	237,324	309,757	Vermont	90	378	468
Maryland	120	87,018	87,138	Virginia	85,104	37,179	122,283
Massachusetts	5,318	67,474	72,792	West Virginia	7,867	29,338	37,205
Michigan	2,301	152,100	154,401	Wisconsin	17,460	1,708,873	1,726,333
Minnesota	278	131,849	132,127	Other States [a]	2,510	50,842	53,352
Mississippi	31,695	250	31,945				
Missouri	39,570	6,100	45,670		854,490	4,021,955	4,876,445
New Hampshire	20	9,579	9,599				

[a] Louisiana, Montana, Nevada, New Mexico, South Dakota, Washington, and Wyoming.

CONDITION OF TRADE.

Mineral waters sold in the United States, 1917–1921.

Year.	Commercial springs.	Gallons.	Value.	Average price per gallon (cents).
1917	717	46,784,419	$4,931,710	10.5
1918	569	40,709,722	4,533,001	11.1
1919	527	38,697,280	4,880,186	12.6
1920	479	36,218,260	4,860,915	13.4
1921	456	34,781,238	4,876,445	14.0

The value of mineral water sold has been about the same in each of the last five years. The quantity sold has steadily decreased, so that the sales in 1921 were 12,000,000 gallons less than in 1917, a decrease of 26 per cent. The number of commercial springs in 1921 was 36 per cent less than in 1917.

An improvement in general business conditions is likely to include an increase in the sales of mineral water, but many more of the smaller producers will probably find it unprofitable to continue in business. The regulation of the mineral-water trade by Federal, State, and municipal agencies has involved further investments for the protection of the springs and for equipment for bottling—additional charges that can not be carried without fairly large sales of water at a good price.

SOFT DRINKS.

Mineral waters used in the manufacture of soft drinks in 1921.

State.	Gallons.	State.	Gallons.
Massachusetts	919,159	Colorado	160,610
Pennsylvania	613,357	New York	147,470
New Hampshire	562,700	Iowa	122,632
Wisconsin	548,716	Maine	107,609
Connecticut	252,325	Other States [a]	679,123
California	237,930		
Minnesota	181,952		4,533,583

[a] In order of quantity, Nebraska, Louisiana, Vermont, Rhode Island, Arkansas, Illinois, New Jersey, Oklahoma, North Dakota, Florida, Virginia, Michigan, Ohio, Kansas, New Mexico, Oregon, Alabama, South Dakota, Washington, Maryland, Montana, and Kentucky.

IMPORTS.

The total imports of natural mineral waters entered for consumption in the United States in 1921, as reported by the Bureau of Foreign and Domestic Commerce, Department of Commerce, amounted to 498,090 gallons, valued at points of shipment at $156,297, the average value per gallon being 31 cents. During the entire year 14,012 pounds of mineral salts obtained by evaporation from natural mineral waters were imported for consumption in this country. These imports were valued at $8,606.

Mineral waters imported for consumption in the United States, 1917–1921.

Year.	Gallons.	Value.	Average value per gallon (cents).
1917	618,405	$268,665	43
1918 January to June	258,791	123,695	48
1918 July to December [a]	200,786	102,970	51
1919 [a]	193,933	112,732	58
1920 [a]	466,547	177,992	38
1921 [a]	498,090	156,297	31

[a] Natural mineral waters exclusively. Figures for first half of 1918 and for all preceding years include artificial mineral waters and imitation mineral waters, in addition to natural mineral waters.

The following table shows the general imports by principa. countries. The figures include both natural and artificial mineral waters:

Mineral waters imported into the United States in 1921,[a] by countries.

[General imports.]

Country	Gallons.	Value.	Country.	Gallons.	Value.
Australia	45	$26	Italy	48,993	$23,329
Belgium	1,332	131	Japan	5,106	838
Canada	909	873	Mexico	1,251	365
Colombia	129	52	Netherlands	2,787	799
Cuba	165	152	New Zealand	48	39
Czechoslovakia	13,011	1,804	Spain	894	938
England	753	328	Sweden	105	65
France	273,480	104,907	Switzerland	1,800	1,390
Germany	137,856	18,920			
Greece	12	4		491,808	155,935
Hungary	3,132	975			

[a] Include artificial and natural water.

"General imports" and "imports for consumption" for any period will differ to the extent that the value of entries for warehouse for the period differs from the value of withdrawals from warehouse for consumption. The term "entry for consumption" is the technical name of the import entry made at the customhouse and implies that the goods have been delivered into the custody of the importer and that the duties have been paid on the dutiable portion.

EXPORTS.

Large quantities of a few domestic waters are exported, but no statistics regarding such shipments are available. The quantity and the value of these waters are included in the statistics of production for the United States.

THE VALUE OF ANALYSES OF MINERAL WATERS.

MEDICINAL WATERS.

The largest use of mineral waters a good many years ago was medicinal. As late as 1905, the first year that the United States Geological Survey's report on mineral waters gave separate figures for the sales of table waters and those of medicinal waters, the value of the water sold for medicinal use was practically the same as that of the water sold for table use and was nearly four times the value of the water sold for medicinal use in 1921. A large part of the business in medicinal waters in the early days of the industry was based upon reported cures of diseases of those who used the waters. In those days the advertisements of mineral waters contained long lists of diseases that could be cured by the waters, and according to present standards of the ethics of advertising it might be charged that practically the whole business was built on false or mistaken representations. This charge is not true, however, because some of the most extravagant advertisements referred to waters which, although incapable of producing the wonderful cures described, nevertheless had qualities that made them decidedly beneficial in the treatment of disease.

In their prescription of mineral waters physicians rarely pay much attention to claims of wonderful curative properties. They recognize the fact that many of their patients will be benefited by drinking more water, and they attempt to increase its consumption by prescribing a medicinal water to be taken in certain doses, although they may be convinced that they would get exactly the same results if they could induce their patients to drink the same quantity of ordinary water. Many waters that have been widely advertised as curative agents are not essentially different from waters obtained from public or private supplies used by millions of persons with no thought that they are using medicine for drinking, bathing, dish washing, and laundry work.

Many mineral waters contain enough soluble salts to produce the therapeutic effect that would be obtained from drinking solutions of these salts in distilled water or in tap water. The chief active ingredients of these waters are magnesium sulphate (Epsom salt), sodium sulphate (Glauber's salt), sodium bicarbonate (baking soda), and sodium chloride (table salt). Some mineral waters contain much less dissolved mineral matter than the water of most public supplies;

others, without having unusual composition, contain much more dissolved mineral matter than the water of some of the large public supplies. If a physician wishes to prescribe a water that is similar in composition to the water normally used by a patient, or to prescribe one containing more or less dissolved mineral matter, he must consider analyses of waters. An analysis of a mineral water has little practical value except to show the quantity of the soluble salts it contains in large quantities or for comparison with analyses of the waters of public or private supplies.

Many analyses of waters of ordinary composition have been made to look impressive by the inclusion of results of determinations of constituents that are present in minute traces. No other purpose was served by the figures showing "traces" or very small quantities of bromide, iodide, borate, phosphate, nitrite, ammonium, lithium, strontium, barium, or other unusual constituents.

Nearly all natural waters contain determinable quantities of calcium, magnesium, sodium, carbonate or bicarbonate, sulphate and chloride. The mineral matter dissolved in the water of most large public supplies is in large part calcium and magnesium bicarbonate. In a few supplies the sulphate makes up a considerable part of the total dissolved material. A large number of mineral waters contain these same constituents in almost the same total quantity and relative proportions as the water of some public supplies. The waters that contain large quantities of dissolved salts have the same constituents as ordinary potable waters, but they contain much more of the easily soluble salts of sodium or magnesium named above. A few waters contain moderate quantities of some unusual constituents like iodide or bromide, but all these waters are so concentrated that they can not be taken in large quantities.

Lithium was at one time supposed to have special value in the treatment of certain diseases for which mineral waters had been found beneficial. This idea led to the use of the word "lithia" in the names of many springs. In a case[1] brought against one mineral water company for violation of the Federal food and drugs act it was shown that in order to obtain the dose of lithium stated in the United States Pharmacopœia it would be necessary to drink from one to a thousand barrels a day of any natural water that was not too concentrated to drink. It was further shown that even if a moderate quantity of a water did contain enough lithium to furnish this dose the lithium in itself would probably have no beneficial effect in the treatment of the diseases for which it is recommended.

When radium was discovered and it was found that radium emanation in waters was dissipated in about 30 days, this discovery was supposed to explain the well-known fact that the beneficial effects of the use of mineral waters are generally greater if the waters are used at the springs than if they are obtained from bottles some time after bottling. It was soon found, however, that there appeared to be no particular relation between the radioactivity of waters and their therapeutic properties, and that the quantities of radium in the natural waters were far less than the quantities necessary to produce any measurable physiologic effect. Some of the first waters examined for radioactivity were well-known mineral waters, and therefore the

[1] Notice of Judgment 3,869: U. S. Dept. Agr. Bur. Chem., Service and Regulatory Announcements, Suppl. 8, pp. 439-446, May 11, 1915.

radioactivity appeared to be peculiarly a property of these waters, but later investigations have shown that practically every natural water is radioactive. The radioactivity of many hot springs is, however, much greater than that of most cold ground waters.

MINERAL-WATER RESORTS.

Perhaps the greatest benefits obtained by the use of medicinal waters are due to the fact that health resorts have been built up around some of the springs. The use of the waters is only one of the many agencies at these resorts that assist in the restoration of health. The chemical composition of the waters at many of these resorts probably has little relation to the benefits obtained.

BATHS.

Some mineral waters are used chiefly for bathing, especially the naturally hot or warm waters of hot springs. Some observers believe that certain waters have peculiarly beneficial effects that can not be explained by their composition as shown by chemical analysis. Others claim that the benefits derived are results of special skill in prescribing and administering the baths and of the unusually complete equipment of the bathing establishments at the springs. In any event the chemical analysis of a spring water used for bathing does not show its therapeutic value.

TABLE WATERS.

The commercial value of medicinal waters, including the value of the water used at resorts for bathing and drinking as well as that of the medicinal water bottled, is probably greater than the value of the table waters, but reports of sales for the last eight years show that the value of the table waters sold has been three or four times the value of the medicinal waters bottled and sold.

The sales of table water in any area have been closely related to the quality of the water of public supplies in that area. In a city where polluted or turbid water was served as the public supply large quantities of mineral water were sold. As more plants were installed for the purification of public supplies the mineral-water business decreased. For several years there have been few public water systems that did not furnish safe water of good appearance. The increasing pollution of the sources of some supplies has made the purification more difficult and has necessitated the employment of methods of purification that make the purified water less palatable than a clear, pure spring water. Water from some of the large public supplies has at times an unpleasant taste, due to the growth of microorganisms in reservoirs.

The value of a spring water sold for drinking in place of water from a public supply is affected very little by its chemical composition. If the water is clear and palatable the quantity of dissolved mineral matter may be from 20 to 500 parts per million. Absolute freedom from contamination with harmful bacteria is, of course, the prime requisite for a table water. In places where the ordinary supply of drinking water contains comparatively large quantities of dissolved mineral matter a water of low mineral content may be in demand as a table water.

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PUBLISHED ANALYSES OF MINERAL WATERS.

The following list of publications includes reports that contain large numbers of analyses of spring waters, analyses of water from springs of special importance, or analyses of other waters with which spring waters may be compared:

BAILEY, E. H. S., Special report on mineral waters: Kansas Univ. Geol. Survey, vol. 7, 1902.

Analyses of 115 ground waters are given, including the well-known mineral waters of the State.

BLATCHLEY, W. S., The mineral waters of Indiana: Indiana Dept. Geol. and Nat. Res. Ann. Rept., vol. 26, pp. 11–158, 1901.

Descriptions of more than 100 mineral springs are given and analyses of the waters from many of them are quoted.

COLLINS, W. D., The industrial utility of public water supplies in the United States: U. S. Geol. Survey Water-Supply Paper 496 (in press).

Analyses are given showing the composition of public supplies of 307 cities with a total population of about 39,000,000.

CROOK, James K., Mineral waters of the United States and their therapeutic uses: Lea Brothers & Co., New York and Philadelphia, 1899.

GEORGE, R. D., CURTIS, Harry A., LESTER, O. C., CROOK, Jas. K., YEO, J. B., and others, Mineral waters of Colorado: Colorado Geol. Survey Bull. No. 11, 1920.

GOOCH, F. A., and WHITFIELD, J. E., Analyses of waters of the Yellowstone National Park: U. S. Geol. Survey Bull. 47, 1888.

The methods of analysis are described and analyses of the waters of the geysers, pools, and hot and cold springs are given. (Out of print; available for consultation in most large libraries.)

HAYWOOD, J. K., Analyses of the waters of the Hot Springs of Arkansas: U. S. Dept. Interior, 1912. (Out of print; available for consultation in most large libraries.)

——— Mineral waters of the United States: U. S. Dept. Agr. Bur. Chemistry Bull. 91, 1905.

Analyses are given of 55 American spring waters, including 13 Saratoga waters. (Out of print; available for consultation in most large libraries.)

LANE, A. C., Lower Michigan mineral waters: U. S. Geol. Survey Water-Supply Paper 31, 1899.

Analyses of 40 mineral and several other ground waters are discussed in relation to their geologic source. (Out of print; available for consultation in most large libraries.)

MILFORD, L. R., Analyses of the Saratoga mineral waters: Jour. Ind. and Eng. Chemistry, vol. 4, p. 593, 1912; vol. 5, p. 24, and p. 557, 1913; vol. 6, p. 207, 1914.

This series of four articles gives new analyses of all the important Saratoga waters.

PEALE, A. C., Lists and analyses of the mineral springs of the United States: U. S. Geol. Survey Bull. 32, 1886.

About 2,800 mineral springs are listed and about 800 analyses are quoted. (Out of print; available for consultation in most large libraries.)

PRATT, J. H., The mining industry in North Carolina during 1907, with a special report on the mineral waters: North Carolina Geol. and Econ. Survey Econ. Paper 15, 1908.

Analyses of 90 mineral waters are given.

SCHWEITZER, Paul, A report on the mineral waters of Missouri: Missouri Geol. Survey, vol. 3, 1892.

About 80 analyses of Missouri ground waters are given.

SKINNER, W. W., American mineral waters; The New England States: U. S. Dept. Agr. Bur. Chemistry Bull. 139, 1909.

This pamphlet contains analyses of New England spring waters and the results of bacteriological examinations of them. (Out of print; available for consultation in most large libraries.)

WARING, G. A., Springs of California: U. S. Geol. Survey Water-Supply Paper 338, 1914.

Analyses of practically all California mineral waters are included.

——— Mineral springs of Alaska: U. S. Geol. Survey Water-Supply Paper 418, 1917.

Analyses of about 30 springs are included in this report.

NATURAL-GAS GASOLINE.

By E. G. Sievers.

PRODUCTION.

The output of natural-gas gasoline increased 17 per cent in 1921, but the market for it was rather unstable because of the general

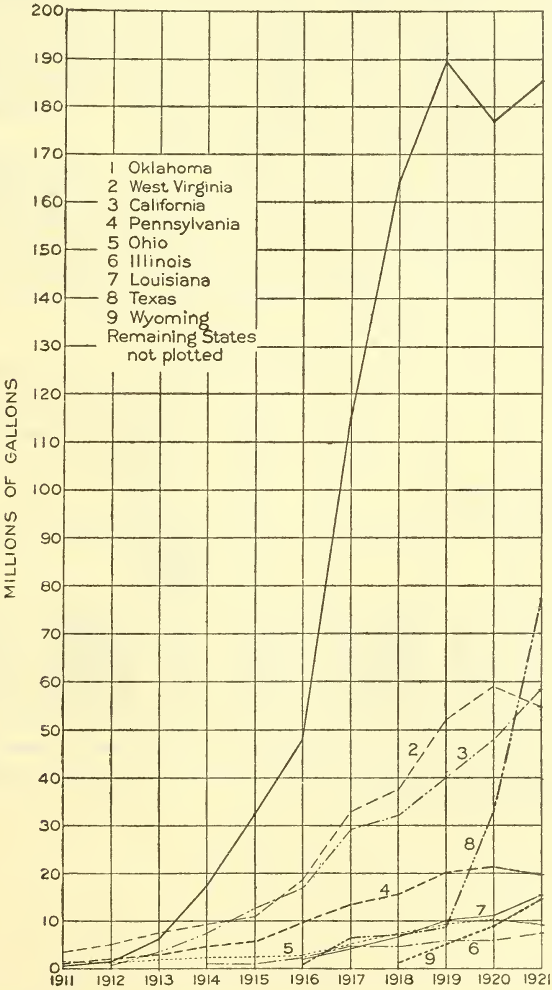

Figure 9.—Natural-gas gasoline produced in the nine leading States, 1911–1921.

business depression. About 74 per cent of the output was recovered at compression plants and the remainder at absorption plants. The average daily production at all plants was 1,232,697 gallons, as compared with 1,054,093 gallons in 1920. The average production per plant in 1921 was 426,074 gallons, compared with 333,400 gallons in 1920.

The total quantity of gasoline produced from all sources in the United States in 1921 was approximately 5,498,000,000 gallons. According to statistics compiled by the Bureau of Mines the total output of gasoline from petroleum refineries in the United States in 1921 was 5,153,549,318 gallons, in the manufacture of which 105,696,444 gallons of natural-gas gasoline was used with blending material; therefore, approximately 5,048,000,000 gallons of gasoline was derived from petroleum. According to data compiled by the United States Geological Survey and shown in the following tables, the total output of natural-gas gasoline in the United States in 1921 was about 450,000,000, or 8.2 per cent of the total output of gasoline.

A decrease in the value of natural-gas gasoline naturally followed the break in the market for petroleum products. The total value in 1921 was about $9,973,000 less than in 1920.

Texas has become an active field for the natural-gas gasoline industry, having an output in 1921 that was 134 per cent greater than in 1920 and occupying second place in the list of producing States. California also increased its production, but West Virginia, which was second in rank in 1920, showed a decrease and occupied fourth place in 1921. Of the 12 producing States 6 increased their output and 6 produced less than in 1920.

Natural-gas gasoline produced in the United States, 1916–1921.

Year.	Number of operators.	Number of plants.	Gasoline produced.			Gas treated (estimated).		
			Gallons.	Value.		M cubic feet.	Value.[a]	Average yield of gasoline per M (gallon).
				Total.	Average (cents).			
1916	[b] 460	596	103,492,689	$14,331,148	13.8	208,705,023	$14,609,300	0.50
1917	[b] 750	886	217,884,104	40,188,956	18.4	429,287,797	34,343,000	.51
1918	503	1,004	282,535,550	50,363,535	17.8	449,108,661	40,419,700	.63
1919	611	1,191	351,535,026	64,196,763	18.3	480,403,963	41,314,700	.73
1920	576	1,154	384,743,922	71,788,122	18.7	496,430,952	41,700,000	.78
1921	458	1,056	449,934,402	61,815,258	13.7	479,618,194	41,500,000	.94

[a] The value of the gas is based on sales to gasoline producers, not on sales for domestic or industrial purposes.

[b] The figures for the number of operators in 1916 and 1917 are not comparable with those for later years as the method of listing has been changed.

Unblended natural-gas gasoline produced in the United States in 1920 and 1921.

State.	Number of operators.	Number of plants.	Gasoline produced.		
			Gallons.	Value.	
				Total.	Average (cents).
Oklahoma	123	280	185,340,742	$22,066,014	11.9
Texas	24	65	77,141,201	9,118,420	11.8
California	29	73	58,220,498	9,874,594	17.0
West Virginia	66	179	54,646,053	9,889,861	18.1
Pennsylvania	170	264	19,856,373	3,354,233	16.9
Louisiana	13	26	15,340,374	1,812,268	11.8
Wyoming	6	7	14,557,684	1,599,591	11.0
Ohio	27	48	9,099,897	1,546,551	17.0
Illinois	34	90	7,536,073	1,101,227	14.6
Kentucky	8	9	4,241,938	834,983	19.7
Kansas	9	11	3,587,329	565,408	15.8
New York	4	4	366,240	52,108	14.2
	458	1,056	449,934,402	61,815,258	13.7
Total, 1920	576	1,154	384,743,922	71,788,122	18.7

State.	Gas treated.		Percentage of total production.				
	M cubic feet.	Average yield per M (gallons).	State.		United States.		
			Compression.	Absorption.	Compression.	Absorption.	Total.
Oklahoma	88,380,173	2.10	89	11	49.9	16.7	41.2
Texas	26,460,805	2.92	89	11	20.6	7.3	17.2
California	69,356,048	.84	63	37	11.1	18.1	12.9
West Virginia	135,483,171	.40	31	69	5.0	32.2	12.2
Pennsylvania	46,336,174	.43	58	42	3.5	7.1	4.4
Louisiana	45,543,846	.34	46	54	2.1	7.0	3.4
Wyoming	4,559,639	3.19	99	1	4.4	.1	3.2
Ohio	35,888,504	.25	18	82	.5	6.3	2.0
Illinois	3,102,246	2.43	100	....	2.3	....	1.7
Kentucky	16,520,224	.26	5	95	.1	3.4	.9
Kansas	7,784,339	.46	42	58	.4	1.8	.8
New York	203,025	1.80	100	....	.1	....	.1
	479,618,194	.94	73.9	26.1	100.0	100.0	100.0
Total, 1920	496,430,952	.78	73.1	26.9	100.0	100.0	100.0

Percentage of natural-gas gasoline produced by States, 1911–1921.

State.	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
Ohio	23	14	9	6	3	3	3	2	3	3	2
Oklahoma	5	13	27	40	48	47	53	58	54	46	41
Pennsylvania	20	17	15	11	9	9	6	6	6	5	5
West Virginia	49	44	32	21	17	18	15	13	15	15	12
California		9	14	18	20	17	13	11	11	13	13
Illinois				3	2	2	2	2	2	2	2
Kentucky	3					1	1	1	1	1	1
New York		3	3	1					[a] 1	[a] 1	[a] 1
Colorado					1	1	2	1	......	......	......
Kansas	......	......							([a])	([a])	([a])
Louisiana	......	......	......	......		1	2	2	3	3	3
Texas	......	......	......	......		1	3	3	3	9	17
Wyoming	......	......	......	......	......	......	......	1	1	2	3
	100	100	100	100	100	100	100	100	100	100	100

[a] New York and Kansas together, 1 per cent.

Natural-gas gasoline produced in the United States in 1921, by principal methods of manufacture.

Produced by compression and by vacuum pumps.

State.	Number of plants.	Gasoline produced.			Gas treated.	
		Gallons.	Value.		M cubic feet.	Average yield per M (gallons).
			Total.	Average (cents).		
Oklahoma [a]	234	165,740,022	$19,474,713	11.8	58,709,714	2.82
Texas [a]	54	68,492,568	8,041,038	11.7	13,956,183	4.91
California [b]	43	36,947,374	6,907,702	18.7	46,423,420	.80
West Virginia [c]	133	16,788,069	2,767,814	16.5	12,419,275	1.35
Wyoming	6	14,495,141	1,590,382	11.0	4,430,742	3.27
Pennsylvania	235	11,558,508	1,756,138	15.2	5,071,295	2.28
Illinois	90	7,533,647	1,100,800	14.6	3,102,246	2.43
Louisiana [a]	14	7,078,748	706,022	10.0	2,554,865	2.77
Ohio	36	1,642,813	268,469	16.3	808,740	2.03
Kansas	8	1,504,372	262,649	17.5	751,971	2.00
New York	4	366,240	52,108	14.2	203,025	1.80
Kentucky	6	196,728	38,294	19.5	87,102	2.26
	863	332,344,230	42,966,129	12.9	148,518,578	2.24
Total, 1920	967	281,131,973	50,272,961	17.9	112,887,802	2.49

Produced by absorption.[d]

State.	Number of plants.	Gallons.	Value, total.	Value, average (cents).	M cubic feet.	Average yield per M (gallons).
West Virginia [e]	50	37,857,984	$7,122,047	18.8	123,992,569	0.31
California [f]	30	21,273,124	2,966,892	13.9	22,932,628	.93
Oklahoma [a]	47	19,600,720	2,591,301	13.2	29,678,245	.66
Texas [a]	12	8,648,633	1,077,382	12.5	12,569,622	.69
Pennsylvania	29	8,297,865	1,598,095	19.3	41,264,879	.20
Louisiana [a]	13	8,261,626	1,106,246	13.4	43,857,173	.19
Ohio	12	7,457,084	1,278,082	17.1	35,079,764	.21
Kentucky	3	4,045,210	796,689	19.7	16,433,122	.25
Kansas	3	2,082,957	302,759	14.5	7,032,368	.30
Wyoming	1	62,543	9,209	14.7	128,897	.23
	[g] 200	[h] 117,590,172	18,849,129	16.0	[i] 332,969,267	.35
Total, 1920	187	103,611,949	21,515,161	20.8	383,543,150	.27

[a] Includes one combination compression and absorption plant.
[b] Includes five combination compression and absorption plants.
[c] Includes eight combination compression and absorption plants.
[d] Includes drip gasoline.
[e] Includes four combination compression and absorption plants.
[f] Includes three combination compression and absorption plants.
[g] Includes seven combination compression and absorption plants duplicated in the total number of compression plants, but not duplicated in the total number of plants for the United States.
[h] Includes 2,426 gallons of drip gasoline, valued at $427, produced in Illinois.
[i] Includes 1,869,651 M cubic feet of gas that was first treated at combination plants by compression and that is duplicated in the total volume of gas treated at the compression plants but not duplicated in the total for the United States.

PRICES.

The general business depression that began early in 1921 broke the market for natural-gas gasoline and brought down the prices. Although prices began to rise in the second half of 1921, the effect of the depression is clearly reflected in the drop in the value of the total output for the year. The prices received by the producers declined as low as 8 cents a gallon, and the average price as computed from the total output in 1921 was 5 cents less than in 1920. As soon as business conditions became more favorable the demand for natural-gas gasoline increased rapidly and the price also rose quickly. Natural-gas gasoline has brought a good price in 1922, ranging from 11 to 22 cents a gallon on the Oklahoma oil market.

CAPACITY OF PLANTS.

Although more natural-gas gasoline was produced in 1921 than in 1920, producers reported that 3 per cent less gas was treated. The average yield of gasoline per 1,000 cubic feet of gas was 0.16 gallon greater in 1921. Of the 1,056 plants in operation in 1921, 107 operated at full capacity. Most of these were in Oklahoma, West Virginia, Pennsylvania, and Texas. Plants with a capacity of 100,000 to 800,000 cubic feet of gas a day exceeded in number those having a capacity below 100,000 cubic feet. West Virginia showed the largest number of plants having a capacity of more than 15,000,000 cubic feet each. The minimum volume of gas treated daily at a plant during the year was 2,000 cubic feet, and the maximum was 150,000,000 cubic feet. The minimum quantity of natural-gas gasoline recovered daily at a plant was 5 gallons, and the maximum was 45,250 gallons. Although data on capacity were received from only a little more than half of the plants operating in 1921, the record on hand is sufficient to indicate the general conditions that prevailed during the year.

Natural-gas gasoline plants classified according to quantity of product in 1921.

State.	Total number of plants.	Number of plants operated at full capacity.	Number of plants treating different quantities of gas (M cubic feet) daily.										Gas treated daily per plant (M cubic feet).		Gasoline produced daily per plant (gallons).	
			Below 100.	100–500	500–1,000	1,000–2,000	2,000–5,000	5,000–10,000	10,000–20,000	20,000–50,000	Over 50,000	No record.	Minimum.	Maximum.	Minimum.	Maximum.
California	73	3	4	13	8	10	11	5	1	1	2	18	128	33,900	102	33,950
Illinois	90	1	21	22	3							44	4	670	26	1,550
Kansas	11		3	2			1	1	1			3	70	10,800	85	3,850
Kentucky	9		3	1			1		1	1		2	20	21,500	30	5,160
Louisiana	26	3	4	7		3	2	3	5	1		1	22	24,300	57	12,000
New York	4		1	1								2	65	250	100	480
Ohio	48	6	7	13		1	2	1	1	2		21	20	28,000	38	9,200
Oklahoma	280	33	28	66	35	25	15	8	1			102	14	19,900	45	45,250
Pennsylvania	264	20	84	21	4	2	6	4	1	2		140	2	42,000	5	8,600
Texas	65	19	1	14	9	11	7	7	2			14	93	16,000	243	26,500
West Virginia	179	22	25	34	18	7	6	4	3	4	6	72	10	150,000	10	40,000
Wyoming	7			1	1	1	2	2					672	8,000	260	31,900
	1,056	107	181	195	78	60	53	35	16	11	8	419				

Range of rated daily capacity of natural-gas gasoline plants in 1921.[a]

State.	Capacity for treating natural gas (M cubic feet).		Capacity for producing natural-gas gasoline (gallons).	
	Minimum.	Maximum.	Minimum.	Maximum.
California	150	35,000	100	35,000
Illinois	6	1,200	25	2,200
Kansas	300	30,000	600	14,230
Kentucky	40	65,000	100	19,000
Louisiana	50	60,000	130	75,000
New York	500	500	1,000	1,000
Ohio	60	28,000	140	9,200
Oklahoma	50	45,000	100	97,000
Pennsylvania	4	42,000	5	10,000
Texas	250	60,000	610	25,000
West Virginia	30	150,000	45	40,000
Wyoming	1,300	10,000	700	40,000

[a] This table is based on the highest capacity that can be obtained at the several plants.

GROWTH OF THE NATURAL-GAS GASOLINE INDUSTRY.

The production of natural-gas gasoline was begun on a small and crude scale in 1900 by a few oil operators in West Virginia and Pennsylvania. The first plant was built in 1904, but it was not until 1910 that the removal of gasoline from natural gas became commercialized. It was early discovered that the gas transmission lines were showing considerable quantities of gasoline, and devices were installed to catch the gasoline. Coils were also placed in old boilers or tanks filled with running water in order to condense and accumulate the gasoline. The raw product was then shipped directly to the market. Blending was not considered at the time, and the product, though very volatile, appeared on the market in its original form.

The growth of the industry accompanied the growth of the internal-combustion engine. With the rapid increase in the number of gasoline engines and motor vehicles, the demand for gasoline taxed the refineries to their capacity, and the additional supply of gasoline obtained from natural gas was very desirable. This gave a great impetus to the development of natural-gas gasoline plants and has resulted in the firm establishment of the industry.

The methods of manufacturing natural-gas gasoline are constantly undergoing changes. The first method applied was that of compression, and it was not until 1913 that the absorption method became of commercial importance. At present absorption plants are largely replacing compression plants, chiefly because the absorption product is more stable and commands a higher price. Combination compression and absorption plants are also very common and successful.

The rapid growth of the industry is graphically shown in figures 10 and 11. From 7,425,800 gallons in 1911 the production has increased to 449,934,400 gallons in 1921, an increase of 5,960 per cent.

PROBLEMS IN THE PRODUCTION OF NATURAL-GAS GASOLINE.

Although the growth in the importance and usefulness of natural-gas gasoline has been rapid, its production has been accompanied by many problems and obstacles. The production of natural gas is generally subordinated to the production of petroleum, except in fields that are strictly gas territory. The contracts between the gas producer and the gasoline manufacturer provide as a rule that the production of gasoline shall not interfere with the production of petroleum, a restriction which has naturally retarded the output of natural-gas gasoline.

Summer temperatures, otherwise favorable to the production of natural-gas gasoline, cause some difficulties in cooling the water necessary for condensation. Cold weather, although theoretically favorable to increased production, by aiding in condensation, may cause the freezing of pipe lines and thereby interrupt the production of both gasoline and petroleum.

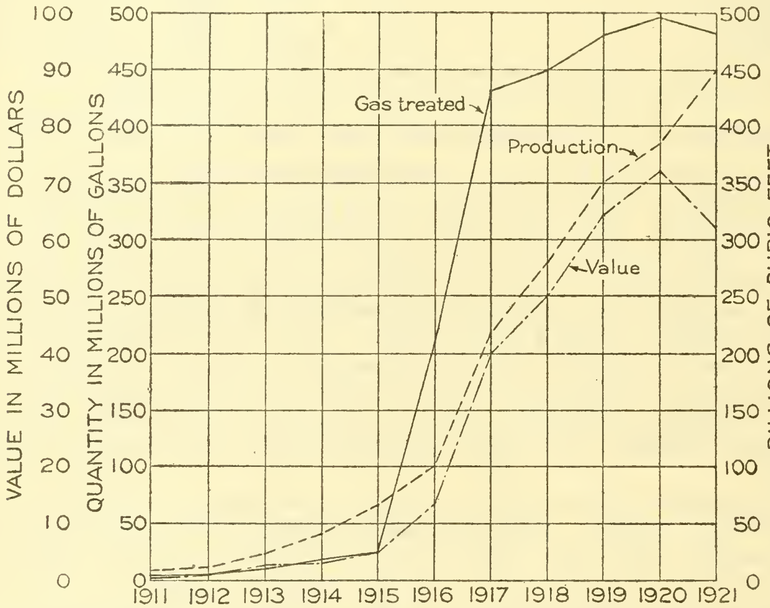

FIGURE 10.—Quantity and value of natural-gas gasoline produced and volume of natural gas treated at plants, 1911-1921.

Another difficulty that frequently confronts manufacturers of gasoline, especially where the quantity of gas from individual leases is small, is that after the gasoline has been extracted from the gas the quantity of gas remaining is not enough to operate the "oil lease." It is generally provided in the gas contract that the "oil lease" shall be supplied by the gasoline manufacturers with sufficient fuel for its operations and that the oil producers shall have the right of using the untreated gas in case of an insufficient fuel supply. It often happens, therefore, that gas is withdrawn from the gasoline plant until another supply of fuel gas is provided by the gasoline manufacturer. This frequently results in temporarily discontinuing the operation of the gasoline plant, especially in winter, when the demands for gas on the leases are greatly increased.

The problem of waste is important. Waste of gas commences with the bringing in of the first well. It is desirable to begin the removal of the gasoline promptly, but until the lease has been developed by several wells and the volume of gas ascertained a plant can not be profitably installed.

Good profits in the natural-gas gasoline business by some operators have led to careless investment by others who were not familiar with the conditions. A large number of plants have been hastily constructed and are not in accordance with standardized plans. Other plants are operated by workers who are not well acquainted with the mechanical equipment; the general result is hard usage of the machinery, which requires early replacement at large additional expenditures, which in turn wipe out any profits that have been made.

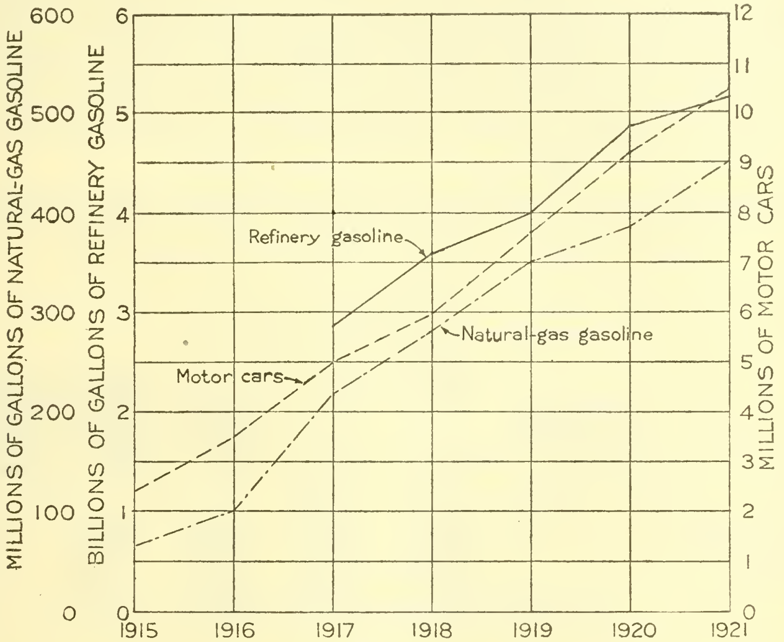

FIGURE 11.—Increase in the production of gasoline and in motor-car registrations in the United States, 1915–1921.

RELATION OF NATURAL-GAS GASOLINE TO THE SUPPLY OF MOTOR FUEL.

The importance of natural-gas gasoline is shown by the increasing demand for it. Although it constitutes only about 10 per cent of the total gasoline produced annually, its importance lies not only in the actual quantity produced, but in the fact that by blending it renders available as motor fuel at least an equal quantity of naphtha, which by itself is not a satisfactory motor fuel. The natural-gas gasoline industry has therefore come to have an important bearing on the petroleum-refining industry and on the marketing of gasoline. The increasing production and the growth of the practice of blending have made natural-gas gasoline a potent factor in the supply of motor fuel. Natural-gas gasoline is a high-grade gasoline and when mixed with "straight-run gasoline" or other petroleum products becomes an ideal motor fuel.

For many years the natural-gas gasoline industry has been unstable, largely because of misunderstandings between the producers, refiners, and consumers. At present, however, the conditions are more favorable, and it can safely be said that the industry is bound to have a prosperous future.

The problem of a future supply of natural-gas gasoline is one that directly affects the motor-fuel situation in general. There is no immediate indication of a decline in volume produced, but it is questionable whether the production will keep pace with the increasing demand for motor fuel. A decline in the supply of natural gas would automatically cause a decline in the supply of natural-gas gasoline. Aside from new gas fields that may be found and developed there is only one additional potential source of natural-gas gasoline, namely, the fields whose gas yields so little gasoline that under the present economic conditions it can not be profitably recovered. If by an improvement in method gas having a low gasoline content could be treated at a profit, it might become possible to increase the production to a small extent.

STATISTICS OF NATURAL-GAS GASOLINE, BY STATES.

Natural-gas gasoline produced in the United States in 1921, by States.

CALIFORNIA.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gasoline produced.		Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
			Gallons.	Value.			
Kern[b]	5	20	22,785,673	$4,370,956	25,718,434	0.64–1.50	66–78
Santa Barbara	4	7	4,324,939	772,012	1,902,536	2.00–2.40	72–83
Los Angeles[c]	5	7	3,685,518	593,337	11,315,400	.06–.85	63–70
Orange	5	6	3,669,840	672,847	5,703,548	.27–1.66	70–78
Ventura	3	3	2,481,404	498,550	1,783,502	1.16–1.50	76–85
	18	43	36,947,374	6,907,702	46,423,420	.06–2.40	63–85

Produced by absorption.[d]

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
Kern[c]	8	13	7,125,646	$943,616	10,698,269	0.50–1.20	57–75
Santa Barbara	3	3	6,206,584	997,389	2,547,463	2.00–2.50	79–83
Los Angeles[c]	3	3	5,481,949	643,530	7,086,907	.73–1.50	67
Orange[c]	6	8	1,760,431	345,056	2,395,281	.17–1.50	55–95
Fresno	1	2	698,514	37,301	204,708	.78	77
Ventura	1	1				1.00	74
	16	30	21,273,124	2,966,892	22,932,628	.17–2.50	55–95
Grand total	29	73	58,220,498	9,874,594	69,356,048	.06–2.50	55–95
Total, 1920	30	70	48,207,976	8,323,819	43,772,395	.06–4.00	43–88
Total, 1919	30	60	40,385,796	5,744,867	39,647,251	.02–2.80	47–81

[a] This number is irrespective of the kind, number, and location of the plants operated. The sum of the number of operators listed for each method employed and for each county will therefore not give the correct number of operators in the State.
[b] Includes four combination compression and absorption plants.
[c] Includes one combination compression and absorption plant.
[d] Includes drip gasoline.

Natural-gas gasoline produced in the United States in 1921, by States—Continued.

ILLINOIS.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gasoline produced. Gallons.	Gasoline produced. Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
Lawrence	12	28	3,644,104	$551,884	1,100,992	1.00–6.00	78–100
Crawford	24	54	3,367,475	483,683	1,632,601	1.00–4.37	68–98
Cumberland	2	3	382,993	47,298	279,641	1.75–1.80	80–81
Clark [e]	4	5	141,501	18,362	89,012	1.30–3.00	80–82
	34	90	7,536,073	1,101,227	3,102,246	1.00–6.00	68–100
Total, 1920	38	92	6,054,916	1,307,980	2,889,334	.4 –6.0	66–98
Total, 1919	42	93	6,059,828	1,115,083	3,160,907	.5 –6.0	70–98

KANSAS.

Produced by compression and by vacuum pumps.

County.	Number of operators.	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Chautauqua	5	6	1,403,419	$243,270	567,221	1.0–3.0	74–82
Butler	1	1	100,953	19,379	184,750	2.0	81
Wilson	1	1				1.5	85
	7	8	1,504,372	262,649	751,971	1.0–3.0	74–85

Produced by absorption.

County.	Number of operators.	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Cowley	1	1	1,405,998	$204,573	2,564,274	0.50	82
Montgomery	2	2	676,959	98,186	4,468,094	.15	76–82
	2	3	2,082,957	302,759	7,032,368	.15–.50	76–82
Grand total	9	11	3,587,329	565,408	7,784,339	.15–3.0	74–85
Total, 1920	8	10	4,330,748	828,887	11,597,340	.10–3.20	72–82
Total, 1919	10	13	3,283,850	620,876	10,432,079	.10–2.13	64–85

KENTUCKY.

Produced by compression and by vacuum pumps.

County.	Number of operators.	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Wayne	4	4	175,285	$34,770	70,802	1–4.0	80–85
Estill	1	1	21,443	3,524	16,300	2.5	74
Morgan	1	1				.67	74
	6	6	196,728	38,294	87,102	.67–4.0	74–85

Produced by absorption.

County.	Number of operators.	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Boyd	2	2	3,506,280	$691,652	14,806,500	0.23–0.24	84–94
Martin	1	1	538,930	105,037	1,626,622	.33	84–94
	2	3	4,045,210	796,689	16,433,122	.23–.33	84–94
Grand total	8	9	4,241,938	834,983	16,520,224	.23–4.0	74–94
Total, 1920	6	9	4,497,320	1,071,628	18,939,285	.20–3.0	38–84
Total, 1919	7	9	5,136,326	1,144,746	20,216,945	.19–4.0	80–90

[a] See California table, footnote *a*.
[e] Includes 2,426 gallons of drip gasoline, valued at $427.

Natural-gas gasoline produced in the United States in 1921, by States—Continued.

LOUISIANA.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gasoline produced.		Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
			Gallons.	Value.			
Caddo	6	8	4,749,230	$422,497	1,450,393	1.0-4.8	72-78
Claiborne [c]	1	1	1,281,703	192,125	868,192	1.5	75
De Soto	4	5	1,047,815	91,400	236,280	2.5-8.6	71-80
	7	14	7,073,748	706,022	2,554,865	1.0-8.6	71-80

Produced by absorption.

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
Ouachita	4	5	2,244,561	$304,867	15,674,970	0.10-0.33	79-88
Claiborne [c]	2	2	2,076,845	199,318	[f] 1,032,918	1.20-6.30	90-96
Caddo	3	3	2,026,760	314,416	14,761,850	.80-1.30	72-96
Morehouse	1	2	1,739,794	260,969	10,275,500	.15- .21	85-88
Bossier	1	1	173,666	26,676	2,111,935	.08	68
	8	[g] 13	8,261,626	1,106,246	[f] 43,857,173	.08-6.30	68-96
Grand total	13	26	15,340,374	1,812,268	45,543,846	.08-8.6	68-96
Total, 1920	14	31	10,609,629	1,712,613	37,754,043	.06-9.0	58-96
Total, 1919	12	23	10,063,025	1,667,275	26,283,936	.03-9.7	58-88

NEW YORK.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
Allegany	3	3	336,240	$47,608	201,025	1.50-2.94	68-88
Cattaraugus	1	1	30,000	4,500	2,000	1.50	103
	4	4	366,240	52,108	203,025	1.50-2.94	68-103
Total, 1920	4	4	411,078	75,576	162,463	1.5 -5.5	68-103
Total, 1919	6	6	457,985	84,083	237,241	.2 -5.5	80-100

OHIO.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
Monroe	11	17	1,005,097	$168,655	430,375	1.0-9.0	76-87
Jefferson	8	8	324,619	52,282	145,811	1.0-4.0	74-98
Washington	7	10	193,364	29,572	144,954	1.0-2.0	76-86
Carroll	1	1	119,733	17,960	87,600	1.4	85
	21	36	1,642,813	268,469	808,740	1.0-9.0	74-98

[a] See California table, footnote [a].
[c] Includes one combination compression and absorption plant.
[f] Includes 868,192 M cubic feet of gas that was first treated at combination plants by compression and that is duplicated in the total volume of gas treated at the compression plants but not duplicated in the total for the State.
[g] Includes one combination compression and absorption plant duplicated in the total number of compression plants but not duplicated in the total number of plants for the State.

Natural-gas gasoline produced in the United States in 1921, by States—Continued.

OHIO—continued.

Produced by absorption.[d]

County.	Number of operators.[a]	Number of plants.	Gasoline produced. Gallons.	Gasoline produced. Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
Licking	2	2	3,558,117	$621,682	12,490,459	0.28–0.3	85–90
Richland	2	2	1,686,059	278,461	7,734,494	.21– .22	79–85
Fairfield	1	1	1,323,478	231,368	11,211,678	.12	90
Lorain	1	1	444,294	72,646	2,485,914	.15	81
Hocking	1	1				.56	80
Carroll[h]	......	......				....	....
Monroe[h]	......	......				....	....
Knox	2	2	377,825	61,371	824,762	.12– .5	80–85
Wayne	1	1	44,098	8,981	318,757	.14	77
Washington	2	2	23,213	3,573	13,700	1.0 –2.3	75
	6	12	7,457,084	1,278,082	35,079,764	.12–2.3	75–90
Grand total	27	48	9,099,897	1,546,551	35,888,504	.12–9.0	74–98
Total, 1920	31	59	10,015,638	2,194,558	40,215,329	.09–9.0	68–98
Total, 1919	35	59	8,800,961	1,963,763	43,609,762	.07–8.0	72–98

OKLAHOMA.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Creek	41	74	88,939,106	$10,305,669	20,042,110	1.00– 7.70	60–95
Okmulgee[c]	19	28	13,759,879	1,426,504	4,113,036	.25–13.50	58–92
Nowata	11	18	12,863,378	1,529,493	3,812,856	1.00– 4.50	73–94
Osage	10	11	8,590,865	856,206	3,554,905	.96– 4.00	74–84
Tulsa	21	23	7,640,894	946,127	2,065,915	1.25–13.50	66–92
Washington	11	14	6,296,998	729,583	2,199,373	1.50–10.00	74–90
Garfield	7	8	6,199,677	905,745	2,396,795	1.60– 3.20	84–90
Kay	3	5	3,687,533	481,726	11,549,544	1.75– 5.60	80–87
Muskogee	14	16	3,044,496	416,474	838,502	1.50– 8.00	74–86
Wagoner	5	6	2,853,872	404,626	827,853	1.00– 8.00	85–89
Rogers	6	7	2,700,384	362,918	632,292	2.28– 6.80	80–89
Pawnee	5	5	2,658,865	332,709	1,171,115	1.71– 3.40	76–82
Carter	7	11	2,554,030	341,076	2,960,881	.60– 2.15	75–90
Payne	4	6	2,175,486	204,204	2,074,340	1.00– 2.00	75–87
Noble	1	1	1,774,559	231,653	470,197	4.00	82
Oklahoma	1	1				2.00	84
	108	234	165,740,022	19,474,713	58,709,714	.25–13.50	58–95

Produced by absorption.[d]

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Osage	4	8	7,465,151	$1,035,336	10,956,727	1.10 – 3.00	72–82
Creek	11	15	4,319,731	560,158	6,731,191	.12 – 5.00	57–88
Okmulgee[c]	4	6	2,498,555	243,987	[i] 1,048,264	.185– 6.50	74–90
Pawnee	2	4	1,891,379	313,266	1,400,880	1.00 – 2.00	74
Carter	1	1	1,314,873	138,062	806,603	1.60	85
Payne	2	3	922,305	114,910	3,377,000	.20 – 2.00	82–86
Kay	3	4	498,958	69,824	2,518,675	.15 – .20	70–78
Washington	2	2	281,699	56,165	193,736	2.00	60
Okfuskee	1	1	275,210	44,391	228,399	1.20	82
Oklahoma	1	1	60,923	6,974	2,030,770	.03	....
Tulsa	1	1	36,000	3,600	36,000	1.00	70
Nowata[h]	......	......	28,000	3,080	....	....	65
Lincoln	1	1	7,936	1,548	350,000	.03	70–78
	23	[g]47	19,600,720	2,591,301	[i] 29,678,245	.03 – 6.50	57–90
Grand total	123	280	185,340,742	22,066,014	88,380,173	.03 –13.50	57–95
Total, 1920	141	315	178,856,929	31,334,493	85,167,518	.12 – 9.80	38–95
Total, 1919	161	329	189,995,038	32,564,532	100,776,135	.05 – 9.22	28–96

[a] See California table, footnote *a*.
[c] Includes one combination compression and absorption plant.
[d] Includes drip gasoline.
[g] Includes one combination compression and absorption plant duplicated in total number of compression plants but not duplicated in the total number of plants for the State.
[h] Drip gasoline only.
[i] Includes 7,786 M cubic feet of gas that was first treated at combination plants by compression and that is duplicated in the total volume of gas treated at the compression plants but not in the total for the State.

Natural-gas gasoline produced in the United States in 1921, by States—Continued.

PENNSYLVANIA.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gasoline produced. Gallons.	Gasoline produced. Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
Warren	35	49	2,765,010	$423,000	894,696	1.00-8.00	72-92
Forest	11	16	2,268,942	325,801	754,287	.67-9.30	74-94
McKean	7	8	1,541,526	235,226	844,487	.75-2.60	72-90
Butler	73	95	1,536,357	247,336	733,863	.20-8.00	68-92
Allegheny	6	15	1,321,613	220,534	462,015	1.00-6.50	78-90
Venango	8	10	767,636	100,339	324,451	.38-7.00	82-98
Crawford	8	9	727,333	97,659	363,366	1.00-4.00	76-90
Washington	4	7	212,991	34,576	80,744	1.00-3.40	75-85
Clarion	10	12	207,246	31,512	483,776	.13-2.00	75-90
Beaver	8	9	175,404	33,608	86,060	1.50-3.00	76-90
Armstrong	4	5	34,450	6,547	43,550	1.06-4.00	72-84
	160	235	11,558,508	1,756,138	5,071,295	.13-9.30	68-98

Produced by absorption.[d]

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Greene	2	4	2,143,611	$409,489	8,688,802	0.05-0.26	77-83
Warren	2	4	1,270,106	245,466	5,350,870	.23- .55	71-88
Washington	4	4	1,229,344	237,770	5,114,572	.12- .24	78-88
Venango	1	2	1,126,372	225,773	4,041,059	.34	74-88
McKean	1	2	882,403	166,245	7,294,668	.12	90
Elk	2	2	383,600	67,406	1,701,211	.18- .64	80-85
Allegheny	1	2	346,442	68,315	4,724,862	.07	82
Clarion	2	2	332,426	66,079	2,687,330	.11- .19	82-88
Potter	2	2	257,047	45,354	954,337	.20- .43	85
Forest	2	2	248,790	50,565	223,877	1.10-1.50	88
Armstrong	1	2	40,005	8,185	425,541	.09	81
Beaver	1	1	22,520	4,808	57,750	.50	76
Butler[h]			15,199	2,640			60-84
	11	29	8,297,865	1,598,095	41,264,879	.05-1.50	60-90
Grand total	170	264	19,856,373	3,354,233	46,336,174	.05-9.30	60-98
Total, 1920	207	306	21,151,135	4,382,380	60,951,697	.09-8.0	70-96
Total, 1919	241	343	20,283,336	4,407,318	56,280,578	.08-9.4	60-98

TEXAS.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Wichita	20	36	50,441,910	$6,063,203	7,492,733	2.0-7.9	75-98
Eastland[c]	6	15	17,618,053	1,884,522	6,036,264	1.7-7.4	75-92
Williamson	1	1	376,680	86,602	315,336	5.0	75-80
Stephens	1	1				1.5	85
Palo Pinto	1	1	55,925	6,711	111,850	2.0	80
	20	54	68,492,568	8,041,038	13,956,183	1.5-7.9	75-98

Produced by absorption.[d]

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Stephens	4	7	4,900,048	$564,034	6,883,227	0.50-0.71	60-82
Clay	1	1	2,408,628	378,353	3,560,988	.94	84
Shackleford	1	1				.16	76
Wichita[h]							80
Eastland[c]	3	3	1,339,957	134,995	[j] 2,125,407	.31-2.4	74-80
	7	[g] 12	8,648,633	1,077,382	[j] 12,569,622	.16-2.4	60-84
Grand total	24	65	77,141,201	9,118,420	26,460,805	.16-7.9	60-98
Total, 1920	20	42	32,956,028	5,770,809	15,852,213	.40-8.06	72-92
Total, 1919	15	24	9,336,437	1,772,503	8,732,133	.14-7.40	54-90

[a] See California table, footnote [a].
[c] Includes one combination compression and absorption plant.
[d] Includes drip gasoline.
[g] Includes one combination compression and absorption plant duplicated in total number of compression plants but not duplicated in the total number of plants for the State.
[h] Drip gasoline only.
[j] Includes 65,000 M cubic feet of gas that was first treated at combination plants by compression and that is duplicated in the total volume of gas treated at the compression plants but not duplicated in the total for the State.

Natural-gas gasoline produced in the United States in 1921, by States—Continued.

WEST VIRGINIA.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gasoline produced. Gallons.	Gasoline produced. Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
Kanawha [k]	8	12	6,338,269	$1,051,698	4,529,394	0.10-3.50	74-94
Tyler	17	47	4,457,971	747,786	1,348,356	1.00-4.40	75-96
Roane [k]	7	12	2,002,039	317,370	1,356,746	1.00-4.00	75-90
Ritchie [c]	11	13	992,686	165,946	704,955	.75-3.00	72-90
Marion [c]	2	3	796,624	120,809	2,166,664	.33- .55	73-85
Wetzel	6	10	596,020	105,849	498,666	.50-2.00	72-82
Lincoln	1	1	420,057	71,410	420,057	1.00	81
Brooke	7	10	355,085	46,207	156,547	1.00-5.00	72-92
Pleasants	7	9	145,035	20,427	66,149	.50-3.00	80-87
Harrison	1	1	137,081	26,045	82,578	1.60	80
Calhoun [c]	2	2	127,998	18,095	406,933	1.50-2.40	81-90
Clay	1	1	115,694	22,549	65,700	1.80	84-94
Monongalia	1	1	110,546	21,004	221,092	.50	76
Wirt	1	1	73,365	10,788	30,000	2.25	84
Lewis	1	1	40,847	9,293	20,424	2.00	86
Doddridge [c]	2	2	40,901	6,609	332,728	.04-2.40	82-87
Hancock	3	4	28,586	4,328	7,436	1.00-11.00	86-90
Marshall	1	2	9,265	1,601	4,850	2.00	80
Wood	1	1				....	....
	55	133	16,788,069	2,767,814	12,419,275	.04-11.00	72-96

Produced by absorption.[d]

County.	Number of operators.	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield (gallons).	Gravity (°Baumé).
Kanawha [c]	7	10	8,680,395	$1,603,892	21,066,875	0.25 - 1.40	50-94
Lewis	3	6	6,766,060	1,270,226	14,602,030	.22 - .60	75-91
Wetzel	4	6	6,648,149	1,263,153	33,443,063	.112- 2.00	80-88
Cabell	1	1	3,241,979	631,862	10,159,398	.32	84-94
Jackson	1	1	2,450,788	477,659	6,631,365	.37	84-94
Harrison	2	5	2,418,971	465,613	10,870,899	.15 - .36	83-88
Doddridge	3	6	2,393,308	430,783	8,344,284	.23 - .46	82-87
Marion	2	3	2,278,568	448,377	6,494,439	.137- .33	78-87
Lincoln	1	1	886,750	150,500	4,550,000	.25	86
Pleasants	2	3	773,201	148,627	4,246,100	.18 - 3.00	80-86
Marshall	2	2	599,016	114,318	1,738,745	.112- .29	83-85
Roane [k]	3	4	436,471	69,326	519,721	.56 - 1.25	85
Calhoun [c]	1	1	130,715	20,172	449,650	.29	....
Clay	1	1	96,676	16,571	876,000	.125	76
Tyler [h]	......	......	56,937	10,968	....	....	70
	18	[l] 50	37,857,984	7,122,047	[m] 123,992,569	.112- 3	50-94
Grand total	66	179	54,646,053	9,889,861	135,483,171	.04 -11.00	50-96
Total, 1920	74	211	58,941,488	13,049,551	174,320,058	.06 - 6.5	38-96
Total, 1919	89	227	52,150,045	12,179,638	167,239,089	.07 - 9.0	62-98

[a] See California table, footnote [a].
[c] Includes one combination compression and absorption plant.
[d] Includes drip gasoline.
[h] Drip gasoline only.
[k] Includes two combination compression and absorption plants.
[l] Includes four combination compression and absorption plants duplicated in total number of compression plants but not duplicated in the total number of plants for the State.
[m] Includes 928,673 M cubic feet of gas which was first treated at combination plants by compression and that is duplicated in the total volume of gas treated at the compression plants but not duplicated in the total for the State.

Natural-gas gasoline produced in the United States in 1921, by States—Continued.

WYOMING.

Produced by compression and by vacuum pumps.

County.	Number of operators.[a]	Number of plants.	Gasoline produced. Gallons.	Gasoline produced. Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity of gasoline as produced and before blending (°Baumé).
Natrona	3	3	11,853,044	$1,312,413	3,114,097	0.12–4.70	65–85
Park	1	1	1,590,881	171,533	1,028,850	3.15	88
Big Horn	1	1				.40	88
Hot Springs	1	1	1,051,216	106,436	287,795	2.70	....
	5	6	14,495,141	1,590,382	4,430,742	.12–4.70	65–88

Produced by absorption.[d]

County.	Number of operators.[a]	Number of plants.	Gallons.	Value.	Estimated volume of gas treated (M cubic feet).	Yield of gasoline per thousand cubic feet of gas (gallons).	Gravity (°Baumé).
Carbon [h]	......	......	33,000	$3,300	....	....	....
Big Horn	1	1	29,543	5,909	128,897	0.23	76
	1	1	62,543	9,209	128,897	.23	76
Grand total	6	7	14,557,684	1,599,591	4,559,639	.12–4.70	65–88
Total, 1920	4	5	8,711,037	1,735,828	4,809,277	.22–4.5	76–90
Total, 1919	3	5	5,580,599	931,722	3,687,907	.24–3.95	71–80

[a] See California table, footnote *a*. [d] Includes drip gasoline. [h] Drip gasoline only.

PETROLEUM.[1]

By G. B. Richardson.

INTRODUCTION.

The period 1919 to 1921 was a time of readjustment after the World War, when there were profound changes in economic conditions. After the armistice was declared business was unsettled for a few months, but in the spring of 1919 a revival set in which later in the year developed into a business boom that continued into 1920. This boom lasted only a few months and was followed by a period of deflation marked by a drastic fall in commodity prices, which reached a low level in the summer of 1921 and remained low for the rest of the year. During 1922 there has been an upward movement of commodity prices. These fluctuations are indicated by the curve on page 296 showing changes in wholesale prices of all commodities, compiled by the Bureau of Labor Statistics (fig. 16).

The development of the petroleum industry during these years, although controlled by general economic conditions, was modified by conditions peculiar to the industry itself. The increasing demand for petroleum, which continued throughout the year 1920, the need of replenishing stocks of crude petroleum, which had been depleted during the war, an awakened realization of the importance of petroleum, and unprecedented high prices greatly stimulated the industry, and its prosperity was maintained for several months after the depression in general business had become marked. But when at last the pressure of general conditions could no longer be resisted the petroleum industry suffered a reaction which carried it in a few months from great prosperity to a depression more pronounced than that which affected many other industries. Recovery late in 1921 resulted in an advance of prices of petroleum far above the level of the price of all commodities, and from this advance there was a pronounced recession in the summer of 1922. This recession had been indicated by the excess of supply over even the increasing demand. Large imports and greatly augmented domestic production—which for many months was maintained at the previously unequaled high rate of one and one-half million barrels a day—resulted (despite the large demand) in the greatest accumulation of stocks on record, amounting on the last day of June, 1922, to nearly 256 million barrels, equivalent to a supply for 159 days at the current rate of consumption. This quantity of stocks, however, when measured in terms of days' supply, is not so great as the smaller quantity held in 1915 at the time of the development of the Cushing field, when the stocks, amounting to 194 million barrels, were equivalent to a supply for 244 days.

[1] The statistical tables in this report have been prepared, unless otherwise indicated, by Misses A. B. Coons, M. N. Schellenger, A. L. Clapp, C. M. Shanner, and E. V. Shockey, of the United States Geological Survey.

Statistics of crude petroleum for the years 1918 to 1921 are summarized in the following condensed statement:

Condensed summary of statistics of crude petroleum, 1918–1921.

[Thousands of barrels of 42 U. S. gallons.

	1918	1919	1920	1921
Production	355,928	378,367	442,929	472,183
Imports	37,736	52,822	106,175	125,364
Withdrawn from stocks [a]	23,510	....	....	....
	417,174	431,189	549,104	597,547
Indicated consumption [b]	412,273	420,462	530,532	526,032
Exports	4,901	6,019	8,757	8,940
Added to stocks [a]	....	4,708	9,815	62,575
	417,174	431,189	549,104	597,547

[a] Pipe-line, tank-farm, and producers' stocks plus stocks of Mexican petroleum held in the United States by importers.
[b] Deliveries to consumers.

The total quantity of crude petroleum handled by the industry in the United States was 417 million barrels in 1918 and 598 million barrels in 1921, showing an increase in three years of 43 per cent. Production increased 33 per cent, imports 232 per cent, and consumption 28 per cent. The table emphasizes contrasted conditions in the interval of three years by the fact that more than 23 million barrels of crude petroleum was withdrawn from storage during 1918, whereas more than 62 million barrels was added to stock during 1921.

On the following pages are detailed statistics of crude petroleum for the years 1919–1921 and skeleton tables for preceding years.

PRODUCTION.

DOMESTIC PRODUCTION.

The production of petroleum in the United States in 1921, amounting to 472,183,000 barrels, was more than double that of 1912 and was greater than the total production of the country down to and including 1890. The daily average production in 1921 was 1,293,652 barrels, or 318,508 barrels greater than in 1918.

A number of changes occurred in the rank of the producing States in 1921, as contrasted with 1918. Oklahoma maintained its premier position, but its lead over California was substantially reduced. Texas has easily maintained third place, which it attained in 1919. Each of these three States produced in 1921 more than 100 million barrels of petroleum, far surpassing the others. Kansas retained its position as fourth in rank but with a decreasing lead over Louisiana, which remained in fifth place; Wyoming assumed sixth place; Arkansas, which joined the producing States in 1921, took seventh place; Illinois was eighth; and Kentucky advanced to ninth place, passing West Virginia, Pennsylvania, and Ohio.

Oklahoma has produced more than 100 million barrels a year since 1916, except for a drop to 87 million barrels in 1919. In 1920 and 1921 it made large gains, owing to the discovery of many new

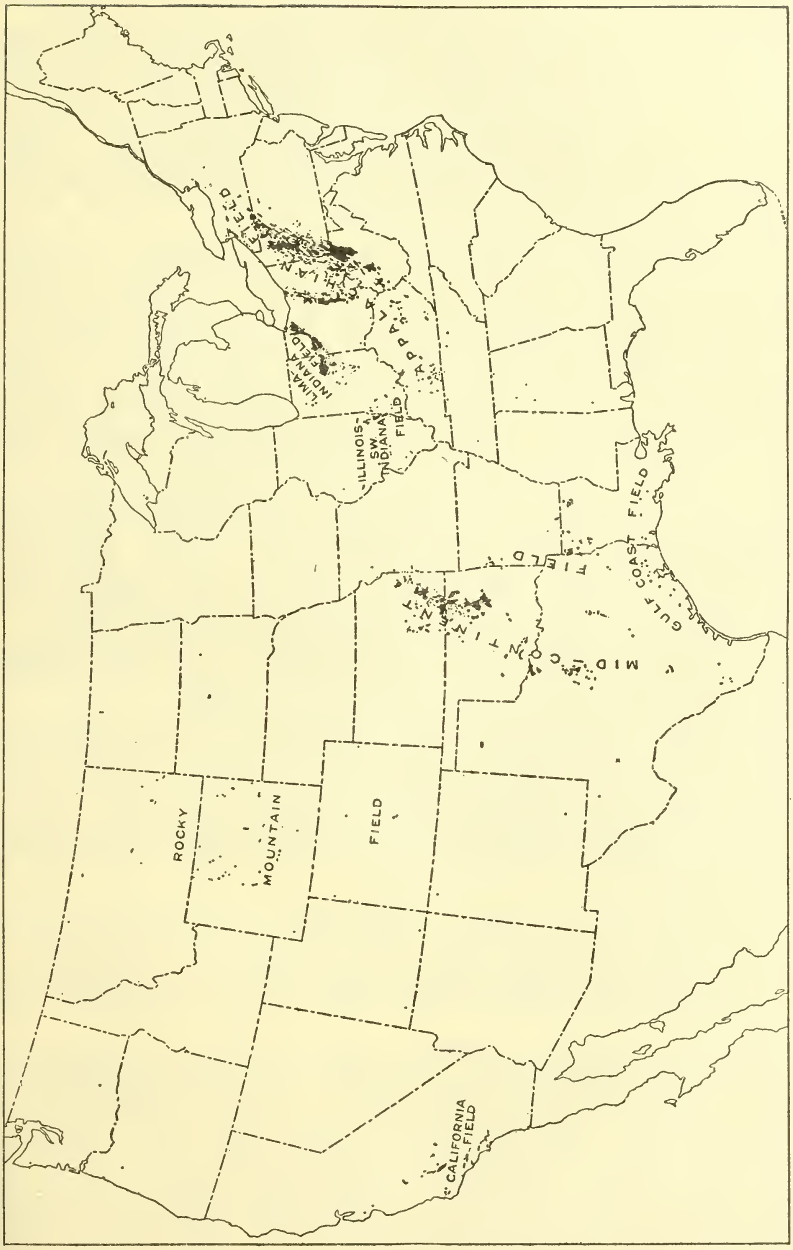

FIGURE 12.—Map of the United States showing oil and gas fields.

pools and the extension of old ones, among which were Hewitt, Beggs, Bristow, Deaner, Burbank, and others in Okmulgee, Creek, Carter, Okfuskee, and Osage counties. The production of Osage County increased from 14,454,000 barrels in 1919 to 21,592,000 barrels in 1921.

California has produced more than 90 million barrels a year since 1913, 1915 excepted, and since 1919 its annual production has been more than 100 million barrels. The increased yield of the period 1919–1921 is due primarily to intensive development of new producing areas in the Elk Hills and Huntington Beach pools. A strike in the oil fields of California during September and October, 1921, cut down the production of the State, but nevertheless the yield for the year was more than 112 million barrels.

Texas has made great gains since 1918 and passed the 100 million barrel mark in 1921. This increase was caused by the development of pools in the north-central part of the State, including Ranger, Desdemona, Breckenridge, Burkburnett, and contiguous districts of Comanche, Eastland, Stephens, and Wichita counties (in which there was great activity also in 1919 and 1920), by the bringing in of the Mexia pool in Limestone County, and by the increased production in the Gulf coast pools. The West Columbia pool, in the Gulf coast field, produced 5 million barrels in 1919, 9 million in 1920, and 12 million in 1921. The Hull pool, which was opened in 1918, was extensively developed in 1919 and 1920, and produced more than 8 million barrels in 1921, doubling the yield of 1920. The Pierce Junction pool began to yield in 1921 and produced more than 1 million barrels the first year. Deeper drilling in the old Cow Run pool, in Orange County, resulted in increased production there.

The total production of California, Oklahoma, and Texas through 1921 amounted to more than 3 billion barrels, which was equivalent to 54 per cent of the entire production of the country.

The steadily increasing growth in the production of Wyoming has been due to the development of the Salt Creek pool and to the bringing in of several new pools, among which are Rock Creek, Lost Soldier, Lance Creek, Osage, Mule Creek, and Hamilton Dome. In 1921 the Salt Creek pool, which has not yet been developed to its maximum capacity, produced 12,172,000 barrels, more than three times its yield in 1917.

Kansas attained its peak in 1918, when the production of the Eldorado field was at its height, and the pools since discovered in Butler, Marion, and Greenwood counties have not prevented a loss in production, the output in 1921 being 9 million barrels less than in 1918.

Louisiana's output of petroleum has greatly increased during the last few years because of the bringing in of highly productive new pools in the northern part of the State. The Bull Bayou pool was discovered late in 1918, the Homer pool in 1919, and the Haynesville pool in 1921. The Homer pool, which produced 2 million barrels in 1919, yielded more than 10 times that quantity in 1920, but the production declined in 1921. This pool is credited with wells of unusually large initial daily production, the yield of some being estimated as high as 30,000 barrels.

In Arkansas the discovery of the El Dorado pool in 1921 brought that State into the list of oil producers, and its output of more than 10 million barrels gave it the distinction of having produced more oil during its first year than any other State.

The only petroleum produced in Montana for several years came from a small area lying near the Wyoming boundary and constituting the northern extension of the Elk Basin pool, but discoveries in 1920 and 1921 of oil in the Devils Basin, Cat Creek, and Soap Creek pools give promise of increasing production, although oil has been marketed only from the Cat Creek field.

In the Eastern States there has been little change in production during the last few years except in Illinois, where the annual production has declined 3 million barrels since 1918, and in Kentucky, where the production has doubled since 1918 and has remained approximately 9 million barrels during 1919, 1920, and 1921. The increased production in Kentucky has been due chiefly to developments in Lee, Estill, Allen, and Warren counties, decreased production in the two former counties in 1921 being counterbalanced by increases in Warren County. In Pennsylvania, West Virginia, and Ohio, whose peak was reached between 1890 and 1900, production for the last few years has been with little change between 7 and 8½ million barrels a year. In these old producing States continued activity has resulted in the occasional finding of small new pools and in the extension of many of the old pools by deeper drilling, which has found oil in lower sands not formerly reached. A campaign of deep drilling during the last few years has been conducted in Pennsylvania and West Virginia by the Peoples Natural Gas Co. and the Hope Natural Gas Co. This campaign culminated in the drilling of the deepest well in the world, on the J. H. Lake farm, near Fairmont, Marion County, W. Va., which was abandoned in 1919 at a depth of 7,579 feet. In addition to the deeper drilling, the production of the older fields has been maintained and locally increased by the application of more efficient field methods and in certain districts by flooding or the so-called "water drive," by which the pressure in depleted sands is increased by allowing water to enter the sands through wells. For the past few years flooding has been successfully practiced in the Bradford district of Pennsylvania and New York, where conditions are especially favorable. The effect of flooding is indicated by the figures of production for New York, whose yield increased from 809,000 barrels in 1918 to 988,000 barrels in 1921.

The figures of production given in the following tables for 1919–1921 were obtained by combining monthly and annual reports to the United States Geological Survey. Monthly reports of pipe-line and other companies, which give the quantity of petroleum transported from producing properties, constitute the preliminary data published in the Geological Survey's monthly press bulletin "Statistics of crude petroleum." To these figures are added, to complete the record of production, the quantity of petroleum consumed for fuel on the leases and the net change in stocks held on producing properties on the first and last days of the year as reported annually by producers to the Geological Survey. Prior to the year 1919 producers' stocks were not taken into account in the figures of production published by the Geological Survey, and in the statistical reports for the years 1914 to

1917, inclusive, this fact was indicated by the use of the terms "marketed production" and "petroleum marketed."

The degree of detail in which the Geological Survey can present statistics of production is determined by the data supplied by pipe-line companies. Detailed figures by months showing petroleum transported from producing properties can be compiled for isolated pools like those of the Gulf coast field and of northern Louisiana and Wyoming, the records of which are kept separately on the books of the companies. But in States like Oklahoma and Pennsylvania, where the pools are close together and where different pipe-line companies have different boundaries delimiting their field districts, it is not practicable for the Survey to obtain data of production by pools.

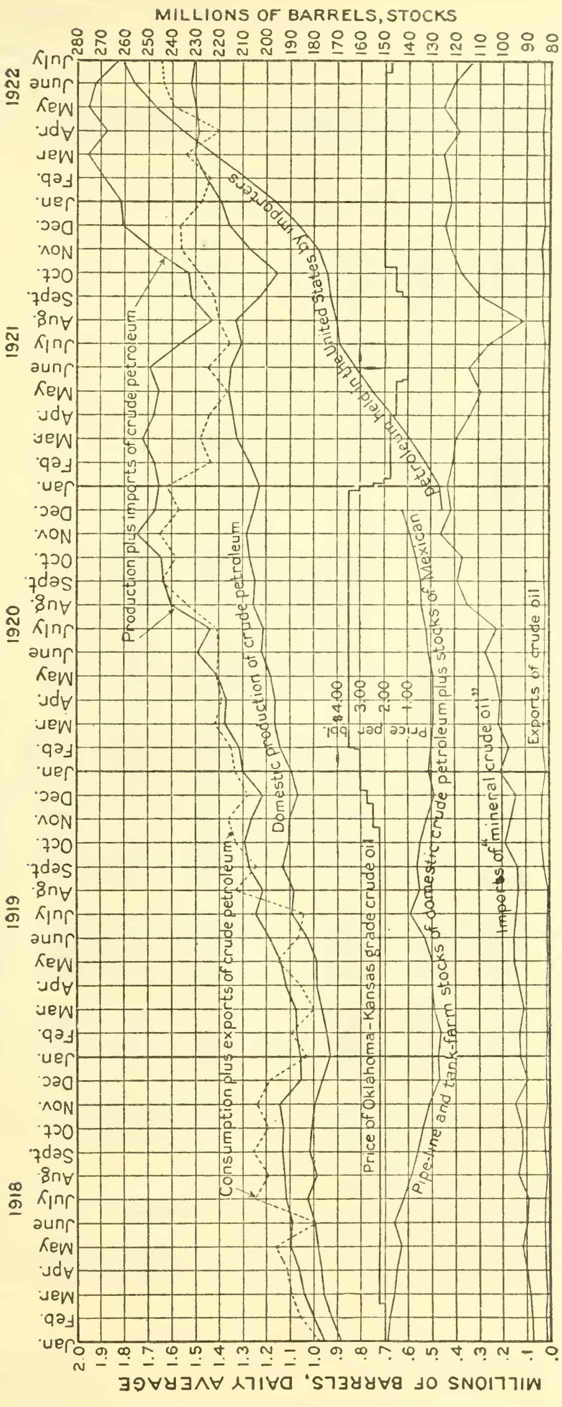

FIGURE 13.—Daily average production, imports, consumption, and exports of crude petroleum; stocks at the end of each month; and price of Oklahoma-Kansas grade crude oil, 1918–1922.

Petroleum produced in

[Thousands of barrels

Year.	New York.	Pennsylvania.	West Virginia.	Kentucky.	Tennessee.	Ohio.	Indiana.	Illinois.	Kansas.	Oklahoma.
1859-1875	....	74,072	....	....	....	....	....	....	....	....
1876	....	8,969	120	....	....	32	....	....	....	....
1877	....	13,135	172	....	....	30	....	....	....	....
1878	....	15,164	180	....	....	38	....	....	....	....
1879	....	19,685	180	....	....	29	....	....	....	....
1880	(a)	[a] 26,028	179	....	....	39	....	....	....	....
1881	(a)	[a] 27,376	151	....	....	34	....	....	....	....
1882	6,685	23,368	128	....	....	40	....	....	....	....
1883	4,004	19,125	126	[b] 5	(b)	47	....	....	....	....
1884	3,231	20,541	90	[b] 4	(b)	90	....	....	....	....
1885	2,658	18,118	91	[b] 5	(b)	662	....	....	....	....
1886	2,151	23,647	102	[b] 5	(b)	1,783	....	....	....	....
1887	2,075	20,281	145	[b] 5	(b)	5,023	....	....	....	....
1888	(a)	[a] 16,489	119	[b] 5	(b)	10,011	....	....	....	....
1889	1,897	19,591	544	[b] 5	(b)	12,472	33	1.5	0.5	....
1890	(a)	[a] 28,458	493	[b] 6	(b)	16,125	64	1	1	....
1891	1,585	31,424	2,406	[b] 9	(b)	17,740	137	.5	1.5	(c)
1892	1,273	27,149	3,810	[b] 7	(b)	16,363	698	1	5	(c)
1893	1,032	19,283	8,446	[b] 3	(b)	16,249	2,335	1	18	(c)
1894	942	18,078	8,577	[b] 2	(b)	16,792	3,689	(c)	40	(c)
1895	913	18,231	8,120	[b] 2	(b)	19,545	4,386	(c)	44	(c)
1896	1,205	19,379	10,020	[b] 2	(b)	23,941	4,681	(c)	114	(c)
1897	1,279	17,983	13,090	(c)	(b)	21,561	4,122	1	81	1
1898	1,205	14,743	13,615	[b] 6	(b)	18,739	3,731	(c)	72	....
1899	1,321	13,054	13,911	[b] 18	(b)	21,142	3,848	(c)	70	....
1900	1,301	13,258	16,196	[b] 62	(b)	22,363	4,874	(c)	75	6
1901	1,207	12,625	14,177	[b] 137	(b)	21,648	5,757	(c)	179	10
1902	1,120	12,064	13,513	[b] 185	(b)	21,014	7,481	(c)	332	37
1903	1,163	11,355	12,900	[b] 554	(b)	20,480	9,186	....	932	139
1904	1,113	11,126	12,645	[b] 998	(b)	18,877	11,339	....	4,251	1,367
1905	1,118	10,437	11,578	[b] 1,217	(b)	16,347	10,964	181	[f] 12,014	(f)
1906	1,243	10,257	10,121	[b] 1,214	(b)	14,788	7,674	4,397	[f] 21,718	(f)
1907	1,212	10,000	9,095	[b] 821	(b)	12,207	5,128	24,282	2,410	43,524
1908	1,160	9,424	9,523	728	....	10,859	3,283	33,686	1,801	45,799
1909	1,135	9,299	10,745	639	....	10,633	2,296	30,898	1,264	47,859
1910	1,054	8,795	11,753	469	....	9,916	2,160	33,143	1,128	52,029
1911	953	8,248	9,796	472	....	8,817	1,695	31,317	1,279	56,069
1912	874	7,838	12,129	484	....	8,969	970	28,602	1,593	51,427
1913	948	7,917	11,567	525	....	8,781	956	23,894	2,375	63,579
1914	939	8,170	9,680	503	....	8,536	1,336	21,920	3,104	73,632
1915	888	7,838	9,265	437	....	7,825	876	19,042	2,823	97,915
1916	874	7,593	8,731	1,202	1	7,744	769	17,714	8,738	107,072
1917	880	7,733	8,379	3,088	12	7,751	760	15,777	36,536	107,508
1918	809	7,408	7,867	4,368	8	7,285	878	13,366	45,451	103,347
1919	851	8,137	8,327	9,278	15	7,736	972	11,960	33,048	86,911
1920	906	7,438	8,249	8,738	14	7,400	945	10,774	39,005	106,206
1921	988	7,418	7,822	9,013	12	7,335	1,158	10,043	36,456	114,634
	[n] 56,192	[n] 757,749	318,873	45,221	62	485,838	109,181	331,002	256,959	1,159,071

[a] New York included with Pennsylvania.
[b] Tennessee included with Kentucky.
[c] Less than five hundred barrels. See Mineral Resources 1916, Part II.
[d] Missouri, and less than 500 barrels.
[e] Michigan and Missouri.
[f] Oklahoma included with Kansas.
[g] Michigan, Missouri, and Utah.

the United States, 1859–1921.

of 42 U. S. gallons.]

Arkansas.	Louisiana.	Texas.	Montana.	Wyoming.	Colorado.	California.	Other.	United States.	Value at wells (thousands of dollars).	Year.
....	....	....	....	....	....	....	....	74,072	215,781	1859–1875
....	....	....	....	....	....	12	....	9,133	22,983	1876
....	....	....	....	....	....	13	....	13,350	31,789	1877
....	....	....	....	....	....	15	....	15,397	18,045	1878
....	....	....	....	....	....	20	....	19,914	17,211	1879
....	....	....	....	....	....	40	....	26,286	24,601	1880
....	....	....	....	....	....	100	....	27,661	25,448	1881
....	....	....	....	....	....	129	....	30,350	23,631	1882
....	....	....	....	....	....	143	....	23,450	25,790	1883
....	....	....	....	....	....	262	....	24,218	20,596	1884
....	....	....	....	....	....	325	....	21,859	19,198	1885
....	....	....	....	....	....	377	....	28,065	19,996	1886
....	....	....	....	....	76	678	....	28,283	18,877	1887
....	....	....	....	....	298	690	....	27,612	17,948	1888
....	....	(*c*)	....	....	317	303	(*d*)	35,164	26,963	1889
....	....	(*c*)	....	....	369	307	(*d*)	45,824	35,365	1890
....	....	(*c*)	....	....	666	324	(*d*)	54,293	30,527	1891
....	....	(*c*)	....	....	824	385	(*d*)	50,515	25,907	1892
....	....	(*c*)	....	....	594	470	(*d*)	48,431	28,950	1893
....	....	(*c*)	....	2	516	706	(*d*)	49,344	35,522	1894
....	....	(*c*)	....	4	438	1,209	(*d*)	52,892	57,632	1895
....	....	1	....	3	361	1,253	(*d*)	60,960	58,519	1896
....	....	66	....	4	385	1,903	(*d*)	60,476	40,874	1897
....	....	546	....	6	444	2,257	(*d*)	55,364	44,193	1898
....	....	669	....	6	390	2,642	(*d*)	57,071	64,604	1899
....	....	836	....	6	317	4,325	*e* 2	63,621	75,989	1900
....	....	4,394	....	5	461	8,787	*e* 2	69,389	66,417	1901
....	549	18,084	....	6	397	13,984	*e* 1	88,767	71,179	1902
....	918	17,956	....	9	484	24,382	*e* 3	100,461	94,694	1903
....	2,959	22,241	....	12	501	29,649	*e* 3	117,081	101,175	1904
....	8,910	28,136	....	8	376	33,428	*e* 3	134,717	84,157	1905
....	9,077	12,568	....	7	328	33,099	*e* 3	126,494	92,445	1906
....	5,000	12,323	....	9	332	39,748	*g* 4	166,095	120,107	1907
....	5,789	11,207	....	18	380	44,855	*g* 15	178,527	129,079	1908
....	3,060	9,534	....	20	311	55,472	*g* 6	183,171	128,329	1909
....	6,841	8,899	....	115	240	73,011	*g* 4	209,557	127,900	1910
....	10,721	9,526	....	187	227	81,134	*g* 8	220,449	134,045	1911
....	9,263	11,735	....	1,572	206	87,269	*h* 4	222,935	164,213	1912
....	12,499	15,010	....	2,407	189	97,788	*i* 11	248,446	237,121	1913
....	14,309	20,068	....	3,560	223	99,775	*j* 8	265,763	214,125	1914
....	18,192	24,943	....	4,246	208	86,592	*j* 14	281,104	179,463	1915
....	15,248	27,645	45	6,234	197	90,952	*j* 8	300,767	330,900	1916
....	11,392	32,413	100	8,978	121	93,878	*h* 10	335,316	522,635	1917
....	16,043	38,750	69	12,596	143	97,532	*h* 8	355,928	703,944	1918
....	17,188	79,366	90	13,172	121	101,183	*i* 12	378,367	*k* 760,266	1919
....	35,714	96,868	340	16,831	111	103,377	*l* 13	442,929	1,360,745	1920
10,473	27,103	106,166	1,509	19,333	108	112,600	*m* 12	472,183	814,745	1921
10,473	230,775	609,950	2,153	89,356	11,659	1,427,383	154	5,902,051	7,464,623	

h Alaska and Michigan.
i Alaska, Michigan, Missouri, and New Mexico.
j Alaska, Michigan, and Missouri.
k Revised figures.
l Alaska, Arkansas, Missouri, New Mexico, and Utah.
m Alaska, Missouri, and New Mexico.
n Four years' production in New York included with Pennsylvania

Petroleum produced in the United States, 1919–1921, by fields.

[Thousands of barrels of 42 U. S. gallons.]

Field.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.	Value at wells (thousands of dollars).
1919.														
Appalachian	2,460	2,337	2,592	2,753	2,842	2,752	2,966	2,708	2,732	2,774	2,422	2,492	31,830	a 113,876
Lima-Indiana	237	221	230	234	265	258	268	254	228	228	181	192	2,796	6,832
Illinois and Southwestern Indiana	1,084	999	1,178	1,015	1,122	1,063	1,107	1,043	1,034	1,070	958	977	12,650	31,341
Mid-Continent	13,383	12,496	14,106	13,861	14,699	15,391	17,769	17,914	18,496	18,670	18,239	18,123	193,147	417,701
Gulf Coast	1,956	1,671	2,082	2,162	1,925	1,850	2,013	2,047	1,858	1,820	1,970	2,012	23,366	27,957
Rocky Mountain	1,078	984	1,149	1,240	1,128	1,128	1,220	1,016	1,166	1,062	1,132	1,080	13,383	19,898
California	8,636	7,840	8,614	8,362	8,605	8,435	8,676	8,630	8,378	8,589	8,123	8,295	101,183	142,611
Other	1	1	1	1	1	1	1	1	1	1	1	1	12	50
United States	28,835	26,549	29,952	29,628	30,587	30,878	34,020	33,613	33,893	34,214	33,026	33,172	378,367	760,266
1920.														
Appalachian	2,308	2,169	2,691	2,523	2,599	2,658	2,623	2,659	2,606	2,619	2,506	2,669	30,630	163,994
Lima-Indiana	151	166	213	203	219	219	222	215	213	206	186	194	2,407	8,757
Illinois and Southwestern Indiana	937	878	1,045	935	987	983	979	976	963	934	907	903	11,427	41,949
Mid-Continent	19,435	19,211	20,405	19,770	20,874	21,134	21,606	22,251	20,873	22,009	21,449	21,094	250,111	840,700
Gulf Coast	1,683	1,781	2,095	2,103	2,118	2,114	2,372	2,483	2,348	2,843	2,987	2,755	27,682	75,595
Rocky Mountain	1,189	1,186	1,337	1,324	1,375	1,542	1,546	1,519	1,587	1,718	1,435	1,524	17,282	51,294
California	8,304	7,801	8,384	8,086	8,449	8,012	8,397	8,802	8,930	9,254	9,138	9,820	103,377	178,395
Other	1	1	1	1	1	1	1	1	1	1	1	2	13	61
United States	34,008	33,193	36,171	34,945	36,622	36,663	37,746	38,906	37,521	39,584	38,609	38,961	442,929	1,360,745
1921.														
Appalachian	2,517	2,415	2,750	2,612	2,778	2,508	2,472	2,664	2,441	2,397	2,386	2,511	30,451	87,896
Lima-Indiana	209	197	215	205	215	216	194	206	193	188	173	193	2,404	5,423
Illinois and Southwestern Indiana	923	855	1,039	841	944	903	882	924	879	960	907	877	10,934	22,486
Mid-Continent	19,985	18,521	21,748	21,470	22,862	22,217	22,672	22,658	20,856	20,624	21,216	23,632	258,461	426,720
Gulf Coast	2,954	2,891	3,332	3,094	3,018	2,780	2,900	3,199	3,107	3,044	3,109	2,943	36,371	43,037
Rocky Mountain	1,563	1,632	1,737	2,033	2,121	1,995	1,285	1,617	1,525	1,661	1,669	2,112	20,950	26,033
California	9,986	9,012	10,283	9,977	10,250	9,928	10,055	9,840	7,761	6,957	8,647	9,904	112,600	203,138
Other	1	1	1	1	1	1	1	1	1	1	1	1	12	12
United States	38,138	35,524	41,105	40,233	42,1[illegible]	40,548	40,461	41,109	36,763	35,832	38,108	42,173	472,183	814,745

a Revised figures.

Petroleum produced in the United States in 1919–1921, by States.

[Thousands of barrels of 42 U. S. gallons.]

State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.	Value at wells (thousands of dollars).
1919.														
California	8,636	7,840	8,614	8,362	8,605	8,435	8,676	8,630	8,378	8,589	8,123	8,295	a 101,183	a 142,611
Colorado	12	11	11	10	11	11	10	10	10	9	8	8	121	183
Illinois	1,028	942	1,117	955	1,059	1,003	1,045	985	977	1,011	912	926	11,960	29,720
Indiana:														
Southwestern	56	57	61	60	63	60	62	58	57	59	46	51	690	1,621
Northeastern	18	17	18	22	25	24	28	28	27	29	21	25	282	663
Total Indiana	74	74	79	82	88	84	90	86	84	88	67	76	972	2,284
Kansas	2,576	2,215	2,504	2,502	2,630	2,707	2,798	2,713	3,216	3,253	3,085	2,849	33,048	77,026
Kentucky	576	658	765	859	851	913	891	799	815	773	704	674	9,278	24,597
Louisiana:														
Northern	1,164	934	1,044	1,042	1,106	1,098	1,284	1,333	1,324	1,372	1,401	1,777	14,879	24,102
Coastal	220	195	211	202	205	182	183	187	182	182	170	190	2,309	2,701
Total Louisiana	1,384	1,129	1,255	1,244	1,311	1,280	1,467	1,520	1,506	1,554	1,571	1,967	17,188	26,803
Montana	9	7	8	7	8	9	8	7	9	8	6	4	90	171
New York	75	63	75	70	71	71	75	70	72	75	64	70	851	b 3,500
Ohio:														
Central and eastern	419	380	423	432	435	429	446	422	482	484	417	453	5,222	17,164
Northwestern	219	204	212	212	240	234	240	226	201	199	160	167	2,514	6,169
Total Ohio	638	584	635	644	675	663	686	648	683	683	577	620	7,736	23,333
Oklahoma	6,948	6,558	7,277	6,968	7,352	7,051	7,603	7,435	7,577	7,714	7,210	7,218	86,911	184,100
Pennsylvania	708	614	666	694	757	674	773	699	657	695	613	587	8,137	33,688
Tennessee	1	1	1	1	1	1	2	2	2	1	1	1	15	37
Texas:														
Central and northern	2,695	2,789	3,281	3,349	3,611	4,535	6,084	6,433	6,379	6,331	6,543	6,279	58,309	132,473
Coastal	1,736	1,476	1,871	1,960	1,720	1,668	1,830	1,860	1,676	1,638	1,800	1,822	21,057	25,256
Total Texas	4,431	4,265	5,152	5,309	5,331	6,203	7,914	8,293	8,055	7,969	8,343	8,101	79,366	157,729
West Virginia	681	621	662	697	727	664	779	716	704	746	623	707	8,327	34,890
Wyoming	1,057	966	1,130	1,223	1,109	1,108	1,202	999	1,147	1,045	1,118	1,068	13,172	19,544
Other c	1	1	1	1	1	1	1	1	1	1	1	1	12	50
United States	28,835	26,549	29,952	29,628	30,587	30,878	34,020	33,613	33,893	34,214	33,026	33,172	378,367	760,266

a California State Mining Bureau. Monthly figures for California prorated on basis of average figures reported by Standard Oil Co. and Independent Oil Producers' Agency.
b Revised figures.
c Alaska, Michigan, Missouri and New Mexico.

Petroleum produced in the United States in 1919–1921, by States—Continued.

[Thousands of barrels of 42 U. S. gallons.]

State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.	Value at wells (thousands of dollars).
1920.														
California	8,304	7,801	8,384	8,086	8,449	8,012	8,397	8,802	8,930	9,254	9,138	9,820	a 103,377	a 178,395
Colorado	10	8	9	8	11	10	9	11	9	9	8	9	111	199
Illinois	887	831	993	884	936	931	926	924	903	872	847	840	10,774	39,583
Indiana:														
Southeastern	50	47	52	51	51	52	53	52	60	62	60	63	653	2,366
Northwestern	17	21	22	24	28	29	27	27	27	25	22	23	292	1,041
Total Indiana	67	68	74	75	79	81	80	79	87	87	82	86	945	3,407
Kansas	3,011	3,023	3,371	3,280	3,420	3,209	3,319	3,418	3,299	3,312	3,256	3,087	39,005	133,469
Kentucky	638	586	724	720	772	758	753	779	770	765	728	745	8,738	34,279
Louisiana:														
Northern	2,632	3,028	2,884	3,101	2,949	2,934	2,894	3,258	2,684	2,544	2,400	2,459	33,767	107,446
Coastal	184	162	169	152	154	150	153	160	148	166	169	180	1,947	5,160
Total Louisiana	2,816	3,190	3,053	3,253	3,103	3,084	3,047	3,418	2,832	2,710	2,569	2,639	35,714	112,606
Montana	6	7	8	8	8	7	8	13	38	57	93	87	340	1,045
New York	56	58	81	76	76	89	80	76	78	82	75	79	906	5,433
Ohio:														
Central and eastern	396	376	449	431	438	463	461	469	453	446	437	466	5,285	29,622
Northwestern	134	145	191	179	191	190	195	188	186	181	164	171	2,115	7,716
Total Ohio	530	521	640	610	629	653	656	657	639	627	601	637	7,400	37,338
Oklahoma	7,999	7,971	8,730	8,312	8,865	9,088	9,369	9,412	9,132	9,478	9,067	8,783	106,206	356,439
Pennsylvania	533	529	664	634	649	646	649	639	625	645	602	623	7,438	44,464
Tennessee	1	1	1	2	1	1	1	2	1	1	1	1	14	50
Texas:														
Central and northern	5,793	5,189	5,420	5,077	5,640	5,903	6,024	6,163	5,758	6,675	6,726	6,765	71,133	243,346
Coastal	1,499	1,619	1,926	1,951	1,964	1,964	2,219	2,323	2,200	2,677	2,818	2,575	25,735	70,435
Total Texas	7,292	6,808	7,346	7,028	7,604	7,867	8,243	8,486	7,958	9,352	9,544	9,340	96,868	313,781
West Virginia	684	619	772	660	663	701	679	694	679	680	663	755	8,249	50,146
Wyoming	1,173	1,171	1,320	1,308	1,356	1,525	1,529	1,495	1,540	1,652	1,334	1,428	16,831	50,050
Other d	1	1	1	1	1	1	1	1	1	1	1	2	13	61
United States	34,008	33,193	36,171	34,945	36,622	36,663	37,746	38,906	37,521	39,584	38,609	38,961	442,929	1,360,745

1921.														
Arkansas	(e)	(e)	38	328	578	908	1,429	1,929	1,428	1,329	1,278	1,228	10,473	12,746
California	9,986	9,012	10,283	9,977	10,250	9,928	10,055	9,840	7,761	6,957	8,647	9,904	a 112,600	a 203,138
Colorado	9	9	10	10	10	9	8	9	9	8	9	8	108	132
Illinois	852	785	962	765	863	823	805	846	806	890	837	809	10,043	20,632
Indiana:														
Southwestern	71	70	77	76	81	80	77	78	73	70	70	68	891	1,854
Northeastern	23	22	23	26	25	25	21	23	21	22	16	20	267	560
Total Indiana	94	92	100	102	106	105	98	101	94	92	86	88	1,158	2,414
Kansas	2,387	2,495	3,105	3,318	3,525	3,490	3,438	3,351	3,023	2,844	2,744	2,736	36,456	68,694
Kentucky	749	699	775	773	832	735	712	792	735	721	723	767	9,013	16,736
Louisiana:														
Northern	2,564	2,201	2,138	1,991	2,423	2,161	2,030	1,820	1,857	1,851	1,789	2,348	25,173	40,235
Coastal	173	171	185	172	178	167	172	155	146	143	131	137	1,930	2,234
Total Louisiana	2,737	2,372	2,323	2,163	2,601	2,328	2,202	1,975	2,003	1,994	1,920	2,485	27,103	42,469
Montana	82	118	103	102	124	120	123	126	144	161	148	158	1,509	2,373
New York	85	66	87	84	105	78	80	87	89	78	68	81	988	3,262
Ohio:														
Central and eastern	434	427	470	443	467	464	403	445	417	405	409	414	5,198	16,649
Northwestern	186	175	192	179	190	191	173	183	172	166	157	173	2,137	4,863
Total Ohio	620	602	662	622	657	655	576	628	589	571	566	587	7,335	21,512
Oklahoma	8,544	7,987	9,675	9,586	10,038	9,747	10,182	10,223	9,769	9,684	9,428	9,771	114,634	183,185
Pennsylvania	618	602	673	635	676	614	565	673	601	579	593	589	7,418	24,746
Tennessee	1	1	1	1	1	1	1	1	1	1	1	1	12	21
Texas:														
Central and northern	6,490	5,838	6,792	6,247	6,298	5,911	5,593	5,335	4,779	4,916	5,977	7,549	71,725	121,860
Coastal	2,781	2,720	3,147	2,922	2,840	2,613	2,728	3,044	2,961	2,901	2,978	2,806	34,441	40,803
Total Texas	9,271	8,558	9,939	9,169	9,138	8,524	8,321	8,379	7,740	7,817	8,955	10,355	106,166	162,663
West Virginia	630	620	744	676	697	616	711	666	598	613	592	659	7,822	26,482
Wyoming	1,472	1,505	1,624	1,921	1,987	1,866	1,154	1,482	1,372	1,492	1,512	1,946	19,333	23,528
Other f	1	1	1	1	1	1	1	1	1	1	1	1	12	12
United States	38,138	35,524	41,105	40,233	42,189	40,548	40,461	41,109	36,763	35,832	38,108	42,173	472,183	814,745

a California State Mining Bureau. Monthly figures for California prorated on basis of average figures reported by Standard Oil Co. and Independent Oil Producers' Agency.
d Alaska, Arkansas, Missouri, New Mexico, and Utah.
e Not available. Figures for subsequent months represent oil transported from producing properties plus adjustment for oil consumed for fuel on the leases and for producers' storage; for early months of the year figures are short of actual production.
f Alaska, Missouri, and New Mexico.

Petroleum produced in coastal Texas, 1901–1921, by districts.

[Thousands of barrels of 42 U. S. gallons.]

Year.	Batson.	Blue Ridge.	Damon Mound.	Dayton.	Goose Creek.	Hull.	Humble.	Markham.	Orange.	Pierce Junction.	Saratoga.	Sourlake.	Spindletop.	West Columbia.	Other.	Total.
1901													3,593			3,593
1902											(a)	a 45	17,421			17,466
1903	5										(a)	a 8,848	8,601			17,454
1904	10,905										735	6,442	3,438		152	21,672
1905	3,775			60			15,594				3,125	3,362	1,653		47	27,616
1906	2,290			93			3,571				2,182	2,156	1,077		81	11,450
1907	2,164			108			2,930				2,131	2,354	1,700		23	11,410
1908	1,594			40	(b)		3,778	62			1,635	1,595	1,747		32	10,483
1909	1,206			18	(b)		3,237	28			1,183	1,704	1,388		88	8,852
1910	1,114			10	(b)		2,496	455			1,024	1,519	1,182		130	7,930
1911	1,023			4	(b)		2,426	560			926	1,365	966		5	7,275
1912	845			12	44		1,830	611			1,117	1,175	823		3	6,460
1913	741			13	250		1,505	293	18		938	1,348	716		3	5,825
1914	776			19	135		2,799	163	43		890	5,209	580		3	10,617
1915	704			10	119		11,062	137	22		864	4,115	388		48	17,469
1916	745			9	397		10,926	157	18		781	4,923	341		45	18,342
1917	693		c 124	10	7,300		7,390	127	7		683	4,763	380	(c)	36	21,513
1918	635		c 283	9	8,944	245	6,555	65			722	3,408	557	(c)	47	21,470
1919	560		191	8	5,770	1,273	3,706	54			737	2,709	407	5,611	31	21,057
1920	527	92	379	17	4,476	3,909	3,607	57			849	2,024	322	9,459	17	25,735
1921	495	326	666	40	4,640	8,150	3,004	49	470	1,239	1,129	1,802	344	12,081	6	34,441

a Sourlake includes Saratoga. b Included under "Other." c Damon Mound includes West Columbia.

Petroleum produced in coastal Texas, 1919–1921, by districts and months.

[Thousands of barrels of 42 U. S. gallons.]

District.	Petroleum transported from producing properties.													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31.	Production.
	January	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.		
1919.															
Batson	47	44	46	47	47	43	45	43	42	42	40	39	525	+35	560
Damon Mound	12	14	19	17	13	14	13	18	19	16	16	20	191	......	191
Dayton	1	1	.....	1	1	1	1	.....	1	1	.....	.....	8	......	8
Goose Creek	620	502	515	495	505	431	472	444	348	340	368	369	5,409	+361	5,770
Hull	62	38	51	80	75	84	93	96	94	113	199	190	1,175	+98	1,273
Humble	329	297	286	268	278	278	264	244	229	230	218	212	3,133	+573	3,706
Markham	2	3	3	7	7	6	4	2	4	4	4	5	51	+3	54
Saratoga	55	51	58	57	68	59	58	53	53	51	48	47	650	+87	737
Sourlake	241	203	240	220	218	201	201	187	193	182	172	174	2,432	+277	2,709
Spindletop	40	36	39	36	36	33	33	30	30	29	28	27	397	+10	407
West Columbia	68	53	354	481	220	267	386	483	412	370	456	479	4,029	+1,582	5,611
Other	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	......	+31	31
	1,477	1,242	1,611	1,709	1,460	1,417	1,570	1,600	1,425	1,378	1,549	1,562	18,000	+3,057	21,057
1920.															
Batson	40	38	39	39	43	41	45	43	40	42	46	47	503	+24	527
Blue Ridge	.....	.....	.....	.....	.....	.....	.....	.....	.....	30	31	6	67	+25	92
Damon Mound	16	13	16	85	56	35	22	41	31	36	23	5	379	......	379
Dayton	.....	.....	1	.....	.....	.....	.....	.....	2	4	4	5	16	+1	17
Goose Creek	347	294	294	306	298	369	445	367	327	306	394	353	4,100	+376	4,476
Hull	143	211	310	196	282	281	238	290	334	362	497	506	3,650	+259	3,909
Humble	204	181	283	214	256	276	319	345	401	350	286	256	3,371	+236	3,607
Markham	3	3	4	5	4	5	4	5	4	4	4	12	57	......	57
Saratoga	49	44	48	45	53	48	64	70	91	105	99	95	811	+38	849
Sourlake	162	160	168	163	176	164	162	164	150	145	147	154	1,915	+109	2,024
Spindletop	23	25	23	25	21	25	24	28	29	30	28	31	312	+10	322
West Columbia	454	596	682	817	716	664	837	911	735	1,205	1,203	1,047	9,867	−408	9,459
Other	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	......	+17	17
	1,441	1,565	1,868	1,895	1,905	1,908	2,160	2,264	2,144	2,619	2,762	2,517	25,048	+687	25,735
1921.															
Batson	47	42	47	42	42	41	37	38	39	28	41	36	480	+15	495
Blue Ridge	20	23	44	31	28	27	19	23	14	16	16	13	274	+52	326
Damon Mound	.....	71	.....	37	94	91	71	64	70	68	75	4	645	+21	666
Dayton	4	3	3	4	3	3	3	2	4	2	3	2	36	+4	40
Goose Creek	371	405	383	427	498	348	342	332	360	318	331	313	4,428	+212	4,640
Hull	743	881	1,007	793	652	561	559	658	612	552	452	443	7,913	+237	8,150
Humble	247	212	246	254	230	216	248	291	240	228	209	203	2,824	+180	3,004
Markham	8	5	6	4	3	2	3	4	3	3	2	2	45	+4	49
Orange	.....	.....	.....	.....	17	12	4	15	10	39	103	207	407	+63	470
Pierce Junction	.....	.....	.....	.....	.....	.....	41	108	240	208	324	265	1,186	+53	1,239
Saratoga	95	90	90	81	81	73	74	63	65	60	63	59	894	+235	1,129
Sourlake	150	133	145	155	142	132	139	183	131	123	122	127	1,682	+120	1,802
Spindletop	32	28	35	33	29	28	29	29	25	26	23	24	341	+3	344
West Columbia	893	673	970	896	850	914	988	1,063	983	1,059	1,049	937	11,275	+806	12,081
Other	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	......	+6	6
	2,610	2,566	2,976	2,757	2,669	2,448	2,557	2,873	2,796	2,730	2,813	2,635	32,430	+2,011	34,441

Petroleum produced in coastal Louisiana, 1909–1921, by districts.

[Thousands of barrels of 42 U. S. gallons.]

Year.	Anse la Butte.	Edgerley.	Jennings.	Vinton.	Other.	Total.
1909	38	....	1,967	....	26	2,031
1910	44	....	1,625	27	55	1,751
1911	63	....	1,180	2,454	28	3,725
1912	25	....	1,106	932	22	2,085
1913	6	....	791	1,889	31	2,717
1914	19	586	412	1,465	19	2,501
1915	21	1,403	435	1,234	17	3,110
1916	13	1,252	517	1,640	4	3,426
1917	5	806	399	1,595	25	2,830
1918	a 3	512	369	1,839	15	2,738
1919	....	361	347	1,592	9	2,309
1920	....	379	232	1,333	3	1,947
1921	47	250	254	1,379	....	1,930

a Estimated.

Petroleum produced in coastal Louisiana, 1919–1921, by districts and months.

[Thousands of barrels of 42 U. S. gallons.]

District.	Petroleum transported from producing properties.													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31.	Production.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.		
1919.															
Edgerley	25	26	27	23	19	19	18	24	31	29	21	31	293	+68	361
Jennings	30	26	30	29	31	25	26	26	23	22	23	23	314	+33	347
Vinton	145	123	134	130	136	118	118	116	108	112	107	117	1,464	+128	1,592
Other	1	2	1	1	.....	1	1	1	1	.....	.....	.....	9	......	9
	201	177	192	183	186	163	163	167	163	163	151	171	2,080	+229	2,309
1920.															
Edgerley	22	21	22	22	22	23	27	29	25	29	30	32	304	+75	379
Jennings	30	22	23	19	19	19	18	17	16	19	22	21	245	−13	232
Vinton	115	103	107	95	97	92	92	98	91	102	101	111	1,204	+129	1,333
Other	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	......	+3	3
	167	146	152	136	138	134	137	144	132	150	153	164	1,753	+194	1,947
1921.															
Anse la Butte	.....	.....	3	7	8	4	5	5	2	1	1	3	39	+8	47
Edgerley	26	26	27	20	17	15	17	12	15	11	13	10	209	+41	250
Jennings	22	21	20	20	19	17	21	16	15	16	16	13	216	+38	254
Vinton	108	109	118	109	116	114	112	105	98	98	85	94	1,266	+113	1,379
	156	156	168	156	160	150	155	138	130	126	115	120	1,730	+200	1,930

Petroleum produced in northern Louisiana, 1909–1921, by districts.

[Thousands of barrels of 42 U. S. gallons.]

Year.	Caddo.	De Soto.	Haynesville.	Homer.	Red River (Bull Bayou, Crichton).	Other.	Total.
1909	1,029						1,029
1910	5,090						5,090
1911	6,996						6,996
1912	7,178						7,178
1913	9,782						9,782
1914	7,572	3,834			402		11,808
1915	6,472	1,797			6,802	11	15,082
1916	5,464	1,657			4,691	10	11,822
1917	5,483	1,371			1,665	43	8,562
1918	11,144	1,066			1,046	49	13,305
1919	a 8,700	a 1,200		a 2,000	a 2,900	79	14,879
1920	6,336	(b)		21,508	b 5,923		33,767
1921	5,342	719	3,161	13,030	2,844	77	25,173

a Estimated. b De Soto included under Red River.

Petroleum produced in northern Louisiana, 1920 and 1921, by districts and months.

[Thousands of barrels of 42 U. S. gallons.]

District.	Petroleum transported from producing properties.													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31.	Production.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.		
1920.															
Caddo Field	622	523	484	460	436	464	514	612	556	551	508	571	6,301	+35	6,336
De Soto and Red River Field	648	539	541	643	495	463	457	515	450	426	366	387	5,930	−7	5,923
Homer	1,323	1,930	1,820	1,961	1,979	1,970	1,884	2,092	1,641	1,528	1,489	1,462	21,079	+429	21,508
	2,593	2,992	2,845	3,064	2,910	2,897	2,855	3,219	2,647	2,505	2,363	2,420	33,310	+457	33,767
1921.															
Caddo	528	483	515	460	482	444	427	390	412	382	366	385	5,274	+68	5,342
De Soto	62	61	68	72	66	60	62	58	57	55	52	51	724	−5	719
Haynesville					74	218	190	250	313	417	510	1,074	3,046	+115	3,161
Homer	1,625	1,348	1,204	1,143	1,503	1,172	1,099	876	837	761	638	617	12,823	+207	13,030
Red River (Bull Bayou, Crichton)	308	269	303	269	263	233	217	210	202	202	189	187	2,852	−8	2,844
Other	8	11	15	15	3	3	3	5	4	3	2	2	74	+3	77
	2,531	2,172	2,105	1,959	2,391	2,130	1,998	1,789	1,825	1,820	1,757	2,316	24,793	+380	25,173

Petroleum produced in Osage County, Okla., 1919–1921, by months.

[Petroleum transported from producing properties; thousands of barrels of 42 U. S. gallons.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	The year.
1919	1,040	933	1,102	1,083	1,213	1,207	1,281	1,322	1,356	1,371	1,273	1,273	14,454
1920	1,329	1,324	1,525	1,544	1,699	1,781	1,931	1,940	1,776	1,871	1,740	1,547	20,007
1921	1,383	1,452	1,782	1,677	1,764	1,723	1,746	1,914	1,901	1,976	2,122	2,152	21,592

Petroleum produced in Colorado, 1909–1921, by districts.

[Thousands of barrels of 42 U. S. gallons.]

Year.	Boulder.	Florence.	Other.	Total.
1909	86	225	....	311
1910	42	194	4	240
1911	38	187	2	227
1912	15	191	....	206
1913	12	177	....	189
1914	6	216	1	223
1915	6	202	....	208
1916	6	191	....	197
1917	6	114	1	121
1918	4	135	4	143
1919	5	102	14	121
1920	7	88	16	111
1921	5	83	20	108

Petroleum produced in Colorado, 1919–1921, by districts and months.

[Thousands of barrels of 42 U. S. gallons.]

District.	Petroleum transported from producing properties.													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31.	Production.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.		
1919.															
Boulder	....	1	1	....	....	....	1	....	....	1	....	1	5	......	5
Florence	11	10	10	9	10	9	7	7	8	7	7	7	102	......	102
Other	1	....	....	1	1	2	1	2	2	1	1	....	12	+2	14
	12	11	11	10	11	11	9	9	10	9	8	8	119	+2	121
1920.															
Boulder	1	1	1	....	1	1	1	....	....	....	1	....	7	......	7
Florence	7	6	7	7	9	8	7	8	8	7	7	8	89	−1	88
Other	2	1	1	1	1	1	1	2	1	2	....	1	14	+2	16
	10	8	9	8	11	10	9	10	9	9	8	9	110	+1	111
1921.															
Boulder	1	....	....	....	1	1	1	....	....	....	1	....	5	......	5
Florence	7	7	8	7	8	7	6	7	7	7	6	6	83	......	83
Other	1	2	2	3	1	1	1	2	2	1	2	2	20	......	20
	9	9	10	10	10	9	8	9	9	8	9	8	108	......	108

Petroleum produced in Wyoming, 1919–1921, by districts and months.

[Thousands of barrels of 42 U. S. gallons.]

District.	Petroleum transported from producing properties.													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31.	Production.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.		
1919.															
Big Muddy	304	274	334	308	281	265	261	250	223	208	188	187	3,083	+21	3,104
Byron-Greybull-Torchlight	2	3	4	3	3	2	2	2	2	2	1	1	27	......	27
Elk Basin	65	61	70	68	70	63	67	71	65	54	47	38	739	+1	740
Grass Creek	199	170	183	185	191	179	179	172	161	152	132	120	2,023	+26	2,049
Lance Creek	.....	.....	.....	70	48	52	29	46	55	40	41	75	456	+5	461
Lander	3	4	4	10	12	7	6	4	.....	.....	.....	1	51	+11	62
Lost Soldier	.....	.....	.....	4	21	28	25	25	14	11	.....	.....	128	+39	167
Pilot Butte	2	6	14	10	6	9	10	8	7	8	7	4	91	......	91
Rock Creek	.....	.....	.....	.....	19	14	34	34	32	31	31	37	232	+10	242
Salt Creek	472	439	510	555	447	479	578	376	578	528	662	595	6,219	+6	6,225
Other	.....	.....	.....	1	.....	1	.....	.....	.....	.....	.....	.....	2	+2	4
	1,047	957	1,119	1,214	1,098	1,099	1,191	988	1,137	1,034	1,109	1,058	13,051	+121	13,172
1920.															
Big Muddy	191	179	187	172	174	174	171	169	184	179	159	158	2,097	−14	2,083
Byron-Greybull-Torchlight	5	5	4	5	4	5	8	7	6	7	7	7	70	−1	69
Elk Basin	46	50	56	54	59	61	63	65	66	76	70	69	735	−3	732
Grass Creek	118	121	128	124	129	130	134	125	129	164	126	124	1,552	+21	1,573
Hamilton Dome-Warm Springs	2	2	1	3	5	4	5	5	5	4	4	3	43	+14	57
Lance Creek	68	47	49	36	27	20	17	16	13	16	16	27	352	+1	353
Lander	3	3	5	4	4	13	13	6	7	7	5	5	75	+9	84
Lost Soldier-Ferris	.....	.....	.....	.....	53	78	36	21	26	15	.....	1	230	−95	135
Mule Creek	.....	4	10	13	10	18	22	20	21	21	22	1	162	+20	182
Osage	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	9	10	+6	16
Pilot Butte	4	6	5	6	6	4	12	5	5	5	4	4	66	+3	69
Rock Creek	53	60	102	109	82	72	103	102	147	168	178	191	1,367	+3	1,370
Salt Creek	682	693	772	781	801	944	943	952	929	987	740	827	10,051	+39	10,090
Other	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1	.....	2	+16	18
	1,172	1,170	1,319	1,307	1,355	1,523	1,527	1,493	1,538	1,650	1,332	1,426	16,812	+19	16,831
1921.															
Big Muddy	182	188	193	171	176	164	157	148	136	141	132	128	1,916	+11	1,927
Byron-Greybull-Torchlight	6	7	6	6	7	6	7	7	8	7	6	6	79	+1	80
Elk Basin	73	64	71	74	69	59	49	45	47	49	36	44	680	+1	681
Grass Creek	135	145	158	176	182	130	95	99	93	99	94	95	1,501	−66	1,435
Hamilton Dome-Warm Springs	.....	.....	.....	5	7	6	6	10	8	8	4	5	59	+8	67
Lance Creek	35	33	36	27	23	22	24	27	22	21	52	25	347	−1	346
Lander	5	5	5	5	16	12	3	9	10	11	11	12	104	+15	119
Lost Soldier-Ferris	2	10	24	30	59	97	27	15	83	56	14	7	424	+100	524
Mule Creek	.....	.....	.....	26	26	17	.....	.....	3	.....	.....	.....	72	−4	68
Osage	9	9	12	14	16	16	21	19	17	16	13	11	173	+3	176
Pilot Butte	5	4	4	3	4	2	5	4	4	4	4	4	47	−1	46
Rock Creek	206	164	189	202	205	147	80	88	106	110	89	96	1,682	−1	1,681
Salt Creek	804	868	915	1,174	1,185	1,180	669	1,001	826	959	1,049	1,503	12,133	+39	12,172
Other	.....	.....	1	.....	1	.....	1	.....	1	1	.....	.....	5	+6	11
	1,462	1,497	1,614	1,913	1,976	1,858	1,144	1,472	1,364	1,482	1,504	1,936	19,222	+111	19,333

Petroleum produced in Wyoming, 1914–1921, by districts.

[Thousands of barrels of 42 U. S. gallons.]

Year.	Big Muddy.	Byron-Greybull-Torchlight.	Elk Basin.	Grass Creek.	Hamilton-Dome-Warm Springs.	Lance Creek.	Lander-Dallas.	Lost Soldier-Ferris.
1914		96					27	
1915	(a)	141		99			28	
1916	(a)	140	721	1,370			[b] 63	
1917	665	62	1,530	2,756			[b] 50	
1918	3,082	45	1,067	2,951			48	
1919	3,104	27	740	2,049		461	62	167
1920	2,083	69	732	1,573	57	353	84	135
1921	1,927	80	681	1,435	67	346	119	524

Year.	Mule Creek.	Osage.	Pilot Butte.	Rock Creek.	Salt Creek.	Other.	Total.
1914					3,421	16	3,560
1915					3,971	7	4,246
1916			(b)		3,933	7	6,234
1917			(b)		3,911	4	8,978
1918			62		5,337	4	12,596
1919			91	242	6,225	4	13,172
1920	182	16	69	1,370	10,090	18	16,831
1921	68	176	46	1,681	12,172	11	19,333

[a] Included under "Other." [b] Pilot Butte included with Lander-Dallas.

Petroleum produced in Montana, 1916–1921, by districts and months.

[Thousands of barrels of 42 U. S. gallons.]

Year.	Cat Creek.	Elk Basin.	Other.	Total.
1916		45		45
1917		100		100
1918		69		69
1919		90		90
1920	243	97		340
1921	1,408	75	[a] 26	1,509

[a] Devils Basin and Soap Creek.

Petroleum produced in Montana, 1919–1921, by districts and months.

[Thousands of barrels of 42 U. S. gallons.]

District.	Petroleum transported from producing properties.													Oil consumed on leases plus net change in producers' stocks, Jan. 1–Dec. 31.	Production.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.		
1919.															
Elk Basin	9	7	8	7	8	9	8	7	9	8	6	4	90	......	90
1920.															
Cat Creek	.....	.....	.....	.....	.....	.....	.....	4	28	47	83	77	239	+4	243
Elk Basin	6	7	8	8	8	7	8	9	9	9	9	9	97	......	97
	6	7	8	8	8	7	8	13	37	56	92	86	336	+4	340
1921.															
Cat Creek	68	108	87	88	109	108	113	115	131	149	140	144	1,360	+48	1,408
Elk Basin	10	7	10	8	9	6	3	4	6	4	3	5	75	......	75
Other	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	......	+26	26
	78	115	97	96	118	114	116	119	137	153	143	149	1,435	+74	1,509

Petroleum produced in California, 1919–1921, by counties.[a]

[Thousands of barrels of 42 U. S. gallons.]

County.	1919	1920	1921
Fresno	16,091	15,375	12,162
Kern	47,734	50,660	57,435
Los Angeles	15,077	14,026	12,396
Orange	14,459	15,463	22,929
San Luis Obispo } San Mateo }	31	43	31
Santa Barbara	6,089	5,804	5,466
Santa Clara	17	16	14
Ventura	1,685	1,990	2,167
	101,183	103,377	112,600

[a] California State Mining Bureau.

Petroleum produced in California, 1919–1921, by districts.

[From Standard Oil Bulletin. Thousands of barrels of 42 U. S. gallons.]

District.	1919	1920	1921
Kern River	7,563	7,457	6,716
McKittrick	2,811	2,607	2,056
Midway-Sunset	32,004	37,917	46,872
Lost Hills-Belridge	4,555	4,140	3,261
Coalinga	16,386	15,464	12,341
Lompoc and Santa Maria	6,031	5,928	5,563
Ventura County and Newhall	1,792	2,122	2,376
Los Angeles and Salt Lake	1,341	1,311	1,345
Whittier-Fullerton	28,658	28,694	31,681
Huntington Beach	....	....	2,561
Summerland	54	55	54
Watsonville and miscellaneous	27	26	24
	101,222	105,721	114,850

NOTE.—The total production in California as reported in the Standard Oil Bulletin differs slightly from the official figures, based on sworn statements of producers, as reported by the State Mining Bureau.

WORLD'S PRODUCTION.

An increasing appreciation, especially since the World War, of the importance of petroleum in modern life has resulted in a world-wide search for prospective petroleum territory. A canvass of the world's potential supply and a realization of the dwindling reserves of the United States have prompted a number of American petroleum companies to take an active part in these explorations and to extend their holdings of foreign supplies. In addition to reported finds of many promising areas, some actual discoveries of oil have been made. Thus the discovery in 1920 of petroleum in promising quantity in the Canadian Northwest, on Mackenzie River 45 miles north of Fort Norman, within 100 miles of the Arctic Circle, has revealed a

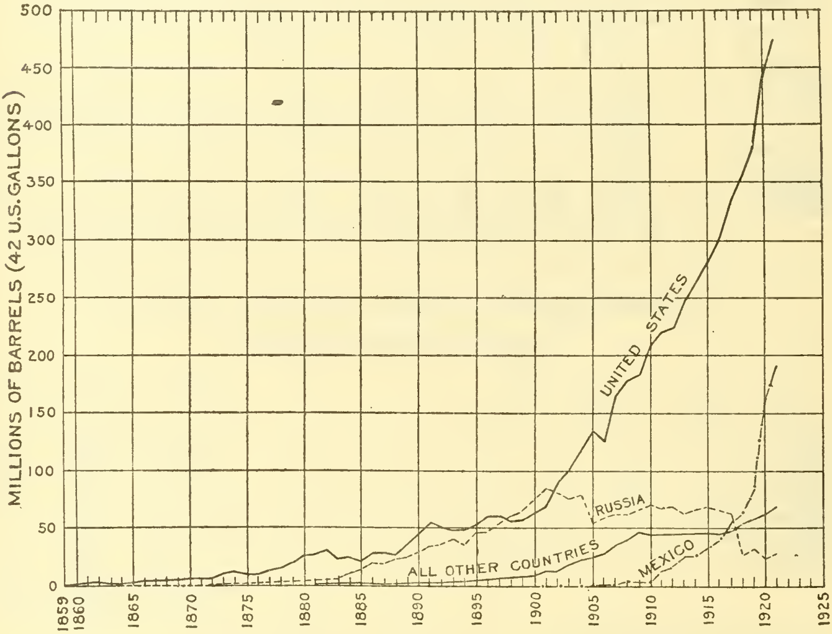

FIGURE 14.—Production of petroleum in the United States, Russia, Mexico, and all other countries, 1859–1921.

considerable territory which, though difficulties of transportation prevent its being of immediate commercial importance, is a striking indication of the present general scope of exploration.

The world's production of petroleum in 1921 amounted to 766 million barrels, of which the United States produced 62 per cent, Mexico 25 per cent, and Russia 4 per cent, as shown in the table on page 278 and in figure 14. The relative output of these three leading petroleum-producing countries has materially changed in the last few years. The United States, notwithstanding large gains, has decreased in percentage of the world's annual production from 66 per cent in 1916 and 1917 and 71 per cent in 1918 to 62 per cent in 1921. As a result of the partial collapse of the petroleum industry in Russia consequent on the World War, that country has fallen from second to third place, producing (according to soviet records) less than 30 million barrels in 1920 and 1921, as contrasted with more than 60 million barrels annually before the war. In 1912 Russia contributed more than 19 per cent of the world's production. The production of Mexico, on the other hand, in 1921 was 193 million barrels—almost eight times its production in 1913. Until the last year or two the production of Mexico has been below its potential capacity, being limited by transportation facilities. The release of tankers after the war, the increase of pipe lines, and the ready market led to great expansion, which has resulted in a much larger production. By 1921, however, it became evident that salt-water invasion menaced the life of the more productive southern fields. These conditions were not reflected in the production returns until 1922, when one well after another was abandoned and the approach of exhaustion of the developed pools in the southern part of the Tampico-Tuxpam field became certain.

Persia, by producing more than 16 million barrels of petroleum in 1921, surpassed the rapid rate of increase which it had maintained since it began to produce on a large scale in 1913. It has assumed fifth place in the list of petroleum-producing countries and apparently will soon supplant the Dutch East Indies, which for many years has ranked fourth. However, the production of the Dutch East Indies and also of Sarawak (British Borneo) has considerably increased during the last three years. Venezuela also had a noteworthy increase, as shown by its production of 1,433,000 barrels in 1921 as compared with 120,000 barrels in 1917, the date of its first credited commercial output. England's place in the list of petroleum-producing countries is due to the discovery in 1919 of oil on a faulted dome at Hardstoft, Derbyshire, where, although a number of test holes have been sunk, only one productive well has been reported.

World's production of crude petroleum,

[Thousands of barrels

Year.	Rumania.	United States.	Italy.	Canada.	Russia.	Galicia.	Japan and Formosa.	Germany.	India.	Dutch East Indies.	Peru.
1857	2										
1858	4										
1859	4	2									
1860	9	500	(a)								
1861	17	2,114	(a)								
1862	23	3,057	(a)	12							
1863	28	2,611	(a)	83	41						
1864	33	2,116	(a)	90	65						
1865	39	2,498	2	110	67						
1866	42	3,598	1	175	83						
1867	51	3,347	1	190	120						
1868	56	3,646	(a)	200	88						
1869	59	4,215	(a)	220	202						
1870	84	5,261	(a)	250	204						
1871	90	5,205	(a)	270	165						
1872	91	6,293	(a)	308	185						
1873	104	9,894	(a)	365	475						
1874	103	10,927	1	169	583	150					
1875	108	8,788	1	220	697	158	5				
1876	111	9,133	3	312	1,321	164	7				
1877	108	13,350	3	312	1,801	170	10				
1878	109	15,397	4	312	2,401	176	18				
1879	110	19,914	3	575	2,761	215	23				
1880	115	26,286	2	350	3,001	229	26	9			
1881	122	27,661	1	275	3,601	287	17	29			
1882	136	30,350	2	275	4,538	330	15	58			
1883	139	23,450	2	250	6,002	365	20	27			
1884	211	24,218	3	250	10,805	408	28	46			
1885	193	21,859	2	250	13,925	465	30	41			
1886	168	28,065	2	584	18,006	306	38	74			
1887	182	28,283	1	526	18,368	344	29	74			
1888	219	27,612	1	695	23,049	467	37	85			
1889	298	35,164	1	705	24,609	515	53	68	94		
1890	383	45,824	3	795	28,691	659	52	108	118		
1891	488	54,293	8	755	34,573	631	53	109	190		
1892	593	50,515	18	780	35,775	646	69	101	242		
1893	535	48,431	19	798	40,457	693	106	100	299	600	
1894	508	49,344	21	829	36,375	949	172	123	327	688	
1895	576	52,892	26	726	46,140	1,453	141	121	372	1,216	
1896	543	60,960	18	727	47,221	2,444	197	145	430	1,427	47
1897	571	60,476	14	710	54,399	2,226	218	166	546	2,552	71
1898	776	55,364	15	758	61,610	2,376	265	184	542	2,964	71
1899	1,426	57,071	16	808	65,955	2,314	536	192	941	1,796	89
1900	1,629	63,621	12	913	75,780	2,347	866	358	1,079	2,253	274
1901	1,678	69,389	16	757	85,168	3,251	1,111	314	1,431	4,014	275
1902	2,060	88,767	19	531	80,540	4,142	1,193	354	1,617	2,430	287
1903	2,763	100,461	18	487	75,591	5,235	1,210	446	2,510	5,770	278
1904	3,599	117,081	26	553	78,537	5,947	1,420	637	3,385	6,508	290
1905	4,421	134,717	44	634	54,960	5,766	1,473	561	4,137	7,850	373
1906	6,378	126,494	54	569	58,897	5,468	1,711	579	4,016	8,181	531
1907	8,118	166,095	60	789	61,851	8,456	2,002	757	4,344	9,983	751
1908	8,252	178,527	51	528	62,187	12,612	2,070	1,009	5,047	10,283	945
1909	9,327	183,171	42	421	65,970	14,933	1,889	1,019	6,677	11,042	1,411
1910	9,724	209,557	51	316	70,337	12,673	1,931	1,032	6,138	11,031	1,258
1911	11,108	220,449	75	291	66,184	10,519	1,659	1,017	6,451	12,173	1,465
1912	12,976	222,935	54	243	68,019	8,535	1,671	1,031	7,117	10,846	1,752
1913	13,555	248,446	47	228	62,834	7,818	1,942	857	7,930	11,172	2,071
1914	12,827	265,763	40	215	67,020	6,436	2,738	781	7,410	11,422	1,837
1915	12,030	281,104	44	215	68,548	5,352	3,118	703	8,202	11,920	2,579
1916	8,945	300,767	51	198	65,817	6,587	2,997	656	8,491	12,547	2,593
1917	3,721	335,316	41	214	63,072	6,228	2,882	642	8,079	13,180	2,577
1918	8,730	355,928	35	305	27,168	6,032	2,449	270	8,188	12,778	2,527
1919	6,618	378,367	35	241	31,752	6,096	2,237	265	8,736	15,508	2,628
1920	7,435	442,929	35	196	25,430	5,607	3,226	246	8,375	17,529	2,817
1921	8,368	472,183	34	190	29,150	5,167	2,233	274	8,734	16,958	3,699
	173,829	5,902,051	1,078	25,053	1,933,171	174,347	46,193	15,668	132,195	236,621	33,496

a Less than 1 thousand. b Estimated. c Cuba.

1857–1921, by years and countries.

of 42 U. S. gallons.]

Mexico.	Argentina.	Trinidad.	Egypt.	Persia.	Sarawak.	Algeria.	Venezuela.	France.	England.	Other countries.	Total.	Year.
......	......	......	......	......	......	......	......	......	......	......	2	1857
......	......	......	......	......	......	......	......	......	......	......	4	1858
......	......	......	......	......	......	......	......	......	......	......	6	1859
......	......	......	......	......	......	......	......	......	......	......	509	1860
......	......	......	......	......	......	......	......	......	......	......	2,131	1861
......	......	......	......	......	......	......	......	......	......	......	3,092	1862
......	......	......	......	......	......	......	......	......	......	......	2,763	1863
......	......	......	......	......	......	......	......	......	......	......	2,304	1864
......	......	......	......	......	......	......	......	......	......	......	2,716	1865
......	......	......	......	......	......	......	......	......	......	......	3,899	1866
......	......	......	......	......	......	......	......	......	......	......	3,709	1867
......	......	......	......	......	......	......	......	......	......	......	3,990	1868
......	......	......	......	......	......	......	......	......	......	......	4,696	1869
......	......	......	......	......	......	......	......	......	......	......	5,799	1870
......	......	......	......	......	......	......	......	......	......	......	5,730	1871
......	......	......	......	......	......	......	......	......	......	......	6,877	1872
......	......	......	......	......	......	......	......	......	......	......	10,838	1873
......	......	......	......	......	......	......	......	......	......	......	11,933	1874
......	......	......	......	......	......	......	......	......	......	......	9,977	1875
......	......	......	......	......	......	......	......	......	......	......	11,051	1876
......	......	......	......	......	......	......	......	......	......	......	15,754	1877
......	......	......	......	......	......	......	......	......	......	......	18,417	1878
......	......	......	......	......	......	......	......	......	......	......	23,601	1879
......	......	......	......	......	......	......	......	......	......	......	30,018	1880
......	......	......	......	......	......	......	......	......	......	......	31,993	1881
......	......	......	......	......	......	......	......	......	......	......	35,704	1882
......	......	......	......	......	......	......	......	......	......	......	30,255	1883
......	......	......	......	......	......	......	......	......	......	......	35,969	1884
......	......	......	......	......	......	......	......	......	......	......	36,765	1885
......	......	......	......	......	......	......	......	......	......	......	47,243	1886
......	......	......	......	......	......	......	......	......	......	......	47,807	1887
......	......	......	......	......	......	......	......	......	......	......	52,165	1888
......	......	......	......	......	......	......	......	......	......	......	61,507	1889
......	......	......	......	......	......	......	......	......	......	......	76,633	1890
......	......	......	......	......	......	......	......	......	......	......	91,100	1891
......	......	......	......	......	......	......	......	......	......	......	88,739	1892
......	......	......	......	......	......	......	......	......	......	......	92,038	1893
......	......	......	......	......	......	......	......	......	......	......	89,336	1894
......	......	......	......	......	......	......	......	......	......	......	103,663	1895
......	......	......	......	......	......	......	......	......	......	......	114,159	1896
......	......	......	......	......	......	......	......	......	......	......	121,949	1897
......	......	......	......	......	......	......	......	......	......	......	124,925	1898
......	......	......	......	......	......	......	......	......	......	......	131,144	1899
......	......	......	......	......	......	......	......	......	......	......	149,132	1900
10	......	......	......	......	......	......	......	......	......	b 20	167,434	1901
40	......	......	......	......	......	......	......	......	......	b 26	182,006	1902
75	......	......	......	......	......	......	......	......	......	b 36	194,880	1903
126	......	......	......	......	......	......	......	......	......	b 40	218,149	1904
251	......	......	......	......	......	......	......	......	......	b 30	215,217	1905
502	......	......	......	......	......	......	......	......	......	b 30	213,410	1906
1,005	(a)	......	......	......	......	......	......	......	......	b 30	264,241	1907
3,933	12	(a)	......	......	......	......	......	......	......	b 30	285,486	1908
2,714	18	57	......	......	......	......	......	......	......	b 20	298,711	1909
3,634	20	143	......	......	......	......	......	......	......	b 20	327,865	1910
12,553	13	285	21	......	......	......	......	......	......	b 20	344,283	1911
16,558	47	437	214	......	......	......	......	......	......	b 20	352,455	1912
25,696	131	504	98	1,857	141	......	......	......	......	b 20	385,347	1913
26,235	276	644	753	2,910	318	1	......	......	......	b 20	407,646	1914
32,911	516	750	212	3,616	392	4	......	......	......	b 10	432,226	1915
40,546	797	929	404	4,477	629	8	......	......	......	b 25	457,464	1916
55,293	1,145	1,602	943	7,147	542	9	120	......	......	c 19	502,772	1917
63,828	1,243	2,082	1,935	8,623	504	7	333	d 363	......	......	503,328	1918
87,073	1,332	1,841	1,517	10,139	596	5	425	334	2	......	555,747	1919
163,540	1,657	2,083	1,042	12,230	1,020	4	457	356	3	......	696,217	1920
193,398	2,061	2,354	1,255	16,673	1,411	3	1,433	392	3	e 50	766,023	1921
729,921	9,268	13,711	8,394	67,672	5,553	41	2,768	1,445	8	466	9,512,949	

d Production in previous years credited to Germany.

e Ecuador.

World's production of petroleum.

Country.	Production, 1921.				Total production, 1857-1921.			
	Barrels of 42 U. S. gallons.	Metric tons.	Cubic meters.	Percentage of total by volume.	Barrels of 42 U. S. gallons.	Metric tons.	Cubic meters.	Percentage of total by volume.
United States	472,183,000	64,718,000	75,069,000	61.6	5,902,051,000	808,409,000	938,323,000	62.0
Mexico	[a] 193,397,587	28,977,500	[a] 30,746,800	25.2	729,921,000	109,024,000	116,034,000	7.7
Russia	29,150,000	[b] 3,972,000	4,635,000	3.8	1,933,171,000	256,045,000	307,340,000	20.3
Dutch East Indies	16,958,105	[c] 2,361,510	2,696,000	2.2	236,621,000	32,069,000	37,619,000	2.5
Persia	[d] 16,672,540	2,223,000	2,650,600	2.2	67,672,000	9,023,000	10,759,000	.7
India	[e] 8,734,000	1,164,500	1,388,500	1.1	132,195,000	17,625,000	21,017,000	1.4
Rumania	8,368,000	[f] 1,163,780	1,330,000	1.1	173,829,000	24,421,000	27,636,000	1.8
Poland (Galicia)	5,167,000	[g] 704,874	821,450	.7	174,347,000	24,121,000	27,718,000	1.8
Peru	[h] 3,699,280	489,000	588,000	.5	33,496,000	4,457,000	5,326,000	.4
Trinidad	[i] 2,354,000	327,400	374,000	.3	13,711,000	1,907,000	2,180,000	.1
Japan and Taiwan (Formosa)	[j] 2,233,000	297,800	355,000	.3	46,193,000	6,159,000	7,344,000	.5
Argentina	2,061,410	[k] 302,000	328,000	.3	9,268,000	1,368,000	1,473,000	
Venezuela	1,433,000	[m] 218,146	228,000	.2	2,768,000	421,000	440,000	
British Borneo (Sarawak)	1,411,000	[n] 203,000	224,000	.2	5,553,000	799,000	883,000	
Egypt	1,255,000	[o] 182,670	200,000		8,394,000	1,205,000	1,335,000	
France (Alsace)	392,000	[p] 55,575	62,000		1,445,000	204,000	230,000	
Germany	274,000	[q] 38,700	43,300		15,668,000	2,108,000	2,491,000	
Canada	[r] 190,338	25,000	30,000		25,053,000	3,340,000	3,983,000	.8
Ecuador	[s] 50,000	7,000	8,000	.3	([t])	([t])	([t])	
Italy	34,400	[u] 4,780	5,500		1,078,000	153,000	171,000	
Algeria	2,688	[v] 418	428		41,000	6,000	6,500	
England	[w] 2,652	347	422		[x] 8,000	[x] 63,000	[x] 75,500	
Other					466,000			
	766,023,000	107,437,000	121,784,000	100.0	9,512,949,000	1,302,927,000	1,512,384,000	100.0

[a] Boletín del petróleo, April, 1922.
[b] Compiled from soviet sources by Eastern European Division, Department of Commerce.
[c] Bureau of Mines, Dutch East Indies.
[d] Anglo-Persian Oil Co. (Ltd.).
[e] India Geol. Survey Records.
[f] Moniteur du pétrole roumain, Feb. 15, 1922.
[g] Commerce Repts., July 31, 1922.
[h] Boletin del Cuerpo de ingenieros de minas, Estadística minera.
[i] Inspector of Mines, Trinidad.
[j] Japan: Report of American consul, Yokohama, Sept. 1, 1922; Taiwan (Formosa): Report of American consul, Taihoku, Aug. 16, 1922.
[k] Ministerio de agricultura, Dirección general de minas, geologia é hidrología.
[m] Memoria del Ministerio de fomento.
[n] Royal Dutch Co., report for 1921.
[o] Ministry of Finance, Cairo.
[p] Director of Mines, Department of Public Works.
[q] Report of American consul general, Berlin.
[r] Dominion Bur. Statistics.
[s] Report of American consul general, Guayaquil.
[t] Included under "Other."
[u] Commerce Repts., Aug. 14, 1922.
[v] Minister of Colonies.
[w] Rept. Secretary for Mines, and H. M. Chief Inspector of Mines.
[x] Includes Ecuador.

IMPORTS AND EXPORTS.

Imports.—Since 1910 the United States has imported rapidly increasing quantities of crude petroleum, until in 1921 more than 125 million barrels was imported. Practically all the imports, as shown in the tables, came from Mexico. The figures presented were compiled from the records of the Bureau of Foreign and Domestic Commerce, which includes under imports of "mineral crude oil" topped oil topped in Mexico. In 1921 between 60 and 70 per cent of the "mineral crude oil" imported was so-called light oil, having an average gravity of about 20° Baumé; approximately 20 per cent was heavy oil, having an average gravity of about 12°; and from 10 to 20 per cent was topped oil. The oil is brought to this country in tankers and received at Atlantic or Gulf ports, where it is delivered to refineries for refining or to other consumers for use as fuel oil. The extent to which imports have supplemented domestic production is shown in the tables relating to consumption and graphically in figures 13 and 15. Data concerning stocks of Mexican petroleum held in the United States by importers have been compiled only since December, 1919, and are shown by months for the years 1920 and 1921 on pages 287, 289.

Exports.—Although approximately 20 per cent of the refined products of petroleum manufactured in the United States are exported, the exports of crude oil amount to less than 2 per cent of the domestic production. The small quantity of foreign oil that has been reexported since 1919 is shown on pages 281–283.

"Mineral crude oil" imported, exported, and shipped to Territories, 1909–1921.[a]

Year.	Imports.[b]		Exports.	
	Barrels.	Value.	Barrels.	Value.
1909	69,614	$197,023	4,055,661	$6,027,588
1910	557,181	1,398,861	4,288,361	5,404,253
1911	1,709,932	2,410,884	4,805,794	6,165,403
1912	7,383,229	6,082,881	4,493,129	6,770,484
1913	17,809,058	12,947,280	4,630,229	8,448,294
1914	17,247,483	11,465,466	2,969,894	4,958,838
1915	18,140,110	10,389,012	3,768,168	4,282,827
1916	20,570,075	12,602,811	4,095,902	7,029,923
1917	30,126,683	16,255,279	4,098,124	7,668,312
1918	37,735,641	21,319,464	4,900,691	12,084,250
1919	52,821,567	26,442,881	[c] 6,018,651	14,848,066
1920	106,175,289	55,799,254	[c] 8,757,092	29,986,874
1921	125,363,983	66,547,379	[c] 8,939,633	20,261,898

Year.	Shipments to Territories from United States.					
	Alaska.		Hawaii.		Porto Rico.	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
1909	334,164	$334,258	1,039,083	$845,805	121	$340
1910	448,468	477,673	1,288,502	1,061,060	208	499
1911	431,961	406,400	1,114,084	917,763	1,229	2,899
1912	79,144	64,866	917,838	861,080	60	278
1913	4,727	4,723	772,493	598,980	35	117
1914	415,560	319,512	1,614,633	1,201,445	10	50
1915	332,623	268,474	1,636,669	1,174,284	23	85
1916	446,097	397,337	1,610,112	1,383,433	940	2,836
1917	482,218	635,480	1,644,357	1,988,508	3,404	11,007
1918	222,639	343,596	759,167	1,041,337	1,289	5,148
1919	71	422	328,805	552,690	4	18
1920	447	2,838	537,116	1,083,954	124	746
1921	....	....	687,173	1,393,831	6	50

[a] Compiled from records of the Bureau of Foreign and Domestic Commerce.
[b] Includes topped oil topped in Mexico.
[c] Includes exports of foreign crude oil. Corresponding exports not included in figures prior to 1919. They were, however, negligible.

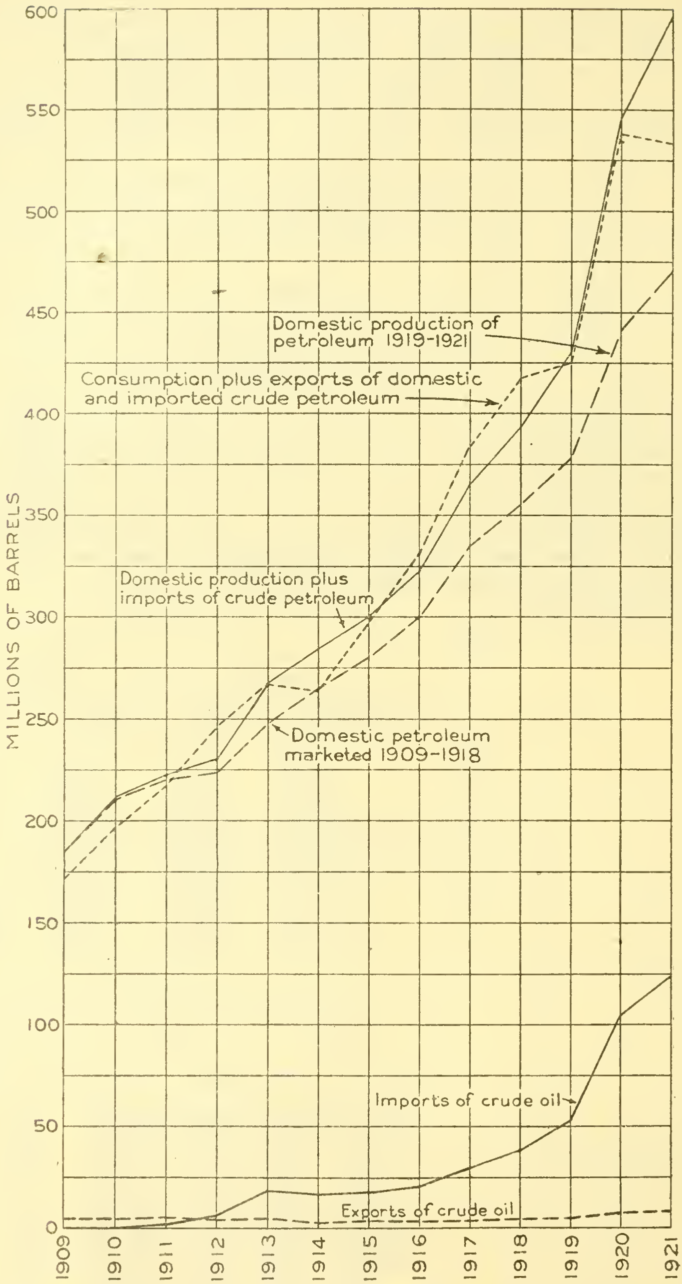

FIGURE 15.—Production, imports, exports, and consumption of crude petroleum, 1909–1921.

"Mineral crude oil" imported and exported in 1919–1921, by months.[a]

[Thousands of barrels of 42 U. S. gallons.]

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.	
													Thousands of barrels.	Value (thousands of dollars).
1919.														
Imports:														
By countries—														
Mexico	3,899	3,656	3,493	3,970	4,758	4,703	4,493	4,144	4,435	5,917	4,939	4,345	52,752	26,384
Trinidad and Tobago						25	25						50	37
Other countries			1	14	5								20	22
	3,899	3,656	3,494	3,984	4,763	4,728	4,518	4,144	4,435	5,917	4,939	4,345	52,822	26,443
By ports of entry—														
Atlantic coast	1,930	1,848	1,606	1,730	2,283	2,508	2,607	2,052	2,226	3,155	2,586	2,278	26,809	13,863
Gulf coast	1,894	1,766	1,793	2,126	2,312	2,089	1,710	1,916	2,108	2,649	2,293	2,000	24,656	11,954
Pacific coast			60	68	111	52	144	102	101	112	60	67	877	473
Northern border			1							1			2	7
Mexican border	75	42	34	60	57	79	57	74					478	146
	3,899	3,656	3,494	3,984	4,763	4,728	4,518	4,144	4,435	5,917	4,939	4,345	52,822	26,443
Exports:														
Domestic crude oil—														
Canada	271	132	178	275	168	254	188	99	670	1,115	1,050	869	5,269	11,897
Cuba	40		39	1				51	58		1	43	233	1,287
Spain	27							32				38	97	663
Germany												64	64	108
England									50				50	239
Other countries	1	52	1	2	9		18	10	1	9	98	10	211	611
Foreign crude oil			77								3	15	95	43
	339	184	295	278	177	254	206	192	779	1,124	1,152	1,039	6,019	14,848
Excess imports over exports	3,560	3,472	3,199	3,706	4,586	4,474	4,312	3,952	3,656	4,793	3,787	3,306	46,803	11,595

[a] Compiled from records of the Bureau of Foreign and Domestic Commerce.

"*Mineral crude oil*" *imported and exported in 1919–1921, by months*—Continued.

[Thousands of barrels of 42 U. S. gallons.]

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year. Thousands of barrels.	The year. Value (thousands of dollars).
1920.														
Imports:														
By countries—														
Mexico	6,293	4,940	6,503	6,185	6,965	8,119	6,768	10,791	11,650	11,361	13,750	12,838	106,163	55,778
Canada	1			1	1	1						1	5	18
Other countries												7	7	3
	6,294	4,940	6,503	6,186	6,966	8,120	6,768	10,791	11,650	11,361	13,750	12,846	106,175	55,799
By ports of entry—														
Atlantic coast	3,448	2,864	3,529	3,240	3,222	4,850	3,865	5,227	6,665	5,902	7,560	7,083	57,455	29,522
Gulf coast	2,775	2,076	2,974	2,946	3,743	3,179	2,893	5,390	4,845	5,376	6,078	5,676	47,951	25,881
Pacific coast	70					65		153		77	83	8	456	218
Northern border	1				1	1							3	16
Mexican border						25	10	21	140	6	29	79	310	162
	6,294	4,940	6,503	6,186	6,966	8,120	6,768	10,791	11,650	11,361	13,750	12,846	106,175	55,799
Exports:														
Domestic crude oil—														
Canada	422	730	850	456	471	427	347	419	652	659	607	432	6,472	20,059
Cuba		1	5	173	47	75	63	55	55	26		118	618	4,259
Argentina							93			59		63	215	893
Germany		27			61	24	58				12	27	209	715
Spain		37		19	7	34	66	5				38	206	1,620
France					43			49					92	564
England					65		1				11	11	88	305
Other countries	7	2	7	1	9	16	58	5	29	5	5	1	145	575
Foreign crude oil	40	56	30	44	58	51	37	20	54	28	161	133	712	996
	469	853	892	693	761	627	723	553	790	777	796	823	8,757	29,986
Excess of imports over exports	5,825	4,087	5,611	5,493	6,205	7,493	6,045	10,238	10,860	10,584	12,954	12,023	97,418	25,813

1921.														
Imports:														
By countries—														
Mexico	13,257	11,384	12,303	10,104	9,148	10,255	8,047	3,352	9,139	11,635	12,986	13,684	125,294	66,491
Canada	1												1	4
Trinidad and Tobago												69	69	52
	13,258	11,384	12,303	10,104	9,148	10,255	8,047	3,352	9,139	11,635	12,986	13,753	125,364	66,547
By ports of entry—														
Atlantic coast	7,260	5,975	6,444	4,679	4,428	4,907	4,239	657	4,853	7,319	7,165	7,159	65,085	33,808
Gulf coast	5,687	5,270	5,529	5,109	4,217	5,142	3,725	2,695	4,196	4,316	5,591	6,361	57,838	31,433
Pacific coast	242	139	43	208	367	143	83		57		70	65	1,417	769
Northern border	1												1	4
Mexican border	68		287	108	136	63			33		160	168	1,023	533
	13,258	11,384	12,303	10,104	9,148	10,255	8,047	3,352	9,139	11,635	12,986	13,753	125,364	66,547
Exports:														
Domestic crude oil—														
Canada	580	552	651	676	716	454	437	748	728	577	602	446	7,167	14,196
Cuba	60	98	32	62	44	91	47		69	49	98		650	3,063
Germany					40			62	62	61	107	45	377	660
England	64						8			42			114	285
France		54					45		15				114	228
Panama		55						46					101	351
Other countries	31	10	46	5	66	41	1	29	7	18	57	32	343	1,421
Foreign crude oil	8	25	21	5	8						5	2	74	57
	743	794	750	748	874	586	538	885	881	747	869	525	8,940	20,261
Excess of imports over exports	12,515	10,590	11,553	9,356	8,274	9,669	7,509	2,467	8,258	10,888	12,117	13,228	116,424	46,286

STOCKS.

Stocks of domestic crude petroleum are classified for statistical purposes as follows:

1. Producers' stocks: Petroleum held on the producing properties (lease storage).
2. Pipe-line and tank-farm stocks: Petroleum that has been removed from the producing properties but not delivered to refineries or to other consumers and is held on tank farms, in tanks along pipe lines, and in pipe lines.
3. Refinery stocks and stocks held by other consumers: Petroleum that has been delivered to refineries or to other consumers.

Pipe-line and tank-farm stocks constitute by far the greater part of the petroleum held in storage in the United States. For the States east of California such stocks are reported monthly to the Geological Survey as gross stocks, including the total contents of tanks and pipe lines, and as net stocks, which are gross stocks minus B. S. and water. The figures showing stocks for California since 1916 are those published in the Standard Oil Bulletin and include, in addition to gross pipe-line and tank-farm stocks, some unfinished products of topping plants that have been turned back to pipe lines and also producers' stocks. Stocks held by more than 14,000 producers of petroleum in the United States are reported to the Geological Survey annually, and since December, 1919, stocks of Mexican petroleum held in the United States by importers have been reported monthly. The Survey does not collect comprehensive data relating to stocks of crude oil held by consumers. The United States Bureau of Mines in its monthly reports on refinery statistics gives a statement of crude oil held at refineries, including both domestic and imported crude oil undifferentiated.

Prior to August, 1920, the companies followed no uniform method in reporting pipe-line and tank-farm stocks of domestic petroleum to the Geological Survey. Some companies reported gross stocks, others net stocks, and there was diverse usage in including or excluding oil in the pipe lines and stocks held on producing property and at refineries. In order to secure uniformity the classification stated above was adopted; and to show the relations of pipe-line and tank-farm stocks of domestic petroleum as recorded prior to and since January 1, 1920, stocks were reported to the Survey by the companies according to both the previous and revised methods for the months September to December, 1920, as shown in the table on page 288. This change in method of reporting explains the breaks in the curves showing stocks on the accompanying diagrams, which show, however, the stocks by both methods only for December, 1920.

The condensed statement of stocks of crude petroleum held on December 31, 1909 to 1921, inclusive, on page 285, shows that the greatest quantity of pipe-line and tank-farm stocks of domestic petroleum plus producers' stocks recorded prior to 1922 was on December 31, 1915, the quantity being 194,185,000 barrels, which at the rate of consumption then current was sufficient to last 244 days. On December 31, 1921, pipe-line and tank-farm stocks plus producers' stocks plus stocks of Mexican petroleum held in the United States by importers amounted to 190,762,000 barrels, but on account of the increased rate of consumption this quantity was equivalent to a supply for only 132 days. By June 30, 1922, however, stocks had increased to 255,817,000 barrels, the greatest quantity ever recorded down to that date, but on account of the increased consumption this quantity of crude petroleum, although 61,632,000 barrels more than the quantity held in storage on December 31, 1915, would last only 159 days, or 85 days less than the stocks at the end of 1915.

Stocks of crude petroleum held in the United States on December 31, 1909–1921.

[Thousands of barrels of 42 U. S. gallons.]

Year.	Pipe-line and tank-farm stocks of domestic petroleum, by field of origin.								Producers' stocks.	Stocks of Mexican petroleum held in the United States by importers.	Total.	
	Appalachian field.	Lima-Indiana field.	Illinois-southwest Indiana field.	Mid-Continent field.	Gulf Coast field.	Rocky Mountain field.	California field.	Total.			Quantity.[a]	Days' supply.[b]
1909..	5,939	4,011	32,344	53,542	2,839	12	18,000	116,687	([c])	([c])	116,687	255
1910..	5,007	4,730	31,325	[d]54,179	[d]2,674	30	33,085	131,030	([c])	([c])	131,030	250
1911..	4,735	3,195	24,064	[d]57,680	[d]3,294	25	44,240	137,233	([c])	([c])	137,233	237
1912..	4,031	2,420	15,710	51,538	1,472	147	47,552	122,870	([c])	([c])	122,870	187
1913..	4,619	1,746	8,243	57,392	2,059	442	48,302	122,803	([c])	([c])	122,803	171
1914..	5,725	1,648	13,564	60,818	3,964	170	55,661	141,550	([c])	([c])	141,550	198
1915..	5,742	2,919	11,328	[e]74,230	7,022	425	44,588	[e]146,254	[e]47,931	([c])	194,185	244
1916..	3,850	2,088	6,600	[e]77,307	9,315	745	39,398	[e]139,303	[e]40,069	([c])	179,372	203
1917..	3,821	1,906	3,560	[e]99,426	8,385	515	[f]32,450	[e]150,063	[g]9,389	([c])	159,452	154
1918..	3,616	1,029	2,367	79,094	8,168	236	[f]32,043	126,553	[g]2,033	([c])	128,586	114
1919..	3,757	1,122	4,395	76,712	12,575	164	[f]30,480	129,205	[g]4,089	2,919	136,213	118
1920..	3,673	1,286	3,495	91,696	12,311	299	[f]22,240	135,000	[g]3,586	7,442	146,028	101
1920[h]	3,427	1,038	2,965	75,690	11,163	636	[f]22,240	117,159	[g]3,586	7,442	128,187	88
1921..	6,838	1,014	7,567	102,401	17,606	1,635	[f]35,022	172,083	[g]5,139	13,540	190,762	132

[a] For stocks of crude petroleum held at refineries see p. 322.
[b] Based on average daily rate of consumption for the year.
[c] Not reported.
[d] Separation of northern and coastal Texas and Louisiana stocks estimated.
[e] In 1915 and 1916 stocks held off producing properties by certain companies were classed as producers' stocks, but for subsequent years similar stocks are classed as tank-farm stocks.
[f] From Standard Oil Bulletin; include, in addition to gross pipe-line and tank-farm stocks, some unfinished products of topping plants that were turned back to pipe lines and also producers' stocks.
[g] Exclusive of producers' stocks in California.
[h] As reported by revised method; see p. 284.

Stocks of crude petroleum at end of each month, 1919–20.

[Thousands of barrels of 42 U. S. gallons.]

Field of origin.	Pipe-line and tank-farm stocks of domestic petroleum.												Producers' stocks.	
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. 1.	Dec. 31.
1919.														
Appalachian	3,535	3,715	3,803	3,974	4,131	4,020	4,087	3,824	3,917	3,796	3,395	3,757	394	525
Lima-Indiana	1,144	1,191	1,221	1,385	1,398	1,480	1,373	1,418	1,270	1,216	1,084	1,122	15	62
Illinois and southwestern Indiana	2,491	3,011	3,594	3,804	4,037	3,990	4,252	4,246	4,423	4,401	4,766	4,395	166	165
Mid-Continent	78,888	76,779	77,837	78,214	76,332	79,142	83,969	80,069	81,459	80,511	78,763	76,712	1,217	1,755
Gulf Coast	8,528	8,866	9,505	10,131	10,546	10,839	11,419	11,914	11,976	12,666	12,268	12,575	78	1,344
Rocky Mountain	205	210	202	193	191	195	201	203	168	112	141	164	163	238
California	32,300	32,671	32,486	32,543	33,110	33,497	33,851	33,705	32,900	32,017	31,159	30,480	3,751	3,954
	127,091	126,443	128,648	130,244	129,745	133,163	139,152	135,379	136,113	134,719	131,576	129,205	5,784	8,043
1920.														
Domestic petroleum: East of California. Pipe-line and tank-farm stocks, by fields of origin:														
Appalachian—														
New York, Pennsylvania, West Virginia, eastern and central Ohio	3,038	3,043	3,364	3,188	3,162	3,189	2,985	3,017	2,868	2,938	2,724	2,712	493	551
Kentucky	844	950	952	958	959	894	937	921	853	933	885	961	32	42
Lima-Indiana	1,094	1,048	1,131	1,136	1,170	1,279	1,215	1,373	1,349	1,307	1,283	1,286	62	59
Illinois and southwestern Indiana	4,064	4,061	4,024	3,981	3,844	3,654	3,628	3,411	3,627	3,518	3,462	3,495	165	171
Mid-Continent—														
Oklahoma-Kansas, central and north Texas	72,206	72,017	72,867	72,432	72,941	76,328	78,674	78,977	79,183	80,214	81,838	84,359	1,755	1,857
North Louisiana	5,120	5,703	5,321	6,038	6,010	6,414	7,007	8,318	8,145	7,853	7,583	7,337		
Gulf Coast	12,328	11,934	11,489	11,248	11,133	10,722	10,377	10,626	10,719	11,138	12,018	12,311	1,344	701
Rocky Mountain	217	229	227	238	217	223	228	251	270	285	260	299	238	205
Total pipe-line and tank-farm stocks east of California	98,911	98,985	99,375	99,219	99,436	102,703	105,051	106,894	107,014	108,186	110,053	112,760	4,089	3,586
California	29,612	28,739	27,578	27,112	26,592	25,371	24,407	23,434	23,159	22,545	22,582	22,240	3,954	3,092

Mexican crude petroleum and topped oil topped in Mexico held in the United States by importers:														
At Atlantic coast stations—														
Crude	684	583	718	905	840	1,251	889	1,668	1,385	1,932	2,193	2,705	....	....
Topped	580	539	481	344	600	838	309	514	727	1,073	1,164	1,356	....	....
At Gulf coast stations—														
Crude	981	852	665	790	701	486	1,001	1,213	1,784	2,034	2,594	2,453	....	....
Topped	331	401	291	248	357	580	455	549	291	515	648	928	....	....
	2,576	2,375	2,155	2,287	2,498	3,155	2,654	3,944	4,187	5,554	6,599	7,442	....	....
Total pipe-line and tank-farm stocks of domestic petroleum and Mexican petroleum held in the United States by importers	131,099	130,099	129,108	128,618	128,526	131,229	132,112	134,272	134,360	136,285	139,234	142,442	....	....

NOTE.—Pipe-line and tank-farm stocks of domestic petroleum east of California, as recorded for the year 1920, are not directly comparable with net or gross pipe-line and tank-farm stocks recorded for 1921 and 1922 because of the adoption of an improved method of reporting stocks (see table on p. 288).

Stocks of crude petroleum, September to December, 1920.[a]

[Thousands of barrels of 42 U. S. gallons.]

		September 30.	October 31.	November 30.	December 31.
Domestic petroleum:					
East of California—Pipe-line and tank-farm stocks, by fields of origin—					
Appalachian—					
New York, Pennsylvania, West Virginia, eastern and central Ohio	gross	3,116	3,140	2,826	2,871
	net	2,858	2,779	2,567	2,591
Kentucky	gross	854	958	834	898
	net	792	784	772	836
Lima-Indiana	gross	1,623	1,378	1,363	1,428
	net	1,235	990	974	1,038
Illinois and southwestern Indiana	gross	4,075	3,427	3,445	3,497
	net	3,550	2,894	2,913	2,965
Mid-Continent—					
Oklahoma, Kansas, central and north Texas	gross	71,467	73,106	75,006	77,039
	net	61,051	63,293	65,314	67,914
North Louisiana and Arkansas	gross	9,019	8,781	8,534	8,338
	net	8,607	8,314	8,012	7,776
Gulf Coast	gross	10,278	10,593	12,006	12,381
	net	9,521	9,986	10,905	11,163
Rocky Mountain	gross	546	550	567	646
	net	541	544	558	636
Total pipe-line and tank-farm stocks east of California	gross	100,978	101,933	104,581	107,098
	net	88,155	89,534	92,015	94,919
California—Gross pipe-line, tank-farm, and producers' stocks		23,159	22,545	22,582	22,240
Mexican crude petroleum and topped oil topped in Mexico held in the United States by importers:					
At Atlantic coast stations	crude	1,385	1,932	2,193	2,705
	topped	727	1,073	1,164	1,356
At Gulf coast stations	crude	1,784	2,034	2,594	2,453
	topped	291	515	648	928
Total Mexican petroleum		4,187	5,554	6,599	7,442
Total net pipe-line and tank-farm stocks east of California; gross pipe-line, tank-farm, and producers' stocks in California; and stocks of Mexican petroleum held in the United States by importers		115,501	117,683	121,196	124,601

[a] Method of reporting revised as explained in text (p. 284).

Stocks of crude petroleum at end of each month in 1921.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Producers' stocks. Jan. 1.	Producers' stocks. Dec. 31.
Domestic petroleum:														
East of California—Pipe-line and tank-farm stocks, by fields of origin—														
Appalachian—														
New York, Pennsylvania, West Virginia, eastern and central Ohio: gross	2,765	3,051	3,586	3,760	4,152	4,335	4,424	4,417	4,495	4,602	4,801	4,933	551	360
net	2,486	2,772	3,307	3,484	3,888	4,061	4,150	4,138	4,229	4,339	4,536	4,670		
Kentucky: gross	1,024	1,389	1,487	1,447	1,677	1,870	1,867	2,107	2,140	1,973	2,064	2,264	42	85
net	962	1,326	1,424	1,385	1,614	1,807	1,804	2,044	2,053	1,881	1,971	2,168		
Lima-Indiana: gross	1,452	1,407	1,519	1,555	1,536	1,575	1,621	1,686	1,548	1,536	1,501	1,386	59	48
net	1,040	1,010	1,121	1,156	1,121	1,156	1,201	1,264	1,110	1,158	1,136	1,014		
Illinois and southwestern Indiana: gross	3,717	4,239	4,860	5,014	5,554	6,052	6,566	6,887	6,951	7,227	7,622	8,066	171	157
net	3,189	3,710	4,332	4,490	5,030	5,526	6,075	6,396	6,473	6,733	7,122	7,567		
Mid-Continent—														
Oklahoma, Kansas, central and north Texas: gross	78,532	80,322	84,135	87,445	90,938	94,436	98,518	99,713	100,107	99,732	99,293	102,012	1,857	3,113
net	68,651	70,153	73,910	77,369	81,086	84,319	88,427	89,591	90,140	90,194	89,317	91,983		
North Louisiana and Arkansas: gross	8,129	8,145	8,070	8,065	8,558	9,379	10,096	10,298	10,163	9,766	9,963	10,912		
net	7,535	7,686	7,652	7,606	8,090	8,902	9,485	9,765	9,650	9,199	9,493	10,418		
Gulf Coast: gross	12,701	14,200	14,805	15,751	16,645	17,900	17,975	17,886	18,702	18,706	18,795	17,973	701	1,110
net	11,248	12,730	13,386	14,413	15,295	16,340	16,476	16,360	17,150	17,159	17,422	17,606		
Rocky Mountain: gross	740	773	735	851	899	885	1,260	1,013	1,120	1,111	1,374	1,647	205	266
net	727	760	726	842	888	874	1,247	1,007	1,113	1,098	1,360	1,635		
Total pipe-line and tank-farm stocks east of California: gross	109,060	113,526	119,197	123,888	129,959	136,432	142,327	144,007	145,226	144,653	145,413	149,193	3,586	5,139
net	95,838	100,147	105,858	110,745	117,012	122,985	128,865	130,565	131,918	131,761	132,357	137,061		
California—Gross pipe-line, tank-farm, and producers' stocks	22,594	22,904	24,214	25,357	28,055	29,769	31,634	33,830	33,671	33,116	33,486	35,022	3,092	2,859
Mexican crude petroleum and topped oil topped in Mexico held in the United States by importers—														
At Atlantic coast stations: crude	3,501	4,245	3,957	3,671	3,363	2,691	2,426	1,654	2,914	4,186	5,561	5,712	....	....
topped	775	905	1,155	1,420	1,564	1,131	1,055	583	914	1,182	1,896	1,599	....	....
At Gulf coast stations: crude	2,348	3,162	3,637	4,458	4,241	4,496	3,573	2,455	2,598	2,564	3,523	5,413	....	....
topped	533	859	678	748	882	1,243	1,123	581	859	1,340	1,437	816	....	....
At Pacific coast stations (crude)	....	....	....	....	150	145	145	14	....	....	....	....	....	....
Total Mexican petroleum	7,157	9,171	9,427	10,297	10,200	9,709	8,322	5,287	7,285	9,272	12,417	13,540	....	....
Total of net pipe-line and tank-farm stocks east of California; gross pipe-line, tank-farm, and producers' stocks in California; and stocks of Mexican petroleum held in the United States by importers	125,589	132,222	139,499	146,399	155,267	162,463	168,821	169,682	172,874	174,149	178,260	185,623	....	....

CONSUMPTION.

The great increase in the consumption of petroleum that has followed the introduction of the internal-combustion engine is brought out by the table showing the relationship of consumption to population. The annual consumption is now more than 5 barrels per capita, whereas in 1900 and previous years it was less than 1 barrel. The increase in population between 1900 and 1920 was only 39 per cent, whereas the increase in consumption of petroleum per capita was 497 per cent.

Consumption per capita of crude petroleum in the United States, 1870–1920.

Year.	Population (thousands).	Consumption of crude petroleum (thousands of barrels).	Annual per capita consumption (barrels).
1870	38,558	5,261	0.14
1880	50,156	26,286	.52
1890	62,948	45,824	.73
1900	75,955	63,620	.84
1910	91,972	191,483	2.08
1920	105,711	530,532	5.02

As there were 10,448,000 registered motor vehicles in the United States in 1921, contrasted with 3,512,000 in 1916, and as there were 3,110 oil-burning ships of 500 gross tons on June 30, 1922, compared with 501 on June 30, 1914, the growth in recent years in demand for petroleum products is not surprising. The consumption of gasoline, gas, and fuel oil and of other petroleum products, reported by the Bureau of Mines, is given on page 322.

The indicated consumption of crude petroleum by years since 1909 is given in the following table and shown graphically in figure 15 (p. 280). The term "consumption" is here used in the sense of deliveries to consumers, and the figures given are based on the following calculation: Consumption is equal to production plus imports, minus exports, plus stocks at beginning of period, minus stocks at end of period. Included with consumption as thus determined is the unmeasured item of loss.

Indicated consumption (deliveries to consumers) of domestic and imported crude petroleum, 1909–1921, by years.

[Thousands of barrels of 42 U. S. gallons.]

	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	*a* 1919	1920	1921
Domestic petroleum, by fields of origin:													
Appalachian	24,739	27,824	24,021	27,043	25,334	22,995	22,843	24,901	24,962	25,606	31,558	30,646	27,188
Lima-Indiana	8,025	6,535	7,766	5,701	5,447	5,160	2,999	4,736	3,852	4,098	2,656	2,246	2,439
Illinois and southwestern Indiana	27,765	34,163	38,578	36,955	31,361	16,599	21,278	22,442	18,817	14,559	10,623	12,321	6,346
Mid-Continent	48,234	58,580	63,095	71,615	79,066	94,569	109,882	133,858	*b* 164,481	199,715	194,991	235,025	230,494
Gulf Coast	11,013	9,846	10,380	10,367	7,955	11,213	17,521	19,475	25,273	24,425	17,693	28,589	29,519
Rocky Mountain	323	337	419	1,656	2,300	4,055	4,199	6,156	9,429	13,088	13,380	17,180	19,890
California	50,970	57,925	69,979	83,957	97,039	92,417	97,664	96,142	*b* 105,464	97,939	102,746	111,617	99,818
Other	6	4	8	4	11	8	14	8	10	8	12	13	12
Consumption and exports	171,075	195,214	214,246	237,298	248,513	247,016	276,400	307,718	352,288	379,438	373,659	437,637	415,706
Exports of domestic crude oil	4,056	4,288	4,806	4,493	4,630	2,970	3,768	4,096	4,098	4,901	5,924	8,045	8,866
Consumption in the United States and Territories	167,019	190,926	209,440	232,805	243,883	244,046	272,632	303,622	348,190	374,537	367,735	429,592	406,840
Imported petroleum:													
Consumption in the United States and Territories	70	557	1,710	7,383	17,809	17,247	18,140	20,570	30,127	37,736	52,727	100,940	119,192
Consumption of domestic and imported petroleum in the United States and Territories	167,089	191,483	211,150	240,188	261,692	261,293	290,772	324,192	378,317	412,273	420,462	530,532	526,032

a Producers' stocks not used in the calculation of consumption prior to 1919.
b Calculation based on 100,401,000 barrels Mid-Continent stocks and 44,036,000 barrels California stocks as of Dec. 31, 1916.

Since 1911, except in 1914, the annual consumption plus exports of domestic and imported crude petroleum has been greater than the quantity of domestic petroleum marketed, and in 1916 to 1918, inclusive, it was greater than domestic petroleum marketed plus imports. In 1919 and 1920 consumption plus exports amounted to slightly less than combined production and imports, and in 1921 it was considerably less, resulting in the large accumulation of stocks shown on page 285.

The monthly relationship between supply (production, imports, and stocks) and demand (consumption and exports) for crude petroleum between January, 1918, and June, 1922 (data for 1922 are subject to revision), is shown in the table on page 299 and illustrated in figure 13, page 259.

Throughout 1918, except in the month of June, consumption plus exports exceeded production plus imports, and during the year stocks were diminished by 23,510,000 barrels. In 1919 consumption plus exports exceeded production plus imports in February, May, August, October, November, and December, but the net result for the year was a comparatively small surplus supply, and stocks were increased by 4,708,000 barrels. In 1920, from January to May, inclusive, consumption plus exports exceeded production plus imports by a small margin; from June to the end of the year, however, in spite of increasing demand, the supply was greater, and by the end of 1920 stocks had been increased 9,815,000 barrels. During 1921 demand decreased and the supply increased, and for each month consumption plus exports was considerably less than production plus imports, so that by the end of December stocks had increased to the extent of 62,575,000 barrels. Similar conditions but with even wider margin between consumption plus exports and production plus imports existed throughout the greater part of 1922, but in the later part of that year, owing to increasing consumption and decreasing imports, there was a close approach between demand and new supply.

Indicated consumption (deliveries to consumers) of domestic and imported crude petroleum, 1919–1921, by months.[a]

[Thousands of barrels of 42 U. S. gallons.]

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.
1919.													
Domestic petroleum, by fields of origin:													
Appalachian	2,527	2,145	2,489	2,569	2,674	2,849	2,884	2,964	2,630	2,888	2,817	2,122	31,558
Lima-Indiana	117	170	194	65	248	171	370	207	373	279	311	151	2,656
Illinois and southwestern Indiana	960	479	595	805	889	1,110	845	1,049	857	1,092	593	1,349	10,623
Mid-Continent	13,530	14,555	12,985	13,429	16,534	12,527	12,883	21,787	17,069	19,589	19,962	20,141	194,991
Gulf Coast	1,458	1,216	1,295	1,406	1,401	1,429	1,293	1,489	1,708	1,061	2,309	1,628	17,693
Rocky Mountain	1,101	972	1,148	1,241	1,124	1,117	1,206	1,010	1,196	1,114	1,099	1,052	13,380
California	8,379	7,469	8,799	8,305	8,038	8,048	8,322	8,776	9,183	9,472	8,981	8,974	102,746
Other	1	1	1	1	1	1	1	1	1	1	1	1	12
Consumption and exports	28,073	27,007	27,506	27,821	30,909	27,252	27,804	37,283	33,017	35,496	36,073	35,418	373,659
Exports of domestic crude oil	339	184	218	278	177	254	206	192	779	1,124	1,149	1,024	5,924
Consumption in the United States and Territories	27,734	26,823	27,288	27,543	30,732	26,998	27,598	37,091	32,238	34,372	34,924	34,394	367,735
Imported petroleum: Consumption in the United States and Territories	3,899	3,656	3,417	3,984	4,763	4,728	4,518	4,144	4,435	5,917	4,936	4,330	52,727
Consumption of domestic and imported petroleum in the United States and Territories	31,633	30,479	30,705	31,527	35,495	31,726	32,116	41,235	36,673	40,289	39,860	38,724	420,462

[a] Figures for consumption by months obtained by the calculation, production plus imports minus exports plus stocks at the beginning of the month minus stocks at the end of month plus or minus the change in producers' stocks for the month, as determined by apportioning the annual net change.

Indicated consumption (deliveries to consumers) of domestic and imported crude petroleum, 1919–1921, by months—Continued.

[Thousands of barrels of 42 U. S. gallons.]

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	The year.
1920.													
Domestic petroleum, by fields of origin:													
Appalachian	2,181	2,057	2,364	2,689	2,620	2,692	2,780	2,635	2,813	2,460	2,758	2,597	30,646
Lima-Indiana	179	212	130	198	185	110	286	57	238	249	211	191	2,246
Illinois and southwestern Indiana	1,268	881	1,081	978	1,124	1,173	1,005	1,192	746	1,042	962	869	12,321
Mid-Continent	18,817	18,814	19,931	19,483	20,387	17,337	18,662	20,626	20,825	21,257	20,079	18,807	235,025
Gulf Coast	1,953	2,192	2,580	2,377	2,271	2,561	2,751	2,306	2,349	2,506	2,205	2,538	28,589
Rocky Mountain	1,137	1,174	1,341	1,315	1,398	1,538	1,543	1,500	1,573	1,707	1,465	1,489	17,180
California	9,172	8,674	9,545	8,552	8,969	9,233	9,361	9,775	9,205	9,868	9,101	10,162	111,617
Other	1	1	1	1	1	1	1	1	1	1	1	2	13
Consumption and exports	34,708	34,005	36,973	35,593	36,955	34,645	36,389	38,092	37,750	39,090	36,782	36,655	437,637
Exports of domestic crude oil	429	797	862	649	703	576	686	533	736	749	635	690	8,045
Consumption in the United States and Territories	34,279	33,208	36,111	34,944	36,252	34,069	35,703	37,559	37,014	38,341	36,147	35,965	429,592
Imported petroleum: Consumption in the United States and Territories	6,597	5,085	6,693	6,010	6,697	7,412	7,232	9,481	11,353	9,966	12,544	11,870	100,940
Consumption of domestic and imported petroleum in the United States and Territories	40,876	38,293	42,804	40,954	42,949	41,481	42,935	47,040	48,367	48,307	48,691	47,835	530,532
1921.													
Domestic petroleum, by fields of origin:													
Appalachian	2,509	1,776	2,129	2,486	2,158	2,154	2,399	2,449	2,353	2,472	2,111	2,192	27,188
Lima-Indiana	208	227	105	171	251	182	150	144	348	141	196	316	2,439
Illinois and southwestern Indiana	701	335	418	684	405	408	334	604	803	702	519	433	6,346
Mid-Continent	19,382	16,772	17,918	17,954	18,554	18,070	17,874	21,107	20,319	20,914	21,696	19,934	230,494
Gulf Coast	2,834	1,378	2,641	2,034	2,101	1,701	2,729	3,280	2,284	3,000	2,813	2,724	29,519
Rocky Mountain	1,467	1,595	1,766	1,912	2,070	2,003	906	1,852	1,414	1,671	1,402	1,832	19,890
California	9,632	8,702	8,973	8,834	7,552	8,214	8,190	7,644	7,920	7,512	8,277	8,368	99,818
Other	1	1	1	1	1	1	1	1	1	1	1	1	12
Consumption and exports	36,734	30,786	33,951	34,076	33,092	32,733	32,583	37,081	35,442	36,413	37,015	35,800	415,706
Exports of domestic crude oil	735	769	729	743	866	586	538	885	881	747	864	523	8,866
Consumption in the United States and Territories	35,999	30,017	33,222	33,333	32,226	32,147	32,045	36,196	34,561	35,666	36,151	35,277	406,840
Imported petroleum: Consumption in the United States and Territories	13,535	9,345	12,026	9,229	9,237	10,746	9,434	6,387	7,141	9,648	9,836	12,628	119,192
Consumption of domestic and imported petroleum in the United States and Territories	49,534	39,362	45,248	42,562	41,463	42,893	41,479	42,583	41,702	45,314	45,987	47,905	526,032

Consumption of crude and fuel oil, 1919–1921.

[Thousands of barrels of 42 U. S. gallons.]

	1919	1920	1921
Crude oil:			
On producing oil properties [a]	5,600	4,647	4,261
In operation of oil pipe lines [a]	Not available.		1,668
Fuel and gas oil (including some crude oil):			
By locomotives (all services, Class I carriers) [b]	37,763	45,945	33,945
By vessels operated by or for account of U. S. Shipping Board [c]—			
Domestic oil	3,000	2,000	3,361
Mexican oil	7,000	14,742	11,936
Open market purchase	2,500	4,185	3,824
	12,500	20,927	19,121
By vessels cleared to foreign countries (bunker oil) [d]	14,031	26,335	27,076
By U. S. Navy (fiscal year) [e]	5,845	7,530	6,372
By electric public utility power plants [f]	11,050	13,123	12,045
By manufacturers of artificial gas	[g] 22,700	[f] 21,982	[g] 21,380

[a] Reported to U. S. Geological Survey.
[b] Interstate Commerce Commission.
[c] Estimated by U. S. Shipping Board Emergency Fleet Corporation.
[d] Bureau of Foreign and Domestic Commerce.
[e] Navy Department.
[f] U. S. Geological Survey.
[g] American Gas Association.

PRICES.

Prices paid at the wells for crude petroleum of different grades by various purchasing organizations for the years 1919 to 1921, inclusive, are given in the table on pages 300–307. The figures show perhaps the greatest range in price in the shortest period of time in the history of the industry.

Prices as stabilized during the war in general held with little change until late in 1919, when they began to rise rapidly. Oklahoma-Kansas grade, for example, which had remained at $2.25 a barrel since March 19, 1918, was increased on November 20, 1919, to $2.50. Four successive increases of 25 cents were made at short intervals until on March 1, 1920, the price was raised to $3.50 a barrel, the highest price ever paid for this grade of oil, more than three and a half times its monthly average price for 1913 and almost nine times its minimum price in 1915, when prices were at their lowest ebb

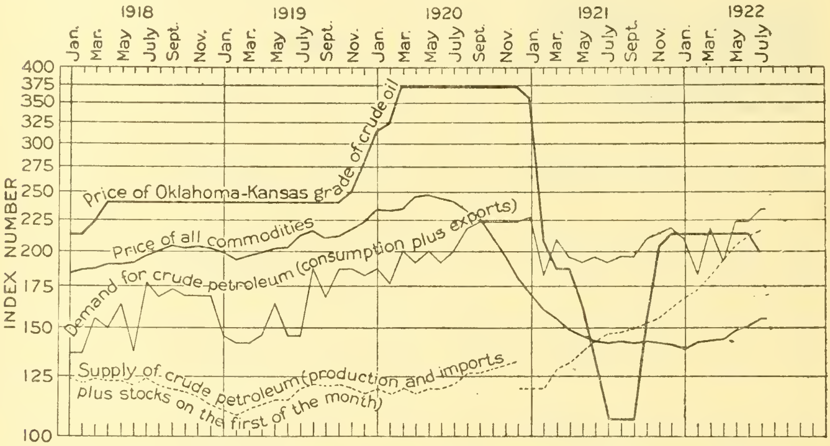

FIGURE 16.—Supply and demand for crude petroleum, contrasted with price of Oklahoma-Kansas grade crude oil and wholesale price of all commodities, by months, 1918–1922, shown by index numbers based on monthly average for 1913=100.

during the period of Cushing overproduction. The high price reached on March 1, 1920, held until January 24, 1921, when it fell to $3. Thereafter the price dropped at frequent intervals until on June 15, 1921, it reached $1 a barrel, at which it remained until October 1, when it rose to $1.25, and it closed the year at $2. This sequence was followed more or less closely by the other grades of crude oil, except in California, where the fluctuations were not so great and where the higher prices held a few months longer. Pennsylvania grade, for instance, rose from its war stabilized price of $4 a barrel to a maximum of $6.10 on March 2, 1920, fell to a minimum of $2.25 on June 28, 1921, and closed the year at $4.

Figures 16 and 17 show graphically the fluctuations in price of Oklahoma-Kansas grade crude oil and in supply (production plus imports plus stocks on the first of the month) and demand (consumption plus exports). The lines of figure 16 are plotted on a ratio chart on a semi-logarithmic scale, which shows the percentage increases as well as the changes in quantity. The curves of figure 16 are drawn on index numbers based on monthly averages for 1913 taken as 100. The year 1913, which is commonly used as a basis for comparison of pre-war and post-war conditions, serves well for petroleum data also because it was a year when supply and demand were about equal and because it preceded the period of unsettling conditions in the petroleum industry brought about by the oversupply consequent on the development of the Cushing field. Figure 16 shows that the price of Oklahoma-Kansas grade crude oil in 1918 and 1919 roughly paralleled the wholesale price of all

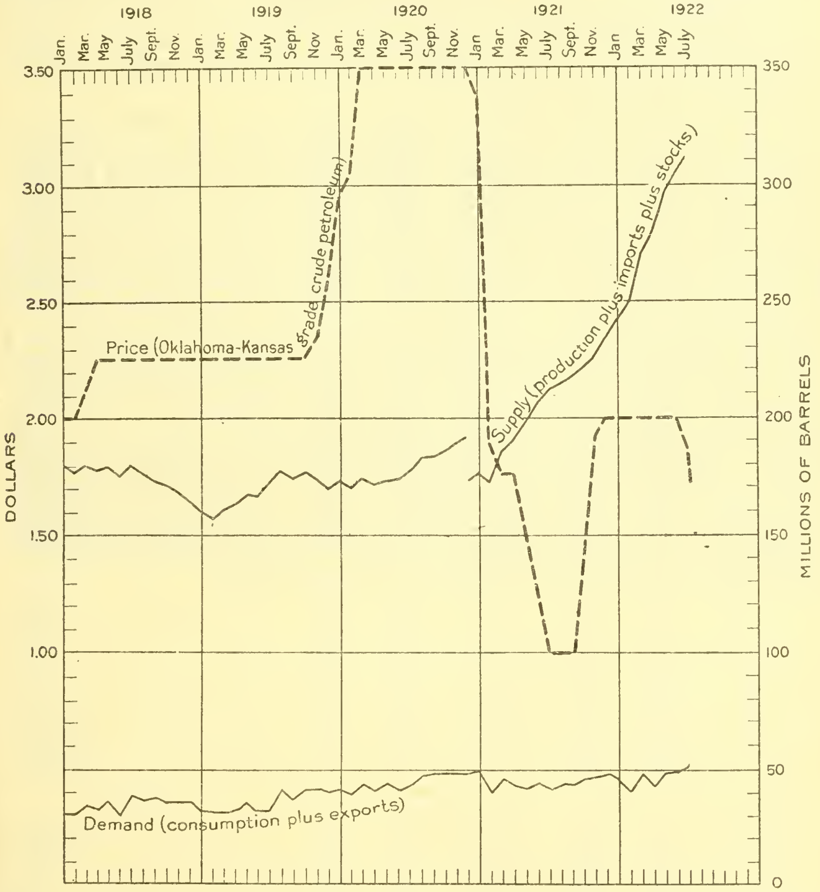

FIGURE 17.—Supply and demand for crude petroleum, in barrels, and price of Oklahoma-Kansas grade crude oil, in dollars, 1918–1922.

commodities, as determined by the Department of Labor, and that the crest of high prices was attained by both crude oil and all commodities during the first part of 1920. At the peak, however, prices of all commodities were only 247 per cent of the average monthly prices for 1913, whereas the price of Oklahoma-Kansas crude reached 373 per cent. The prices of all commodities began to drop in June, 1920, and fell gradually for a year, reaching nearly their lowest point in June, 1921, and they remained near this low point for about eleven months. The lowest level, 138 per cent of the monthly average for 1913, was reached in January, 1922, after which they gradually rose again. The price of Oklahoma-Kansas crude, on the other hand, remained at its peak until January, 1921, some eight months after the peak of prices of all commodities had been reached, and then fell more precipitously to its low point, which was reached in less than six months and was only 106 per cent of the average monthly price for 1913, a drop of 267 per cent, whereas the index price of all commodities dropped only 106 per cent in a period twice as long. Reacting from this violent drop, the price of crude had recovered 107 per cent by December, 1921, and then remained constant for a few months, only to drop 79 per cent by August, 1922, at the time when the price of all commodities was rising.

The curves illustrate that, during the period of the rise in price of crude petroleum in 1919–20 and of the succeeding drop in 1921, the price of crude oil was in general conformity with the price of all commodities and with conditions of supply and demand for crude petroleum. But the curves illustrating the wholesale price of all commodities and price, demand, and supply of crude petroleum for the later part of 1921 and for 1922 contrast sharply. The pronounced upward swing in the price of crude oil in the fall of 1921 and its continuance at a comparatively high level during the early part of 1922 occurred at a time when general business conditions, as indicated by the wholesale price of all commodities, were at low ebb and when, although the fluctuating demand was maintained at a high level, the supply of crude petroleum was steadily increasing month by month to new record high figures. But, apparently yielding to the stress of oversupply, the price of crude oil dropped in the summer of 1922, at a time when the price of all commodities was rising. These facts are shown in another form by figure 17, in which the curves are drawn in units of dollars and barrels rather than in percentage based on index numbers.

Index numbers for wholesale price of all commodities (Bureau of Labor Statistics), price of Oklahoma-Kansas grade crude oil, and supply and demand for crude petroleum, by months, January, 1918, to June, 1922.

[Monthly averages for 1913 taken as 100.]

Month.	Wholesale price of all commodities (index No.).	Price of Oklahoma-Kansas grade crude oil.		Supply (production and imports plus stocks first of month).		Demand (consumption plus exports).	
		Dollars.	Index No.	Millions of barrels.	Index No.	Millions of barrels.	Index No.
1913.							
Monthly average	100	0.939	100	145	100	22	100
1918.							
January	184	2.00	213	180	124	30	136
February	186	2.00	213	177	122	30	136
March	187	2.10	224	180	124	34	155
April	190	2.25	240	178	123	33	150
May	190	2.25	240	179	123	36	164
June	191	2.25	240	175	121	30	136
July	196	2.25	240	180	124	39	177
August	200	2.25	240	176	121	37	168
September	204	2.25	240	173	119	38	173
October	202	2.25	240	171	118	37	168
November	203	2.25	240	168	116	37	168
December	202	2.25	240	163	112	37	168
1919.							
January	199	2.25	240	159	110	32	145
February	193	2.25	240	157	108	31	141
March	196	2.25	240	160	110	31	141
April	199	2.25	240	162	112	32	145
May	202	2.25	240	166	114	36	164
June	203	2.25	240	165	114	32	145
July	212	2.25	240	172	119	32	145
August	216	2.25	240	176	121	41	186
September	210	2.25	240	174	120	37	168
October	211	2.25	240	176	121	41	186
November	217	2.34	249	173	119	41	186
December	223	2.60	277	169	117	40	182
1920.							
January	233	2.96	315	172	119	41	186
February	232	3.03	323	169	117	39	177
March	234	3.50	373	173	119	44	200
April	245	3.50	373	170	117	42	191
May	247	3.50	373	172	119	44	200
June	243	3.50	373	173	119	42	191
July	241	3.50	373	176	121	44	200
August	231	3.50	373	182	126	48	218
September	226	3.50	373	183	126	49	223
October	211	3.50	373	185	128	49	223
November	196	3.50	373	189	130	49	223
December	179	3.50	373	191	132	49	223
December [a]				[a] 173	[a] 119		
1921.							
January	170	3.35	357	176	121	50	227
February	160	1.88	207	172	119	40	182
March	155	1.75	186	186	128	46	209
April	148	1.75	186	190	131	43	195
May	145	1.51	161	198	137	42	191
June	142	1.22	130	206	142	43	195
July	141	1.00	106	211	146	42	191
August	142	1.00	106	213	147	43	195
September	141	1.00	106	216	149	43	195
October	142	1.45	154	220	152	46	209
November	141	1.90	202	225	155	47	214
December	140	2.00	213	234	161	48	218
1922. [b]							
January	138	2.00	213	242	167	46	209
February	141	2.00	213	249	172	40	182
March	142	2.00	213	269	186	48	218
April	143	2.00	213	278	192	42	191
May	148	2.00	213	296	204	49	223
June	150	2.00	213	305	210	49	223

[a] Based on revised method of reporting stocks. [b] Data for 1922 are subject to revision.

76571°—M R 1921——20

Posted price per barrel of crude petroleum at wells, 1919–1921, by grades, with dates of change.

Date.	Appalachian field.									Lima-Indiana field.		Illinois and southwestern Indiana field.		
	Pennsylvania.	Cleveland.	Corning.	Lodi.	Cabell.	Wooster.	Ragland.	Somerset heavy.	Somerset light.	Lima-Ohio.	Indiana.	Illinois and Princeton, Ind.	Plymouth.	Waterloo.
1919.														
January 1	$4.00	$2.78	$2.85	$2.38	$2.77	$2.85	$1.25	$2.60		$2.38	$2.28	$2.42	$2.23	
September 2	4.25		2.95	2.48	2.87	2.95		2.70						
September 8										2.48	2.38	2.52	2.33	
September 9		2.88												
November 7	4.50		3.10		3.02		1.35	2.85						
November 20				2.75										
November 21						3.20				2.73	2.63	2.77	2.53	
December 16		2.98												
December 22	4.75		3.35	3.00	3.27	3.45	1.60	3.10		2.98	2.88	3.02	2.78	
December 23		3.23												
December 31	5.00		3.50		3.42		1.75	3.25						
Average for year	4.13	2.82	2.91	2.44	2.83	2.93	1.27	2.66		2.45	2.35	2.49	2.30	
1920.														
January 7												3.27	3.03	
January 12						3.70				3.23	3.13			
January 15		3.48		3.25										
January 26	5.25													
February 5	5.50													
February 17	5.65													
February 27	5.80							3.50						
March 1	5.95	3.50		3.50	3.67	3.80				3.48	3.38	3.52	3.28	
March 2	6.10				3.92			3.75						
March 4			3.65										3.48	
March 10		3.98		3.75						3.73	3.63	3.77		
March 19			3.75											
March 22						4.05								
March 30			4.00											
May 10					4.17		2.10	4.00						
May 15			4.25											
June 2		4.23		4.00										
July 20							2.35							
September 23							2.60	4.25						
October 11					4.46				$4.50					
December 27			4.00											
Average for year	5.97	3.91	4.05	3.70	4.06	3.97	1.96	3.90	4.50	3.63	3.53	3.68	3.40	

1921.														
January 8	5.75				4.21		2.25	4.00	4.25					
January 10			3.75											
January 21	5.50				3.96		2.00	3.75	4.00					
January 25						3.80				3.48	3.38	3.52	3.23	
January 26		4.03	3.50	3.80										
January 31	5.00				3.71		1.75	3.50	3.75					
February 1						3.55				3.23	3.13	3.27	2.73	
February 2		3.75	3.00	3.55										
February 4	4.75				3.46	3.30	1.50	2.75	3.00					
February 5		3.50		3.05						2.98	2.88	3.02	2.48	
February 10		3.25				3.05				2.73	2.63	2.77	2.23	
February 11	4.25				2.96		1.25	2.25	2.50					
February 14			2.55		2.46									
February 15	3.75				2.21		1.15	2.00	2.25					
February 16			2.25											
February 21	3.25				1.96		1.00	1.75	2.00					
February 23		3.00	1.90	2.80									1.98	
February 26	3.00				1.86	2.80		1.65	1.80	2.48	2.38	2.52		
March 10													1.75	$1.75
April 18	3.25		2.15		1.96		1.15	1.75	2.00					
April 25	3.50				2.16		1.25	1.95	2.20					
May 3		2.75		2.55		2.55				2.33	2.13	2.27	1.50	1.50
May 17			2.00		1.91			1.70	1.95					
May 19	3.25													
May 23		2.50		2.30		2.30				2.08	1.88	2.02		
May 25	3.00		1.90		1.81			1.60	1.80					
May 27												1.77	1.15	1.25
June 14	2.75	2.25	1.65	2.05	1.56	2.05	1.00	1.35	1.55	1.83	1.63	1.52	.90	1.00
June 16	2.50		1.40		1.31		.75	1.10	1.30					
June 27		2.00		1.80		1.80				1.58	1.38	1.27	.65	.75
June 28	2.25		1.20		1.11		.60	.90	1.00					
August 18								1.10	1.25					
September 27	2.50		1.45		1.41		.85	1.20	1.45					
October 4	2.75	2.25	1.65	2.05	1.61	2.05		1.40	1.65	1.83	1.63	1.52	.90	1.00
October 7	3.00		1.90		1.86			1.65	1.90					
October 8		2.50		2.30		2.30				2.08	1.88	1.77	1.15	1.25
October 14	3.25				2.11		1.00	1.90	2.15					
October 20	3.50		2.15		2.36		1.15	2.15	2.40					
November 2	4.00		2.40		2.61		1.25	2.40	2.65					
November 9		2.90		2.70		2.70				2.48	2.28	2.27	1.65	1.75
Average for year	3.33	2.75	2.01	2.51	2.07	2.52	1.09	1.83	2.07	2.27	2.10	2.10	1.49	1.03

Posted price per barrel of crude petroleum at wells, 1919–1921, by grades, with dates of change—Continued.

Date.	Mid-Continent field.															
	Cement.	Healdton.[a]	Oklahoma-Kansas grade.[b]	Breckenridge, Burkburnett, Desdemona, Electra, Holliday, Moran, Petrolia, Ranger.[c]	Corsicana heavy.[a]	Corsicana light.[a]	Mexia.[a]	Caddo.[d]				De Soto.[d]	Bull Bayou.[d]			
								Heavy.	32°–34.9°.	35°–37.9°.	38° and above.		32° and below.	32°–34.9°.	35°–37.9°.	38° and above.
1919.																
January 1		$1.45	$2.25	$2.25	$1.30	$2.25		$1.55	$2.10	$2.15	$2.25	$2.15				
January 14																
January 16								1.25								
February 1																
February 6								1.00								
February 21		1.20			1.05											
March 18																
March 24								.75								
May 2																
June 5																
August 12													$0.75	$1.75	$1.80	$1.90
November 20			2.50	2.50												
November 21		1.35			1.15											
December 2																
December 5																
December 18						2.50		1.00	2.35	2.40	2.50	2.40	1.00	2.00	2.05	2.15
December 19		1.85														
December 20			2.75	2.75												
December 21																
December 22		2.00														
December 23					1.30	2.75		1.25	2.60	2.65	2.75	2.65	1.25	2.25	2.30	2.40
Average for year		1.27	2.28	2.28	1.10	2.27		.86	2.12	2.17	2.27	2.17	.79	1.79	1.84	1.94
1920.																
January 6			3.00	3.00	1.55			1.50	2.85	2.90	3.00	2.90	1.50	2.50	2.55	2.65
January 8		2.25														
February 19																
February 27		2.50	3.25	3.25				1.75								
February 28									3.10	3.15	3.25	3.15	1.75	2.75	2.80	2.90
March 1			3.50	3.50	1.75	3.00										
March 2																
March 3		2.75														
March 4																
March 15								2.00	3.35	3.40	3.50	3.40	2.00	3.00	3.05	3.15
April 13																

May 5								2.25								
May 10								2.50								
May 12																
August 20					2.50											
September 27	$2.85															
November 24																
Average for year	2.85	2.66	3.42	3.42	1.99	2.96		2.24	3.26	3.31	3.41	3.31	1.91	2.91	2.96	3.06
1921.																
January 18		2.25			2.00											
January 21	2.35															
January 24			3.00	3.00												
January 25	1.85	1.75			1.50	2.50		2.00	2.85	2.90	3.00	2.90	1.50	2.50	2.55	2.65
January 27								1.50								
January 31	1.35	1.25	2.50	2.50	1.00	2.00										
February 1									2.35	2.40	2.50	2.40	1.00	2.00	2.05	2.15
February 3								1.25								
February 4	1.00	1.00	2.00	2.00	.75	1.50										
February 8									1.85	1.90	2.00	1.90	.50	1.50	1.55	1.65
February 9			1.75	1.75												
February 11																
April 14																
May 2			1.50	1.50												
May 3						1.25			1.60	1.65	1.75	1.65	.25	1.25	1.30	1.40
May 5								1.00								
May 13																
June 4	.75	.75			.50	1.00										
June 11																
June 13			1.25	1.25												
June 14									1.35	1.40	1.50	1.40		1.00	1.05	1.15
June 15			1.00	1.00												
June 16								.80	1.10	1.15	1.25	1.15		.75	.80	.90
June 18								.60								
June 21		.60				.85										
September 3																
September 13																
September 23																
September 28				1.25												
September 30	.85	.70			.60	.95										
October 1			1.25													
October 3				1.50												
October 4	.95	.80			.70	1.05										
October 5								.85				1.25	.50	1.00	1.05	1.15
October 7			1.50	1.75				1.10	1.35	1.40	1.50	1.50		1.25	1.30	1.40
October 8					.85	1.20	$0.60									
November 7			2.00	2.25												
November 8	1.10	.95					.75		1.85	1.90	2.00	2.00	1.00	1.75	1.80	1.90
November 10								1.25								
December 15	1.30	1.30			.95	1.30	1.00									
Average for year	1.07	.99	1.65	1.71	.82	1.32	.75	1.10	1.67	1.72	1.82	1.74	.61	1.38	1.43	1.53

a Magnolia Petroleum Co. b Prairie Oil & Gas Co. c Texas Co. d Standard Oil Co. of Louisiana.

Posted price per barrel of crude petroleum at wells, 1919–1921, by grades, with dates of change—Continued.

Date.	Mid-Continent field—Continued.											Gulf Coast field.
	Homer.[d]				Haynesville.[d]				El Dorado.[d]			(Texas:[e] Batson, Blue Ridge, Cow Bayou, Goose Creek, Hull, Humble, Pierce Junction, Saratoga, Sourlake, Spindletop; Louisiana:[f] Edgerley, Jennings, Vinton).
	32° and below.	32°–34.9°.	35°–35.9°.	36° and above.	Below 32°.	32°–33.9°.	34°–35.9°.	36° and above.	Below 33°.	33°–34.9°.	35° and above.	
1919.												
January 1												$1.80
January 14												1.50
January 16												
February 1												1.25
February 6												
February 21												
March 18												1.00
March 24												
May 2		$2.15										
June 5		2.10	$2.15	$2.25								
August 12												
November 20												
November 21												
December 2												
December 5												1.25
December 18		2.35	2.40	2.50								
December 19												
December 20												
December 21												1.50
December 22												
December 23		2.60	2.65	2.75								
Average for year		2.13	2.23	2.33								1.11
1920.												
January 6		2.85	2.90	3.00								1.75
January 8												
February 19												2.00
February 27												
February 28		3.10	3.15	3.25								
March 1												
March 2												2.25
March 3												
March 4												2.50
March 15												
April 13												3.00
May 5												

May 10												
May 12									$0.50	$0 60	$0.75	
August 20												
September 27												
November 24												2.50
Average for year		3.06	3.11	3.21					.50	.60	.75	2.44
1921.												
anuary 18												
January 21												2.00
January 24												
January 25	$1.25	2.60	2.65	2.75								
January 27												
January 31												
February 1		2.10	2.15	2.25								1.50
February 3												
February 4												
February 8		1.60	1.65	1.75								
February 9												
February 11												1.25
April 14												1.00
May 2												
May 3	1.00	1.35	1.40	1.50								
May 5												
May 13											.70	
June 4												
June 11					$1.00	$1.10	$1.15	$1.25				
June 13												.80
June 14	.75	1.10	1.15	1.25	.75	.85	.90	1.00				
June 15												
June 16	.50	.85	.90	1.00	.50	.60	.65	.75				
					Below 34°.		34° and above.		Below 34°.	34° and above.		
September 3									$0.70	$0.80		
September 13					$0.65		$0.75					
September 23									.80	.90		
September 28					.75		.85		.90	1.00		
September 30												
October 1												
October 3												
October 4												
October 5	.75	1.10	1.15	1.25	1.00		1.10		1.15	1.25		
October 7	1.00	1.35	1.40	1.50	1.25		1.35		1.40	1.50		1.00
October 8												
November 7												1.25
November 8	1.50	1.80	1.90	2.00	1.75		1.85		1.75	2.00		
November 10												
December 15												
Average for year	1.04	1.47	1.53	1.66								1.14

d Standard Oil Co. of Louisiana. *e* Gulf Pipe Line Co. *f* Gulf Refining Co.

Posted price per barrel of crude petroleum at wells, 1919–1921, by grades, with dates of change—Continued.

Date.	Rocky Mountain field.[a]									California field.[b]					
	Ferris.	Grass Creek, Elk Basin, Greybull Torchlight.	Lance Creek.	Lander heavy crude.	Mule Creek.	Osage.	Rock Creek.	Salt Creek, Big Muddy Hamilton Dome.	Cat Creek.	14°–17.9°	18°–18.9°	19°–19.9°	20°–20.9°	21°–21.9°	22°–22.9°
1919.															
January 1		$1.85	$1.80	$0.90			$1.50	$1.50		$1.23	$1.24	$1.25	$1.26	$1.27	$1.28
June 10													1.27	1.29	1.31
November 21		2.10	2.05	1.05			1.75	1.75							
December 23		2.35	2.30	1.25			2.00	2.00							
Average for year		1.88	1.83	.92			1.53	1.53		1.23	1.24	1.25	1.27	1.28	1.30
1920.															
January 1			2.35												
January 13		2.60	2.55	1.75			2.25	2.25							
January 31												1.26	1.29	1.33	1.38
February 4							2.35								
March 2		2.85	2.80				2.50	2.50							
March 16		3.10	3.05	2.00	$2.05		2.75	2.75							
March 17										1.48	1.49	1.51	1.54	1.58	1.63
July 10										1.60	1.61	1.63	1.66	1.70	1.75
Average for year		3.00	2.95	1.93	2.05		2.66	2.65		1.49	1.50	1.52	1.54	1.58	1.63
1921.															
January 25		2.60	2.55	1.25	1.80		2.35	2.25	$2.60						
February 1		2.25	2.20		1.45		2.00	1.90	2.25						
February 5		2.00	1.95	1.00	1.20		1.75	1.65	2.00						
February 10	$1.60	1.75	1.70	.8725	.95	$1.70	1.50	1.40	1.75						
May 3	1.35	1.50	1.45	.71		1.45	1.25	1.15							
May 13										1.35	1.36	1.38	1.41	1.45	1.50
May 21	1.20			.6125	.80		1.10	1.00	1.50						
June 14	.95	1.25	1.20	.45		1.20	.85	.75	1.25						
June 17	.85	1.15	1.10	.385	.70	1.10	.75	.65	1.15						
June 22					.60										
June 27	.70	1.00	.95	.2875	.45	.95	.60	.50	1.00						
August 3										1.10	1.11	1.13	1.16	1.20	1.25
October 4	.95	1.25	1.20	.45	.70	1.20	.85	.75	1.25						
October 8	1.10	1.45	1.40	.5475	.85	1.35	1.05	.90	1.45						
November 8	1.60	1.90	1.90	.8725	1.30	1.90	1.50	1.40	1.90						
Average for year	1.20	1.60	1.56	.82	.91	1.41	1.25	1.16	1.51	1.34	1.35	1.37	1.40	1.44	1.49

Date.	California field [b]—Continued.															
	23°–23.9°	24°–24.9°	25°–25.9°	26°–26.9°	27°–27.9°	28°–28.9°	29°–29.9°	30°–30.9°	31°–31.9°	32°–32.9°	33°–33.9°	34°–34.9°	35°–35.9°	36°–36.9°	37°–37.9°	Above 37.9°.
1919.																
January 1	$1.29	$1.30	$1.32	$1.34	$1.36	$1.38	$1.40	$1.42	$1.44	$1.46	$1.48	$1.50	$1.52	$1.54	$1.57	3¢ additional per barrel for each full degree.
June 10	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.51	1.53	1.55	1.57	1.59	1.62	Do.
Average for year	1.31	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.51	1.53	1.55	1.57	1.60	
													35° and above.			
1920.																
January 31	1.44	1.51	1.59	1.68	1.78	1.88	1.98	2.08	2.18	2.28	2.38	2.48	$2.58			
March 17	1.69	1.76	1.84	1.93	2.03	2.13	2.23	2.33	2.43	2.53	2.63	2.73	2.83			
July 10	1.81	1.88	1.96	2.05	2.15	2.25	2.35	2.45	2.55	2.65	2.75	2.85	2.95			
Average for year	1.69	1.75	1.83	1.91	2.01	2.10	2.19	2.29	2.38	2.47	2.57	2.66	....			
1921.																
May 13	1.56	1.63	1.71	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50	2.60	2.70			
August 3	1.31	1.38	1.46	1.55	1.65	1.75	1.85	1.95	2.05	2.15	2.25	2.35	2.45			
Average for year	1.55	1.62	1.70	1.79	1.89	1.99	2.09	2.19	2.29	2.39	2.49	2.59	2.69			

[a] Midwest Refining Co. [b] Standard Oil Co.

WELLS.

On December 31, 1921, there were 274,500 producing oil wells in the United States, having an average production per well per day of 4.9 barrels, as shown by the following table. For the States east of California the well data are based on information supplied by pipe-line companies, supplemented by reports of producing companies which supply the few pipe-line companies that do not maintain lists of wells with which their gathering lines are connected. The data for California are taken from the Standard Oil Bulletin.

Producing oil wells in the United States, December 31, 1921.

State.	Approximate number of wells.	Approximate production per well per day (barrels).
Arkansas	550	72.0
California	9,980	32.0
Colorado	80	3.2
Illinois	16,650	1.5
Indiana:		
Southwestern	1,100	2.0
Northeastern	1,500	.4
Total Indiana	2,600	1.1
Kansas	17,200	5.1
Kentucky	9,200	2.7
Louisiana:		
Northern	2,850	26.6
Coastal	150	29.5
Total Louisiana	3,000	26.7
Montana	90	56.6
New York	13,500	.2
Ohio:		
Central and Eastern	17,600	.8
Northwestern	19,400	.3
Total Ohio	37,000	.5
Oklahoma	56,200	5.5
Pennsylvania	73,700	.3
Texas:		
Central and northern	11,200	21.7
Coastal	2,100	42.5
Total Texas	13,300	23.3
West Virginia	20,000	1.1
Wyoming	1,450	443.3
	274,500	4.9

The following tables of wells drilled for oil and gas, including dry holes, were compiled for the States east of California from the Oil and Gas Journal and for California from the Standard Oil Bulletin, supplemented in years prior to 1919 by reports of producers.

For the last nine years, over the country as a whole, approximately 71 per cent of the total number of wells drilled were oil wells, 9 per cent were gas wells, and 20 per cent were dry holes. But in the individual States the results varied considerably, as appears from the tables. The fluctuations in the number of oil wells completed from year to year, shown in the summary table of wells drilled in the years 1913–1921, contrast with the progressive increase in production of petroleum. In 1915 and 1921, when prices of crude oil were unusually low, there was a correspondingly small number of oil wells completed as compared with the number in 1916 and 1920, when prices of crude oil were high. Although the number of wells drilled varies with fluctuations in price of crude oil, the number of new wells is not the chief factor causing increased production, for a few wells that open up highly productive new pools are obviously of much more consequence than many new wells in old fields. Of the 14,000 oil wells drilled in 1921, having an average initial daily production per well ranging from 3.4 barrels in New York and Pennsylvania to 984 barrels in coastal Texas (California not reported), 1,800 new wells (less than 1 per cent of the producing wells in the country) produced 30,000,000 barrels in California, Arkansas, coastal Texas, and Montana. In the last few years the application of geology to oil-field operations has been of increasing importance in bringing in new pools. In the Mexia (Texas), Burbank (Oklahoma), Bellevue (Louisiana), Teapot Dome (Wyoming), and Sweet Grass Hills (Montana) pools, geologic mapping by the United States Geological Survey had proved the existence of oil-bearing structural features prior to the extensive development that has since taken place.

Summary of wells drilled in the United States, 1913–1921.

	1913	1914	1915	1916	1917	1918	1919	1920	1921
Wells completed:									
Oil	19,101	16,668	9,154	18,777	16,590	17,845	21,052	24,273	14,666
Gas	2,207	2,327	2,022	1,803	1,966	2,229	2,135	2,274	2,111
Dry	4,282	4,142	2,981	4,039	4,851	5,613	5,986	7,364	5,160
	25,590	23,137	14,157	24,619	23,407	25,687	29,173	33,911	21,937
Percentage of total wells drilled:									
Oil	74.7	72.0	64.7	76.3	70.9	69.5	72.2	71.6	66.9
Gas	8.6	10.1	14.2	7.3	8.4	8.7	7.3	6.7	9.6
Dry	16.7	17.9	21.1	16.4	20.7	21.8	20.5	21.7	23.5
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Wells drilled in the United States, 1919–1921, by States.

	1919				1920				1921			
	Oil.	Gas.	Dry.	Total.	Oil.	Gas.	Dry.	Total.	Oil.	Gas.	Dry.	Total.
Arkansas	......	......	......	......	2	1	11	14	558	42	46	646
California	559	(a)	(a)	559	572	(a)	(a)	572	704	(a)	(a)	704
Illinois	254	2	114	370	257	3	125	385	165	......	102	267
Indiana	321	5	111	437	354	5	109	468	237	1	79	317
Kansas	2,725	182	639	3,546	2,320	148	695	3,163	913	113	354	1,380
Kentucky	3,165	130	407	3,702	2,542	66	265	2,873	1,935	64	469	2,468
Louisiana:												
Northern	512	69	109	690	841	112	211	1,164	327	55	186	568
Coastal	84	4	99	187	101	......	76	177	46	1	66	113
Total Louisiana	596	73	208	877	942	112	287	1,341	373	56	252	681
Michigan	......	......	......	......	1	......	3	4	4	1	......	5
Montana	......	......	......	......	......	......	......	......	61	......	33	94
Ohio:												
Southeastern	1,218	334	591	2,143	1,502	354	722	2,578	898	405	531	1,834
Northwestern	328	4	53	385	478	7	80	565	372	......	89	461
Total Ohio	1,546	338	644	2,528	1,980	361	802	3,143	1,270	405	620	2,295
Oklahoma	5,211	718	2,267	8,196	6,304	757	2,036	9,097	3,545	660	1,509	5,714
Pennsylvania and New York	2,058	215	224	2,497	2,263	189	317	2,769	1,565	208	244	2,017
Tennessee	9	......	4	13	7	......	8	15	17	1	13	31
Texas:												
Central and Northern	2,973	49	611	3,633	4,728	243	1,717	6,688	2,052	174	758	2,984
Coastal	541	14	464	1,019	772	34	609	1,415	482	38	361	881
Total Texas	3,514	63	1,075	4,652	5,500	277	2,326	8,103	2,534	212	1,119	3,865
West Virginia	895	382	216	1,493	971	343	305	1,619	526	332	259	1,117
Wyoming	199	27	77	303	258	12	75	345	259	16	61	336
United States	21,052	2,135	5,986	29,173	24,273	2,274	7,364	33,911	14,666	2,111	5,160	21,937

a Not reported.

Wells drilled in the United States, 1919–1921, by States.[a]

Pennsylvania and New York.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Oil	92	117	117	146	164	173	188	200	236	229	222	174	2,058	82.4	3.8
Gas	11	14	19	12	19	19	21	19	16	15	27	23	215	8.6	......
Dry	12	19	18	15	18	18	19	21	28	16	19	21	224	9.0	......
	115	150	154	173	201	210	228	240	280	260	268	218	2,497	100.0	......
1920.															
Oil	104	99	102	179	194	217	209	253	235	264	211	196	2,263	81.7	3.7
Gas	19	11	6	9	15	11	21	16	20	26	19	16	189	6.8	......
Dry	18	12	12	17	23	29	36	31	36	28	42	33	317	11.5	......
	141	122	120	205	232	257	266	300	291	318	272	245	2,769	100.0	......
1921.															
Oil	174	183	145	119	154	145	103	88	75	99	129	151	1,565	77.6	3.4
Gas	12	18	18	11	13	24	26	18	5	15	24	24	208	10.3	......
Dry	22	36	22	18	24	26	17	17	15	14	17	16	244	12.1	......
	208	237	185	148	191	195	146	123	95	128	170	191	2,017	100.0	......

West Virginia.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Oil	63	58	52	76	80	84	84	84	88	81	78	67	895	60.0	23.9
Gas	32	22	33	35	26	34	23	35	30	42	32	38	382	25.5	......
Dry	11	20	13	19	19	17	21	19	24	13	14	26	216	14.5	......
	106	100	98	130	125	135	128	138	142	136	124	131	1,493	100.0	......
1920.															
Oil	66	55	74	66	72	82	78	102	101	95	92	88	971	60.0	17.1
Gas	21	30	22	16	26	25	30	36	32	30	40	35	343	21.1	......
Dry	24	10	10	27	26	30	38	34	25	34	26	21	305	18.9	......
	111	95	106	109	124	137	146	172	158	159	158	144	1,619	100.0	......
1921.															
Oil	73	74	63	55	46	40	34	32	22	27	27	33	526	47.1	14.7
Gas	39	31	44	34	15	16	22	26	27	26	24	28	332	29.7	......
Dry	21	30	25	28	27	26	17	21	18	11	19	16	259	23.2	......
	133	135	132	117	88	82	73	79	67	64	70	77	1,117	100.0	......

Kentucky.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Oil	148	189	232	268	283	323	307	302	315	291	297	210	3,165	85.5	33.8
Gas	8	6	11	9	11	15	11	8	7	10	14	20	130	3.5	......
Dry	13	20	25	29	36	58	33	35	39	20	65	34	407	11.0	......
	169	215	268	306	330	396	351	345	361	321	376	264	3,702	100.0	......
1920.															
Oil	174	155	211	242	229	263	166	225	204	237	232	204	2,542	88.5	31.3
Gas	1	7	3	6	4	6	3	8	6	2	13	7	66	2.3	......
Dry	26	26	19	28	28	27	20	22	13	18	22	16	265	9.2	......
	201	188	233	276	261	296	189	255	223	257	267	227	2,873	100.0	......
1921.															
Oil	175	227	180	153	195	267	148	150	94	94	103	149	1,935	78.4	20.9
Gas	4	3	5	1	2	3	11	3	10	7	10	5	64	2.6	......
Dry	25	17	15	10	28	102	57	75	46	33	26	35	469	19.0	......
	204	247	200	164	225	372	216	228	150	134	139	189	2,468	100.0	......

[a] Oil and Gas Journal and Standard Oil Bulletin.

Wells drilled in the United States, 1919–1921, by States—Continued.

Tennessee.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Oil	....	....	3	....	4	....	1	....	1	....	....	....	9	69.2	10.0
Gas	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......
Dry	....	....	....	....	3	....	....	....	....	....	1	....	4	30.8	......
	....	....	3	....	7	....	1	....	1	....	1	....	13	100.0	......
1920.															
Oil	1	1	1	1	....	....	....	....	....	....	3	....	7	46.6	22.9
Gas	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......
Dry	....	2	....	....	....	....	....	....	....	....	6	....	8	53.4	......
	1	3	1	1	....	....	....	....	....	....	9	....	15	100.0	......
1921.															
Oil	....	3	1	5	....	1	....	7	....	....	....	....	17	54.9	22.9
Gas	....	....	....	1	....	....	....	....	....	....	....	....	1	3.2	......
Dry	....	....	....	2	....	6	....	3	....	....	2	....	13	41.9	......
	....	3	1	8	....	7	....	10	....	....	2	....	31	100.0	......

Ohio.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Southeast and central:															
Oil	67	66	76	82	99	108	120	116	129	141	108	106	1,218	56.8	22.2
Gas	27	32	30	20	20	22	34	31	38	32	22	26	334	15.6	......
Dry	37	32	32	40	41	43	27	70	69	92	41	67	591	27.6	......
	131	130	138	142	160	173	181	217	236	265	171	199	2,143	100.0	......
Northwestern:															
Oil	20	20	30	23	31	22	29	40	38	29	27	19	328	85.2	18.6
Gas	1	....	....	2	....	....	....	1	....	....	....	....	4	1.0	......
Dry	6	1	4	2	7	1	10	7	3	9	1	2	53	13.8	......
	27	21	34	27	38	23	39	48	41	38	28	21	385	100.0	......
1920.															
Southeast and central:															
Oil	83	74	108	135	131	138	134	139	159	155	126	120	1,502	58.3	21.5
Gas	24	18	17	19	14	41	32	34	34	40	44	37	354	13.7	......
Dry	44	33	49	63	56	83	65	64	63	67	84	51	722	28.0	......
	151	125	174	217	201	262	231	237	256	262	254	208	2,578	100.0	......
Northwestern:															
Oil	15	12	18	32	38	48	53	52	59	59	56	36	478	84.6	17.1
Gas	....	....	....	1	....	....	1	....	2	....	3	....	7	1.2	......
Dry	1	4	4	6	6	9	5	6	8	6	11	14	80	14.2	......
	16	16	22	39	44	57	59	58	69	65	70	50	565	100.0	......
1921.															
Southeast and central:															
Oil	109	105	68	66	71	100	79	49	42	55	70	84	898	49.0	12.7
Gas	17	30	37	13	18	16	43	26	56	60	34	55	405	22.0	......
Dry	60	57	48	39	48	50	45	30	42	42	36	34	531	29.0	......
	186	192	153	118	137	166	167	105	140	157	140	173	1,834	100.0	......
Northwestern:															
Oil	39	54	42	31	28	39	31	20	20	12	30	26	372	80.7	17.6
Gas	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......
Dry	2	6	16	9	10	13	6	9	4	2	3	9	89	19.3	......
	41	60	58	40	38	52	37	29	24	14	33	35	461	100.0	......

Wells drilled in the United States, 1919–1921, by States—Continued.

Indiana.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Northeastern:															
Oil	10	12	16	13	28	28	26	24	27	22	23	11	240	78.7	23.4
Gas	2	....	....	....	....	....	....	....	....	....	....	....	2	.7	......
Dry	3	2	4	4	5	10	11	3	5	7	5	4	63	20.6	......
	15	14	20	17	33	38	37	27	32	29	28	15	305	100.0	......
Southwestern:															
Oil	2	13	8	5	9	7	6	5	6	4	14	2	81	61.3	33.2
Gas	....	....	....	....	....	....	....	....	2	1	....	....	3	2.3	......
Dry	3	6	5	4	2	3	4	3	7	4	4	3	48	36.4	......
	5	19	13	9	11	10	10	8	15	9	18	5	132	100.0	......
1920.															
Northeastern:															
Oil	11	....	14	17	21	38	14	21	24	23	21	41	245	81.9	15.4
Gas	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......
Dry	2	....	3	7	10	4	1	8	9	7	2	1	54	18.1	......
	13	....	17	24	31	42	15	29	33	30	23	42	299	100.0	......
Southwestern:															
Oil	8	6	11	4	5	9	5	9	16	11	13	12	109	64.5	28.4
Gas	....	....	....	....	1	1	1	....	1	....	....	1	5	3.0	......
Dry	4	4	9	3	3	5	4	4	8	3	2	6	55	32.5	......
	12	10	20	7	9	15	10	13	25	14	15	19	169	100.0	......
1921.															
Northeastern:															
Oil	10	7	24	11	15	14	8	16	7	....	7	4	123	80.9	15.6
Gas	....	....	....	....	....	....	....	1	....	....	....	....	1	.7	......
Dry	2	3	5	2	2	....	2	7	....	3	2	....	28	18.4	......
	12	10	29	13	17	14	10	24	7	3	9	4	152	100.0	......
Southwestern.															
Oil	15	10	12	15	11	18	9	4	5	6	4	5	114	69.1	34.3
Gas	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......
Dry	2	2	1	5	6	8	10	5	6	1	4	1	51	30.9	......
	17	12	13	20	17	26	19	9	11	7	8	6	165	100.0	......

Illinois.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Oil	9	24	23	19	18	22	14	27	30	29	25	14	254	68.7	19.7
Gas	....	....	....	1	....	....	....	....	1	....	....	....	2	.5	......
Dry	8	9	15	7	7	10	14	12	11	4	9	8	114	30.8	......
	17	33	38	27	25	32	28	39	42	33	34	22	370	100.0	......
1920.															
Oil	10	13	17	16	27	29	25	21	33	22	22	22	257	66.8	20.3
Gas	1	....	....	....	....	....	....	....	....	....	1	1	3	.8	......
Dry	11	5	4	11	7	21	10	13	10	9	9	15	125	32.4	......
	22	18	21	27	34	50	35	34	43	31	32	38	385	100.0	......
1921.															
Oil	14	22	22	12	16	24	10	11	9	8	10	7	165	61.8	27.2
Gas	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......
Dry	7	3	6	13	17	14	7	8	5	10	9	3	102	38.2	......
	21	25	28	25	33	38	17	19	14	18	19	10	267	100.0	......

Wells drilled in the United States, 1919–1921, by States—Continued.

Arkansas.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1920.															
Oil	....	....	....	....	....	....	....	1	....	1	....	....	2	14.3	17.5
Gas	....	....	....	....	....	....	....	....	....	....	....	1	1	7.1	......
Dry	....	....	....	....	....	2	....	....	....	4	....	5	11	78.6	......
	....	....	....	....	....	2	....	1	....	5	....	6	14	100.0	......
1921.															
Oil	1	2	3	8	34	59	88	77	82	69	68	67	558	86.4	914.9
Gas	1	....	7	10	4	1	4	6	3	2	1	3	42	6.5	......
Dry	5	....	2	2	5	1	1	5	7	8	6	4	46	7.1	......
	7	2	12	20	43	61	93	88	92	79	75	74	646	100.0	......

Kansas.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Oil	153	285	143	249	284	274	230	330	222	232	210	113	2,725	76.9	63.3
Gas	10	14	15	16	19	17	25	12	19	15	7	13	182	5.1	......
Dry	39	46	45	67	63	62	48	55	73	54	58	29	639	18.0	......
	202	345	203	332	366	353	303	397	314	301	275	155	3,546	100.0	......
1920.															
Oil	140	127	159	184	234	231	236	241	211	162	202	193	2,320	73.3	78.4
Gas	13	10	14	11	12	5	13	17	8	14	13	18	148	4.7	......
Dry	32	44	31	47	57	73	68	75	43	80	76	69	695	22.0	......
	185	181	204	242	303	309	317	333	262	256	291	280	3,163	100.0	......
1921.															
Oil	162	59	123	91	76	98	68	36	27	37	30	106	913	66.2	104.9
Gas	33	1	13	9	3	7	4	8	11	4	1	19	113	8.2	......
Dry	58	18	46	44	30	32	23	20	12	22	21	28	354	25.6	......
	253	78	182	144	109	137	95	64	50	63	52	153	1,380	100.0	......

Oklahoma.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Oil	322	351	408	399	568	501	454	488	508	460	441	311	5,211	63.6	93.8
Gas	53	63	73	80	69	53	69	52	62	55	48	41	718	27.6	......
Dry	159	189	176	180	221	199	234	207	200	196	171	135	2,267	8.8	......
	534	603	657	659	858	753	757	747	770	711	660	487	8,196	100.0	......
1920.															
Oil	293	365	520	524	693	572	523	670	519	559	587	479	6,304	69.3	122.8
Gas	50	56	61	60	81	46	75	73	54	48	70	83	757	8.3	......
Dry	110	147	128	163	184	178	189	239	169	160	199	170	2,036	22.4	......
	453	568	709	747	958	796	787	982	742	767	856	732	9,097	100.0	......
1921.															
Oil	505	406	328	269	377	360	319	218	197	184	184	198	3,545	62.0	166.2
Gas	82	82	66	34	59	56	54	47	37	46	44	53	660	11.6	......
Dry	161	178	158	97	144	158	143	121	98	88	78	85	1,509	26.4	......
	748	666	552	400	580	574	516	386	332	318	306	336	5,714	100.0	......

Wells drilled in the United States, 1919–1921, by States—Continued.

Louisiana.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Northern:															
Oil	33	29	51	43	33	32	37	53	58	61	42	40	512	74.2	885.9
Gas	3	5	7	9	5	6	11	6	2	4	3	8	69	10.0	......
Dry	2	18	7	8	13	10	18	10	6	5	9	3	109	15.8	......
	38	52	65	60	51	48	66	69	66	70	54	51	690	100.0	......
Coastal:															
Oil	9	11	4	6	10	8	11	7	4	4	5	5	84	44.9	103.5
Gas	....	....	1	....	....	1	....	1	....	....	1	....	4	2.1	......
Dry	7	5	6	6	17	9	7	6	8	10	11	7	99	53.0	......
	16	16	11	12	27	18	18	14	12	14	17	12	187	100.0	......
1920.															
Northern:															
Oil	50	40	53	89	112	62	81	91	88	55	52	68	841	72.4	771.9
Gas	2	5	5	11	24	14	8	4	10	....	20	9	112	9.6	......
Dry	6	2	8	11	24	21	26	37	30	15	9	22	211	18.0	......
	58	47	66	111	160	97	115	132	128	70	81	99	1,164	100.0	......
Coastal:															
Oil	6	4	7	8	8	13	10	11	10	8	10	6	101	57.1	246.9
Gas	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......
Dry	3	2	5	4	7	11	9	8	7	4	12	4	76	42.9	......
	9	6	12	12	15	24	19	19	17	12	22	10	177	100.0	......
1921.															
Northern:															
Oil	69	49	41	35	13	7	14	7	19	8	24	41	327	57.6	590.1
Gas	7	6	8	6	3	4	3	2	5	4	3	4	55	9.7	......
Dry	30	41	29	18	9	7	9	1	11	6	11	14	186	32.7	......
	106	96	78	59	25	18	26	10	35	18	38	59	568	100.0	......
Coastal:															
Oil	9	9	7	3	3	3	3	1	1	....	4	3	46	40.7	102.9
Gas	....	....	....	....	....	....	....	....	....	....	1	....	1	.9	......
Dry	4	6	6	7	10	2	6	4	3	4	3	11	66	58.4	......
	13	15	13	10	13	5	9	5	4	4	8	14	113	100.0	......

Wells drilled in the United States, 1919–1921, by States—Continued.

Texas.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
North and Central:															
Oil	102	176	153	166	224	263	241	244	349	334	315	406	2,973	81.9	584.7
Gas	....	2	3	5	2	5	2	2	5	11	3	9	49	1.3	......
Dry	19	18	25	39	58	72	95	69	78	53	42	43	611	16.8	......
	121	196	181	210	284	340	338	315	432	398	360	458	3,633	100.0	......
Coastal:															
Oil	53	61	47	62	51	47	45	45	35	27	45	23	541	53.0	503.2
Gas	1	1	2	3	1	1	4	....	1	....	....	....	14	1.4	......
Dry	28	26	29	39	47	47	56	45	35	39	31	42	464	45.6	......
	82	88	78	104	99	95	105	90	71	66	76	65	1,019	100.0	......
Total Texas	203	284	259	314	383	435	443	405	503	464	436	523	4,652	......	......
1920.															
North and central:															
Oil	545	453	423	485	327	410	229	468	375	326	362	325	4,728	70.7	221.7
Gas	12	12	6	30	19	19	13	38	35	12	27	20	243	3.6	......
Dry	97	88	98	131	98	179	112	254	212	147	160	141	1,717	25.7	......
	654	553	527	646	444	608	354	760	622	485	549	486	6,688	100.0	......
Coastal:															
Oil	31	29	49	60	78	81	73	76	86	74	83	52	772	54.6	670.4
Gas	2	4	4	1	4	4	5	3	....	....	2	5	34	2.4	......
Dry	39	44	47	41	70	58	65	65	51	36	54	39	609	43.0	......
	72	77	100	102	152	143	143	144	137	110	139	96	1,415	100.0	......
Total Texas	726	630	627	748	596	751	497	904	759	595	688	582	8,103	......	......
1921.															
North and central:															
Oil	282	320	238	189	228	172	124	106	92	77	102	122	2,052	68.8	279.5
Gas	18	22	21	21	21	14	17	16	10	5	5	4	174	5.8	......
Dry	95	91	74	72	75	60	61	41	52	36	44	57	758	25.4	......
	395	433	333	282	324	246	202	163	154	118	151	183	2,984	100.0	......
Coastal:															
Oil	75	48	54	54	47	30	21	25	21	25	35	47	482	54.7	984.1
Gas	4	4	3	7	7	....	....	3	3	....	2	5	38	4.3	......
Dry	34	40	31	38	45	20	23	19	29	25	31	26	361	41.0	......
	113	92	88	99	99	50	44	47	53	50	68	78	881	100.0	......
Total Texas	508	525	421	381	423	296	246	210	207	168	219	261	3,865	......	......

Wyoming.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Oil	6	17	9	20	12	15	19	20	21	23	18	19	199	65.7	260.9
Gas	....	1	3	1	3	7	3	2	2	2	2	1	27	8.9	......
Dry	5	5	2	8	8	8	10	5	10	6	8	2	77	25.4	......
	11	23	14	29	23	30	32	27	33	31	28	22	303	100.0	......
1920.															
Oil	11	11	11	9	10	25	25	28	33	31	25	39	258	74.8	160.5
Gas	1	3	....	....	2	2	....	....	....	....	4	....	12	3.5	......
Dry	5	3	5	3	4	3	6	9	11	6	9	11	75	21.7	......
	17	17	16	12	16	30	31	37	44	37	38	50	345	100.0	......
1921.															
Oil	28	21	28	39	19	15	25	16	13	14	22	19	259	77.1	358.5
Gas	2	2	1	1	....	1	2	2	....	1	4	....	16	4.8	......
Dry	6	4	5	4	6	6	2	7	8	3	6	4	61	18.1	......
	36	27	34	44	25	22	29	25	21	18	32	23	336	100.0	......

Wells drilled in the United States, 1919–1921, by States—Continued.

Montana.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1921.															
Oil	8	7	2	5	13	4	3	1	14	3	1	....	61	64.9	214.8
Gas	....	....	....	....	....	....	....	....	....	....	....	....	......	......	......
Dry	7	....	1	....	4	....	4	3	12	....	2	....	33	35.1	......
	15	7	3	5	17	4	7	4	26	3	3	....	94	100.0	......

California.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Percentage of total wells drilled.	Average initial daily production per well (barrels).
1919.															
Oil	52	42	36	40	52	39	39	51	61	49	46	52	559	......	......
1920.															
Oil	43	34	51	37	57	36	51	56	55	47	47	58	572	......	......
1921.															
Oil	64	60	66	58	59	76	76	83	47	32	38	45	704	......	......

TRANSPORTATION.

Petroleum is transported from the producing properties by gathering lines that deliver the oil (1) to tank farms, where it is held in storage; (2) to loading racks, whence it is loaded on tank cars for railroad shipment or on tank ships for transportation by water; (3) to main or trunk pipe lines for transportation and delivery to refineries or to other consumers.

Pipe lines transport all but a small fraction of the petroleum produced in the United States. The location of the principal oil pipe lines is shown in a series of maps of the oil and gas fields recently issued by the United States Geological Survey, listed on page 332. There are approximately 34,000 miles of main oil pipe lines in the United States and many thousand miles of gathering lines. The cubic capacity of the main lines is about 10 million barrels—in other words, that quantity is required to keep the lines filled with oil.

In 1921 approximately 137,500 tank cars in service in the United States and Canada were engaged in the transportation of crude petroleum and of petroleum products. These cars vary in capacity from 6,000 to 13,000 gallons.

The following tables, compiled by the Bureau of Navigation, Department of Commerce, give information concerning seagoing tank vessels and oil-burning ships.

World tankers.[a]

[500 gross tons and over.]

Flag.	June 30, 1920.						June 30, 1921.						June 30, 1922.					
	Steam and gas.		Sail and barge.		Total.		Steam and gas.		Sail and barge.		Total.		Steam and gas.		Sail and barge.		Total.	
	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.
American [b]	243	1,362,964	73	105,369	316	1,468,333	356	2,121,863	79	116,521	435	2,238,384	385	2,344,738	79	115,824	464	2,460,562
Argentine							1	640	1	637	2	1,277	2	1,528	1	637	3	2,165
Belgian	7	22,078			7	22,078	6	22,552			6	22,552	6	22,552			6	22,552
British	243	1,224,791	5	16,345	248	1,241,136	272	1,398,187	6	18,951	278	1,417,138	318	1,716,648	5	16,345	323	1,732,993
Chilean			1	2,583	1	2,583												
Chinese							1	510			1	510	1	510			1	510
Cuban			3	3,580	3	3,580	1	1,375	3	3,580	4	4,955	3	3,822	3	3,580	6	7,402
Danish	1	2,750	1	731	2	3,481	1	3,013	1	731	2	3,744	1	3,013	1	731	2	3,744
Danzig							3	26,907			3	26,907	3	26,907			3	26,907
Dominican													1	2,052			1	2,052
Dutch	33	93,863	5	4,728	38	98,591	38	115,032	3	2,171	41	117,203	39	121,179	3	2,171	42	123,350
French	6	21,311	1	3,203	7	24,514	10	47,696			10	47,696	17	88,951			17	88,951
German	7	32,059	1	728	8	32,787	5	11,425	1	728	6	12,153	8	13,740	1	728	9	14,468
Italian	4	21,503			4	21,503	5	27,667			5	27,667	12	60,484			12	60,484
Japanese	2	2,552			2	2,552	3	8,952			3	8,952	5	24,668			5	24,668
Latvian													1	1,268			1	1,268
Mexican	3	11,199	1	1,342	4	12,541	3	11,199	1	1,342	4	12,541	3	11,199	5	3,770	8	14,969
Norwegian	21	107,484			21	107,484	24	130,864			24	130,864	32	173,564			32	173,564
Philippine	2	3,282			2	3,282	3	5,750			3	5,750	4	9,950			4	9,950
Rumanian	1	3,051			1	3,051	1	3,051			1	3,051	1	5,311			1	5,311
Russian	6	11,965			6	11,965	4	7,209			4	7,209	2	3,509			2	3,509
Spanish	3	8,667			3	8,667	8	26,274			8	26,274	8	27,025			8	27,025
	582	2,929,519	91	138,609	673	3,068,128	745	3,970,166	95	144,661	840	4,114,827	852	4,662,618	98	143,786	950	4,806,404

[a] Exclusive of Navy, Admiralty, and other Government tankers. All figures, except for American tankers, are prepared from Lloyd's Register.
[b] Including tankers on Great Lakes.

World oil burners.[a]

[500 gross tons and over.]

Flag.	June 30, 1920.						June 30, 1921.						June 30, 1922.					
	Steam engine.		Oil engine.		Total.		Steam engine.		Oil engine.		Total.		Steam engine.		Oil engine.		Total.	
	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.	Number.	Gross tonnage.
American[b]	1,251	5,923,767	75	135,506	1,326	6,059,273	1,677	8,310,875	76	148,420	1,753	8,459,295	1,720	8,710,935	70	146,152	1,790	8,857,087
Argentine	3	6,017	4	3,664	7	9,681	4	9,962	4	3,818	8	13,780	4	9,962	6	6,989	10	16,951
Belgian	3	9,242	2	4,223	5	13,465	6	25,383	2	4,223	8	29,606	7	27,300	1	2,144	8	29,444
Brazilian	1	3,822	1	1,480	2	5,302	1	3,822	5	6,999	6	10,821	1	3,822	4	5,401	5	9,223
British	282	1,664,631	53	157,813	335	1,822,444	436	2,546,475	72	279,567	508	2,826,042	530	3,143,816	71	316,612	601	3,460,428
Chilean									1	1,919	1	1,919	1	7,000	2	2,500	3	9,500
Chinese			2	1,385	2	1,385	1	510	3	2,998	4	3,508	1	510	3	2,998	4	3,508
Cuban	2	3,244			2	3,244	3	4,533	1	1,111	4	5,644	3	4,533	1	1,111	4	5,644
Danish	3	4,976	21	98,102	24	103,078	6	22,755	26	130,316	32	153,071	11	37,671	31	145,727	42	183,398
Danzig	2	17,600	1	9,932	3	27,532	3	26,907	2	12,078	5	38,985	3	26,907	3	13,371	6	40,278
Dutch	74	221,258	18	29,202	92	250,460	103	402,704	21	33,726	124	436,430	128	533,349	25	59,229	153	592,578
Egyptian															4	5,991	4	5,991
Finnish									3	2,008	3	2,008			3	1,991	3	1,991
French	14	60,738	7	13,098	21	73,836	41	204,516	10	17,768	51	222,284	47	226,599	10	19,162	57	245,761
German							3	8,206	3	2,172	6	10,378	15	67,073	15	41,894	30	108,967
Greek	3	16,284	1	1,472	4	17,756	10	46,728	2	2,948	12	49,676	9	43,197	1	1,476	10	44,673
Honduran							6	12,515	1	677	7	13,192	8	17,106	1	677	9	17,783
Italian	14	64,283	19	42,188	33	106,471	25	122,202	23	52,863	48	175,065	24	123,271	32	68,985	56	192,256
Japanese	4	33,930	3	3,146	7	37,076	14	98,039	5	6,021	19	104,060	29	202,381	4	5,171	33	207,552
Mexican	6	18,917			6	18,917	6	18,917			6	18,917	10	24,670			10	24,670
Norwegian	46	231,102	51	107,635	97	338,737	92	434,353	61	116,989	153	551,342	104	511,096	71	157,723	175	668,819
Panaman									1	1,141	1	1,141			1	1,141	1	1,141
Paraguayan													2	3,254			2	3,254
Peruvian	5	17,812	1	1,584	6	19,396	5	17,611	1	1,584	6	19,195	5	17,611	1	1,584	6	19,195
Philippine	3	5,524	5	5,803	8	11,327	1	762	6	8,269	7	9,031	1	762	6	8,269	7	9,031
Portuguese									5	3,135	5	3,135			3	2,085	3	2,085
Russian	3	5,979	1	1,090	4	7,069	2	3,038	1	1,090	3	4,128	2	3,038	1	1,090	3	4,128
Siamese	3	1,956			3	1,956	2	1,203			2	1,203	2	1,203			2	1,203
Spanish	4	15,144	2	1,775	6	16,919	16	55,110	5	8,199	21	63,309	15	53,557	5	8,144	20	61,701
Swedish	3	16,189	21	72,578	24	88,767	8	31,012	32	107,774	40	138,786	9	30,512	38	135,881	47	166,393
Uruguayan	2	3,498	2	1,658	4	5,156	3	7,043	2	1,658	5	8,701	3	7,043	3	2,872	6	9,915
	1,731	8,345,913	290	693,334	2,021	9,039,247	2,474	12,415,181	374	959,471	2,848	13,374,652	2,694	13,838,178	416	1,166,370	3,110	15,004,548

[a] Exclusive of Army, Navy, Admiralty, and other Government oil burners. All figures, except for American vessels, are prepared from Lloyd's Register.
[b] Including oil burners on Great Lakes.

PRODUCTIVE ACREAGE.

The results of a canvass of producers of petroleum indicate that the area from which petroleum was produced in the United States in 1921 is 3,900,000 acres. This figure includes an allowance for companies not reporting, made by calculating the acreage for each State on the basis of its known production, using as a factor the ratio of production to acreage as reported by producers. The result is preliminary, pending a more complete investigation.

SPECIFIC GRAVITY.

The following table, showing average specific gravity of crude petroleum, weighted for production, by States and fields in 1921, was compiled from reports of pipe-line and producing companies to the Geological Survey. The companies reported in "degrees Baumé," but it was not stated, and doubtless in a number of instances it was not known, whether the scales used were based on modulus 140 or 141.5. Conversion to specific gravity, for use in the accompanying table, was made according to Bureau of Standards Circular No. 57, which is based on the modulus 140 for Baumé degrees. According to the scale used, there may be differences in specific gravity, due to conversion, amounting to one to three units in the third decimal place.

For several years confusion has existed in regard to the hydrometer scales used by the petroleum industry, and recently the question was taken up by a joint committee composed of representatives of the American Petroleum Institute, the Bureau of Mines, and the Bureau of Standards, in an attempt to arrive at a satisfactory settlement. The sentiment in the oil industry appeared to be in favor of departing from the modulus 140, used in the standard Baumé hydrometer, and adopting a modified hydrometer scale based on the modulus 141.5. After due consideration the committee agreed to recommend the adoption of the scale based on the modulus 141.5, this scale to be known as the American Petroleum Institute scale and to be used exclusively in the petroleum industry. In the future, therefore, more uniform reports on specific gravity of petroleum may be expected.

Average specific gravity of crude petroleum, 1921.

[Weighted for production.]

	Specific gravity.	Degrees Baumé.
BY FIELDS.		
Appalachian	0.820	40.8
Lima-Indiana	.844	35.9
Illinois and Southwestern Indiana	.862	32.5
Mid-Continent	.844	35.9
Gulf Coast	.919	22.4
Rocky Mountain	.836	37.5
California	.922	21.9
United States	.864	32.0
BY STATES AND DISTRICTS.		
Alaska (Katalla)	.805	44.0
Arkansas (El Dorado)	.853	34.2
California:		
Coalinga	.940	18.9
Hungtington Beach and Signal Hill	.907	24.4
Kern River	.972	14.0
Lompoc and Santa Maria	.953	16.9
Los Angeles and Salt Lake	.967	14.8
Lost Hills-Belridge	.900	25.5
McKittrick	.967	14.8
Midway-Sunset	.923	21.7
Ventura County and Newhall	.874	30.2
Whittier-Fullerton	.907	24.3
Average	.922	21.9
Colorado:		
Boulder	.824	40.0
Florence	.868	31.3
Rangely	.802	44.5
Average	.831	38.5
Illinois	.862	32.4
Indiana:		
Northeastern	.846	35.4
Southwestern	.859	33.0
Average	.856	33.5
Kansas:		
Augusta-Eldorado	.846	35.4
Peabody-Elbing	.854	34.0
Teeter-Salyards	.841	36.5
Remainder of State	.870	31.0
Average	.856	33.6
Kentucky:		
Eastern and Central	.836	37.4
Ragland	.903	25.0
Western	.850	34.8
Average	.839	36.8
Louisiana:		
Northern—		
Bossier	.902	25.3
Bull Bayou-Crichton	.824	40.0
Caddo (light)	.827	39.3
De Soto	.822	40.3
Haynesville	.853	34.2
Homer	.847	35.3
Pine Island	.911	23.7
Average	.851	34.5
Coastal—		
Anse la Butte	.903	25.0
Edgerley	.927	21.0
Jennings	.904	24.9
Vinton	.938	19.3
Average	.933	20.1
Average for State	.854	33.9
Missouri (Richards)	.909	24.0
BY STATES AND DISTRICTS—con.		
Montana:		
Cat Creek	0.782	49.0
Devils Basin	.905	24.7
Elk Basin	.800	45.0
Soap Creek	.935	19.7
Average	.783	48.8
New York	.815	41.7
Ohio:		
Central and Eastern	.814	42.1
Northwestern	.843	36.0
Average	.831	38.4
Oklahoma:		
Bartlesville	.859	33.0
Beggs	.832	38.2
Blackwell	.833	38.0
Bryant	.833	38.0
Cement	.844	35.8
Cushing	.829	38.8
Duncan	.846	35.5
Garber	.807	43.4
Glenn	.854	34.0
Healdton	.872	30.6
Hewitt	.855	33.8
Nowata	.854	34.0
Osage County	.835	37.7
Ponca-Mervine	.814	42.0
Walters	.876	29.8
Average	.842	36.3
Pennsylvania	.814	42.0
Tennessee	.828	39.0
Texas:		
Northern and central—		
Burkburnett	.833	38.0
Electra	.833	38.0
Iowa Park	.828	39.0
Petrolia	.833	38.0
Holliday	.833	38.0
Breckenridge	.833	38.0
Ranger	.833	38.0
Desdemona	.838	37.0
Corsicana (light)	.849	35.0
Corsicana (heavy)	.909	24.0
Mexia	.843	36.0
Thrall	.843	36.0
Average	.839	36.9
Coastal—		
Batson	.930	20.5
Blue Ridge	.881	29.0
Damon Mound	.924	21.5
Goose Creek	.904	24.8
Hull	.930	20.5
Humble	.914	23.2
Orange	.916	22.8
Pierce Junction	.920	22.2
Saratoga	.923	21.7
Sour Lake	.924	21.6
Spindletop	.917	22.7
West Columbia	.916	22.8
Average	.918	22.5
Average for State	.863	32.2
West Virginia:		
Cabin Creek	.787	48.0
Remainder of State	.809	43.1
Average	.805	43.9
Wyoming:		
Big Muddy	.852	34.4
Elk Basin	.800	45.0
Grass Creek	.800	45.0
Lance Creek	.805	44.0
Lost Soldier	.870	31.0
Rock Creek	.824	40.0
Salt Creek	.845	35.6
Average	.839	36.8
United States (weighted average	.864	32.0

ROYALTIES.

Production and royalty value of crude petroleum produced on Government lands in 1920 and 1921 under the operation of the leasing act of February 25, 1920.

[Reported by the U. S. Bureau of Mines.]

State and land office.	1920			1921		
	Production (barrels).	Royalty.		Production (barrels).	Royalty.	
		Barrels.	Value.		Barrels.	Value.
California:						
Los Angeles	384,861.20	58,415.91	$124,860.68	796,218.31	113,577.90	$228,691.69
Visalia, outside naval reserve	595,916.61	82,978.07	139,098.39	2,075,701.56	327,705.70	439,761.85
Visalia, inside naval reserve	671,365.40	110,149.21	245,641.11	2,038,831.58	394,885.10	707,452.93
	1,652,143.21	251,543.19	509,600.18	4,910,751.45	836,168.70	1,375,906.47
Louisiana: Baton Rouge	...	...	...	4,686.36	313.36	715.31
Montana: Lewistown	...	...	...	831,237.11	52,533.89	69,752.35
Wyoming:						
Cheyenne	...	...	...	1,561.52	195.19	227.16
Douglas	981,315.62	209,721.43	576,733.63	5,708,820.69	1,181,672.12	1,426,134.73
Lander	83,420.95	10,652.97	27,934.27	48,163.63	6,597.14	12,424.36
Newcastle	...	...	...	14,924.10	1,927.30	2,742.97
	1,064,736.57	220,374.40	604,667.90	5,773,469.94	1,190,391.75	1,441,529.22
	2,716,879.78	471,917.59	1,114,268.08	11,520,144.86	2,079,407.70	2,887,903.35

Royalty receipts from production of oil and gas and bonuses paid for sale of leases on Indian reservations, fiscal years ending June 30, 1919–1921.

[From Office of Indian Affairs.]

Reservation.	1919			1920			1921		
	Oil and gas land leased during year (acres).	Receipts.		Oil and gas land leased during year (acres).	Receipts.		Oil and gas land leased during year (acres).	Receipts.	
		Bonus from sale of leases.	Royalty from production.		Bonus from sale of leases.	Royalty from production.		Bonus from sale of leases.	Royalty from production.
Five Civilized Tribes:									
Oil	344,922	$757,081	$2,689,886	329,580	$982,132	$3,052,089	143,446	$664,797	$3,042,080
Gas			260,816			279,053			...
Kiowa:									
Oil	24,449	748,145	9,011	14,364	339,800	21,567	13,563	129,418	46,200
Gas			...			1,200			...
Osage:									
Oil	93,691	10,026,050	4,581,733	96,146	11,965,800	8,079,788	62,795	8,552,850	10,267,544
Gas	512,088	1,173,920	838,941	...	...	972,763	...	...	1,041,202
Otoe:									
Oil	1,790	1,812	...	1,630	1,940	...	(a)	(a)	(a)
Gas			300			300			
Pawnee:									
Oil	...	8,190	182,086	9,410	11,653	66,909	5,057	10,434	547,184
Gas	...		...			...			900
Ponca:									
Oil	...	1,084	59,886	9,000	9,654	147,264	6,177	6,177	140,006
Gas	...		...			2,980			2,946
Shawnee:									
Oil	...	40	1,530	2,838	6,498	8,529	2,321	15,301	11,585
Gas	...		900			...			...
Shoshone:									
Oil	...	3,723	12,934	496 Tribal.	734	15,683	5,779	8,876	13,212
Gas	...		...			...			...
	976,940	12,720,045	8,638,023	463,464	13,318,211	12,648,125	239,138	9,387,853	15,112,859

a Not available.

REFINERY STATISTICS.

The following statistics were furnished by the U. S. Bureau of Mines:

Refinery statistics, 1918–1921.

[Thousands of barrels of 42 U. S. gallons.]

	Crude oil.	Other oils.
Runs to stills:		
1918	326,025	50,565
1919	361,520	45,763
1920	433,915	40,235
1921	443,363	36,493
Stocks at refineries (at end of year):		
1918	15,750	....
1919	13,143	....
1920	21,261	....
1921	26,562	....

	Gasoline.	Kerosene.	Gas and fuel oil.	Lubricating oil.
Output of refineries:				
1918	85,007	43,461	174,319	20,035
1919	94,235	55,753	181,602	20,161
1920	116,251	55,240	210,987	24,922
1921	122,704	46,313	230,091	20,901
Imports:				
1918	307	....	....	....
1919	203	....	....	....
1920	1,097	....	....	....
1921	900	....	....	....
Exports:				
1918	13,248	11,538	[a] 35,169	6,102
1919	8,712	22,986	[a] 27,956	6,573
1920	15,125	20,196	[a] 46,040	9,736
1921	12,483	17,623	[a] 46,773	6,838
Consumption:				
1918	74,512	34,442	136,172	13,823
1919	81,781	33,256	149,771	13,533
1920	101,344	33,291	159,637	14,518
1921	107,524	29,537	168,580	12,626
Stocks at refineries (at end of year):				
1918	7,079	9,050	15,691	3,306
1919	10,638	8,079	17,003	3,270
1920	11,009	9,359	19,938	3,821
1921	13,954	8,119	31,697	5,161
Shipments to Territories:				
1918	291	282	1,047	62
1919	386	483	2,563	92
1920	508	474	2,375	115
1921	652	393	2,977	99

[a] Includes fuel or bunker oil for vessels engaged in foreign trade: 1918, 6,603,043 barrels; 1919, 14,031,356 barrels; 1920, 26,334,883 barrels; 1921, 27,076,138 barrels.

OIL SHALE.

UNITED STATES.

Since 1913, when the importance of the oil-shale deposits of the United States was emphasized by the United States Geological Survey, considerable field and laboratory work has been done on them. The extent and thickness of many of these deposits are now fairly well known, and much progress has been made toward solving the problems of chemical engineering involved in their development. In addition to the work of the United States Geological Survey, the geological surveys of Colorado, Utah, Kentucky, Indiana, and Pennsylvania have given special attention to oil shale, and research technical work has been carried on by the Colorado School of Mines, Columbia University, the Massachusetts Institute of Technology, the Mellon Institute, the United States Bureau of Mines, and other institutions. Some of the large petroleum companies and a number of recently organized oil-shale companies have during the last few years operated laboratories and experimental plants in which small quantities of shale oil have been extracted. Many technical papers describing the results of some of these activities have been written, and a monthly magazine, The Shale Review, is devoted to the industry. A selected bibliography containing almost 300 annotated references to oil shale has been published by the Bureau of Mines. A report on oil shale of the Rocky Mountain region, by D. E. Winchester, including a bibliography that contains about 1,000 references, is in press as Bulletin 729 of the United States Geological Survey.

Very little shale oil has yet been produced in the United States. As a matter of record, however, it should be noted that the first sales of oil shale and shale oil reported to the United States Geological Survey were made in 1921. The credit of the first commercial transactions belongs to Colorado: 5,000 gallons of shale oil made near De Beque, Garfield County, valued at $1,000, was sold to mining companies for mineral flotation, and 2 tons of oil shale, valued at $40, was reported to have been shipped from Rio Blanco County for delivery to chemical plants. Also 1,250 gallons of shale oil made near De Beque was used in the manufacture of "soap, stock dip, ointment, etc." A recovery per ton of shale treated of 50 to 60 gallons of shale oil, having an average gravity of 24° Baumé (specific gravity 0.909), is reported to have been made. About 20,000 gallons of shale oil, having an average specific gravity of 0.889 has been made at Elko, Nev., but has not been marketed.

FOREIGN COUNTRIES.

For many years deposits of oil shale have been worked in France and Scotland and more recently in Australia, Italy, Austria, and Esthonia. The deposits in Germany are reported to have been extensively developed during the war. The following table shows the output of oil shale in the countries named.

Foreign production of oil shale, 1919–1921, in metric tons.

Country.	1919	1920	1921
Austria (ichthyolic shale) [a]	1,003	1,095	1,160
Australia:			
New South Wales [b]	25,861	21,341	33,009
Tasmania [c]	610	142	882
Esthonia [d]	9,632	45,671	94,773
France	[e] 49,127	[e] 69,000	(f)
Italy: [g]			
Ichthyolic shale	1,000	800	1,100
Bituminous shale	10,563	16,325	3,150
United Kingdom: [h]			
Scotland	2,807,615	2,886,455	1,896,860
England	620	1,750	....

[a] Austrian Ministry for Trade and Craft, Industry, and Works.
[b] New South Wales Dept. Mines Ann. Rept.
[c] Tasmania Sec. for Mines Ann. Rept.
[d] Petroleum Times, London, Jan. 27, 1923, p. 123.
[e] Statistique de l'industrie minérale, Paris, 1921.
[f] Not available.
[g] Rivista del servizio minerario.
[h] Great Britain Sec. for Mines Rept.

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Publications marked by an asterisk (*) in the following list can no longer be obtained from the Geological Survey, but some of these can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C.

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*(h) Oil and gas possibilities of the Hatchetigbee anticline, Ala., by O. B. Hopkins, pp. 281–313, pls., xxvi–xxix.
*(i) Phosphatic oil shales near Dell and Dillon, Beaverhead County, Mont., by C. F. Bowen, pp. 315–328 (including index and title-page to volume).

662. Mineral resources of Alaska, report on progress of investigations in 1916, by A. H. Brooks and others.
*(a) The Alaskan mining industry in 1916, by A. H. Brooks, pp. 1–62, pls. i–iv.

*666. Our mineral supplies; H. D. McCaskey and E. F. Burchard, geologists in charge. 1919. 278 pp., 1 pl.
*(dd) Petroleum, by J. D. Northrop, 13 pp.

*670. The Salt Creek oil field, Wyo., by C. H. Wegemann. 1917. 52 pp., 7 pls.

686. Structure and oil and gas resources of the Osage Reservation, Okla.
(Separate chapters covering individual townships have been published).

*688. The oil fields of Allen County, Ky., with notes on the oil geology of adjoining counties, by E. W. Shaw and K. F. Mather. 1919. 126 pp., 10 pls.

*691. Contributions to economic geology (short papers and preliminary reports), 1918, Part II, Mineral fuels; David White, G. H. Ashley, and M. R. Campbell, geologists in charge. 1919.
*(b) Oil shale of the Uinta Basin, northeastern Utah, and Results of dry distillation of miscellaneous shale samples, by D. E. Winchester, pp. 27–55, pls. v–xii.
*(c) Geologic structure of the northwestern part of the Pawhuska quadrangle, Okla., by K. C. Heald, pp. 57–100, pls. xiii–xv.
*(d) Geology and oil and gas prospects of the Lake Basin field, Mont., by E. T. Hancock, pp. 101–147, pls. xvi–xxiii.

*(e) Oil and gas geology of the Birch Creek-Sun River area, northwestern Montana, by Eugene Stebinger, pp. 149–184, pl. xxiv.

*(f) Anticlines in a part of the Musselshell Valley, Musselshell, Meagher, and Sweet Grass counties, Mont., by C. F. Bowen, pp. 185–209, pl. xxv.

(g) The Nesson anticline, Williams Co., N. Dak., by A. J. Collier, pp. 211–217, pl. xxvi.

*(h) Geology and oil prospects of the Salinas Valley-Parkfield area, Calif., by W. A. English, pp. 219–250, pls. xxvii–xxviii.

*(j) Asphalt deposits and oil conditions in southwestern Arkansas, by H. D. Miser and A. H. Purdue, pp. 271–292, pl. xxxiii.

(m) Structure and oil resources of the Simi Valley, southern California, by W. S. W. Kew, pp. 323–355, i–viii (including title-page, contents, list of illustrations, and index to volume), pls. xli–xliv.

*693. The evaporation and concentration of waters associated with petroleum and natural gas, by R. V. A. Mills and R. C. Wells. 1919. 104 pp., 4 pls.

*702. Oil possibilities in and around Baxter Basin, in the Rock Springs uplift, Sweetwater County, Wyo., by A. R. Schultz. 1920. 107 pp. 17 pls.

705. Conservation through engineering, by F. K. Lane. 1920. 35 pp.

711. Contributions to economic geology (short papers and preliminary reports), 1919, Part II, Mineral fuels; David White and G. H. Ashley, geologists in charge. 1920.

*(a) The Farnham anticline, Carbon County, Utah, by F. R. Clark, pp. 1–13, pls. i–ii.

*(b) Oil shale in western Montana, southeastern Idaho, and adjacent parts of Wyoming and Utah, by D. D. Condit, pp. 15–40, pl. iii.

(d) Oil in the Warm Springs and Hamilton domes, near Thermopolis, Wyo., by A. J. Collier, pp. 61–73, pls. vii–x.

*(e) Gas in the Big Sand Draw anticline, Fremont County, Wyo., by A. J. Collier, pp. 75–83, pl. xi.

*(g) Geology and oil and gas prospects of the Huntley field, Mont., by E. T. Hancock, pp. 105–148, pls. xiv–xviii.

(h) Anticlines near Maverick Springs, Fremont County, Wyo., by A. J. Collier, pp. 149–171, i–viii (including title-page, contents, list of illustrations, and index to volume), pls. xix–xxi.

716. Contributions to economic geology (short papers and preliminary reports), 1920, Part II, Mineral fuels; David White and M. R. Campbell, geologists in charge. 1921.

(a) Geology of Alamosa Creek valley, Socorro County, N. Mex., with special reference to the occurrence of oil and gas, by D. E. Winchester, pp. 1–15, pls. i–v.

*(b) The Upton-Thornton oil field, Wyo., by E. T. Hancock, pp. 17–34, pl. vi.

*(c) The Mule Creek oil field, Wyo., by E. T. Hancock, pp. 35–53, pl. vii.

*(d) Natural-gas resources available to Dallas and other cities of central north Texas, by E. W. Shaw and P. L. Ports, pp. 55–89, pls. viii–ix.

(e) The Lance Creek oil and gas field, Niobrara County, Wyo., by E. T. Hancock, pp. 91–122, pls. x–xiii.

719. Preliminary report on petroleum in Alaska, by G. C. Martin. 1921. 83 pp., 11 pls.

*721. Geology and petroleum resources of northwestern Kern County, Calif., by W. A. English. 1921. 48 pp., 2 pls.

726. Contributions to economic geology (short papers and preliminary reports), 1921, Part II, Mineral fuels; David White and M. R. Campbell, geologists in charge. 1922.

(b) Geology of the Cement oil field, Caddo County, Okla., by Frank Reeves, pp. 41–85, pls., vi–xii.

(c) Oil prospects in Washington County, Utah, by Harvey Bassler and J. B. Reeside, jr., pp. 87–107.

(e) Geologic structure of parts of New Mexico, by N. H. Darton, pp. 173–275, pls. xxx–xlix.

(f) Geologic structure and oil and gas prospects of a part of Jefferson County. Okla., by H. M. Robinson, pp. 277–302, pls. li–lii.

(g) The Lacasa area, Ranger district, north-central Texas, by C. S. Ross, pp. 303–314, pls. liii–liv.

729. Oil shale of the Rocky Mountain region, by D. E. Winchester. 1923. 204 pp., 17 pls.

736. Contributions to economic geology (short papers and preliminary reports), 1922, Part II, Mineral fuels.
   (a) The structure of the Madill–Denison area, Oklahoma and Texas, with notes on oil and gas development, by O. B. Hopkins, Sidney Powers, and H. M. Robinson, 3 pp., 6 pls.
   (b) Oil and gas prospects in and near Crow Indian Reservation, Mont., by W. T. Thom, jr., pp. 35–53, pl. vii.
   (c) Geology of the Wiles area, Ranger district, Tex., by C. E. Dobbin, pp. 55–69, pls. viii–ix.
   (d) The Osage oil field, Weston County, Wyo., by A. J. Collier.
   (e) Geology of the Ranger oil field, Tex., by Frank Reeves.
   (f) Possibility of finding oil in laccolithic domes south of Little Rocky Mountains, Mont., by A. J. Collier and S. H. Cathcart.
   (g) The Brooks, Steen, and Grand Saline salt domes, Smith and Van Zandt counties, Texas, by Sidney Powers and O. B. Hopkins.
   (h) Stratigraphy of the El Dorado oil field, Arkansas, as determined by drill cuttings, by James Gilluly and K. C. Heald.

WATER-SUPPLY PAPERS.

113. The disposal of oil-well wastes, at Marion, Ind., by Isaiah Bowman. 1905. pp. 36–50.
*149. Preliminary list of deep borings in the United States (second edition with additions), by N. H. Darton. 1905. 175 pp.
*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls.
*276. Geology and underground waters of northeastern Texas, by C. H. Gordon. 1911. 78 pp., 2 pls.
*317. Geology and underground waters of the Wichita region, north-central Texas, by C. H. Gordon. 1913. 88 pp., 2 pls.
*335. Geology and underground waters of the southeastern part of the Texas Coastal Plain, by Alexander Deussen. 1914. 365 pp., 9 pls.

GEOLOGIC FOLIOS.

NOTE.—Folios 105, 148, 165, 172, 180, 189, 190, and 202 may be obtained from the Director of the Geological Survey at the prices indicated in parentheses.

*40. Wartburg, Tenn., by Arthur Keith. 1897.
*53. Standingstone, Tenn., by M. R. Campbell. 1899.
*64. Uvalde, Tex., by T. W. Vaughan. 1900.
*72. Charleston, W. Va., by M. R. Campbell. 1902.
*76. Austin, Tex., by R. T. Hill and T. W. Vaughan. 1902.
*82. Masontown–Uniontown, Pa., by M. R. Campbell. 1902.
*92. Gaines, Pa.–N. Y., by M. L. Fuller and W. C. Alden. 1903.
*94. Brownsville–Connellsville, Pa., by M. R. Campbell. 1903.
*102. Indiana, Pa., by G. B. Richardson. 1904.
105. Patoka, Ind.–Ill., by M. L. Fuller and F. G. Clapp. 1904. (5c.)
*107. Newcastle, Wyo.–S. Dak., by N. H. Darton. 1904.
*115. Kittanning, Pa., by Charles Butts and F. Leverett. 1904.
*121. Waynesburg, Pa., by R. W. Stone. 1905.
*123. Elders Ridge, Pa., by R. W. Stone. 1905.
*125. Rural Valley, Pa., by Charles Butts. 1905.
*132. Muscogee, Okla., by J. A. Taff. 1906.
*134. Beaver, Pa., by L. H. Woolsey. 1906.
*135. Nepesta, Colo., by C. A. Fisher. 1906.
*144. Amity, Pa., by F. G. Clapp. 1907.
*146. Rogersville, Pa., by F. G. Clapp. 1907.
148. Joplin district, Mo.–Kans., by W. S. T. Smith and C. E. Siebenthal. 1907. (50c.)
*159. Independence, Kans., by F. C. Schrader. 1908.
*163. Santa Cruz, Calif., by J. C. Branner, J. F. Newsom, and R. Arnold. 1909.
165. Aberdeen–Redfield, S. Dak., by J. E. Todd. (5c.)
172. Warren, Pa.–N. Y., by Charles Butts. 1910. (5c.)
*176. Sewickley, Pa., by M. J. Munn. 1911.
*177. Burgettstown–Carnegie, Pa., by E. W. Shaw and M. J. Munn. 1911.
*178. Foxburg–Clarion, Pa., by E. W. Shaw, E. F. Lines, and M. J. Munn. 1911.
180. Claysville, Pa., by M. J. Munn. 1911. (5c.)
*184. Kenova, Ky.–Ohio–W. Va., by W. C. Phalen. 1912
189. Barnesboro–Patton, Pa., by M. R. Campbell, F. G. Clapp, and Charles Butts 1913. (25c.)
190. Niagara, N. Y., by E. M. Kindle and F. B. Taylor. 1913. (50c.)
202. Eureka Springs–Harrison, Ark., by A. H. Purdue and H. D. Miser. 1916. (25c.)

MINERAL RESOURCES.

Statistical reports entitled "Mineral Resources of the United States" have been published annually since 1882. These volumes are a consolidation of chapters on the several minerals which are issued separately in advance. A preliminary summary of the mineral resources of the United States has been published annually, within a few months after the end of the year covered by the statistics, since 1918. A monthly press bulletin, "Statistics of crude petroleum," has been published in mimeograph form since 1918.

MAPS.

In addition to the detailed maps in the reports listed above, the United States Geological Survey has published maps, on scales of 8 to 12 miles to the inch, showing the location of oil and gas fields, oil pipe lines, and refineries in the following States: Kansas, Illinois, Kentucky, Louisiana, Oklahoma, Pennsylvania, West Virginia, and Wyoming. Copies of these maps may be obtained on application to the Director, United States Geological Survey, for 50 cents each. Maps of California, Ohio, and Texas are in preparation. A map of the oil and gas fields of the United States, on a scale of about 40 miles to the inch, published in 1922, may be obtained for $1.

PUBLICATIONS BY STATES.

In the subjoined list of Geological Survey publications on petroleum, natural gas, and oil shale, arranged by States, the following abbreviations are used: A, Annual Report; P, Professional Paper; B, Bulletin; W, Water-Supply Paper; G F, Geologic Folio.

- Alabama — B 471–a, 661–h
- Alaska:
  - Alaska Peninsula — B 467
  - Bear River — B 225
  - Cape Yaktag — B 225
  - Cold Bay — B 225, 259
  - Controller Bay — B 225, 259, 314, 335
  - Cook Inlet — B 225, 259
  - General — B 250, 259, 662–a, 719
- Arizona:
  - Navajo country — P 93
- Arkansas:
  - El Dorado — B 736–h
  - Eureka Springs-Harrison — G F 202
  - Fort Smith-Poteau field — B 541–b
  - Southwestern part — B 691–j
- California:
  - Barstow-Kramer region — B 541–e
  - Bitterwater Valley — B 581–d
  - Cantua-Panoche region — B 431–a
  - Coalinga district — B 213, 357, 398, 603
  - Contra Costa County — B 340–f
  - Cuyama Valley — B 621–m
  - Graciosa district — B 213
  - Kern County — B 721
  - Kern River field — B 213
  - Los Angeles district — B 213, 309
  - McKittrick-Sunset region — B 213, 406, 721
  - Miner ranch field — B 340–f
  - Parkfield area — B 691–h
  - Peachtree Valley — B 581–d
  - Priest Valley — B 581–d
  - Puente Hills — B 213, 309
  - Salinas Valley area — B 691–h
  - Salt Lake field (Los Angeles district) — B 285–g, 309
  - San Joaquin Valley — B 471–a, 603
    - Oil-field waters — B 653
  - Santa Clara district — B 213, 309
  - Santa Cruz district — GF 163
  - Santa Maria district — B 317, 322
  - Simi Valley — B 691–m
  - Summerland district — B 213, 321
  - Sunset-Midway district — P 116
    - Oil-field waters — P 117
  - Waltham Valley — B 581–d
- Colorado:
  - Boulder field — B 213, 225, 265, 381–d
  - De Beque field — B 531–c
  - Florence field — B 260, 381–d
  - Nepesta — GF 135
  - Northwestern — B 415
  - Oil shale — B 729
  - Rangely district — B 350
  - Uinta Basin — B 581–a, 641–f
- Idaho — B 711–b
- Illinois — B 438, 641–l; GF 105
- Indiana:
  - W 113, A 8, II–a; A 11, I–c; B 213, 641–l; GF 105
- Kansas:
  - Analyses (oil) — B 381–d
  - Faults — P 128–c
  - Independence district — B 260, 296; GF 159
  - Iola district — B 238
  - Joplin district — GF 148
  - Western interior coal field — B 184
- Kentucky:
  - Allen County — B 688
  - Campton — B 471–a
  - Estill County — B 661–d
  - Kenova district — GF 184, B 349
  - Knox County — B 471–a
  - McCreary County — B 579
  - Menifee County — B 531–a
  - Ragland — B 531–a
  - Shale — B 641–l
  - Wayne County — B 579
- Louisiana:
  - P 126; B 212, 213, 260, 282, 429, 541–a, 619, 661–c, 716–d
- Mississippi — B 641–d
- Missouri — B 438, GF 148
- Montana:
  - Beaverhead County, phosphatic oil shale — B 661–i
  - Birch Creek-Sun River area — B 691–e
  - Blackfeet Indian Reservation — B 641–j
  - Crow Indian Reservation — B 736–b
  - Huntley field — B 711–g
  - Lake Basin field — B 691–d
  - Musselshell Valley — B 691–f
  - North-central part — B 641–c
  - Northeastern part — B 661–e; P 120–b
  - Oil-land withdrawals and restorations — B 623
  - Porcupine dome — B 621–f
  - Rosebud County — B 621–f
  - South of Little Rocky Mountains — B 736–f
  - Stillwater basin — B 641–g
  - Western Montana, oil shale in — B 711–b
- Nevada:
  - Lyon County — B 381–d
  - Reno region — B 381–d
- New Mexico:
  - Dayton district — B 541–d
  - General — P 93; B 726–e
  - Socorro County — B 716–a
- New York:
  - Niagara quadrangle — G F 190
- North Dakota — B 431–a, 691–g

NATURAL GAS IN 1919–1921.

By R. S. McBride and E. G. Sievers.[1]

SCOPE OF REPORT.

This report gives as complete statistics as are available regarding the production, consumption, and utilization of natural gas in the United States in 1919, 1920, and 1921. It is the first report on natural gas issued in three years as a chapter of Mineral Resources of the United States and shows for the first time since the war the trend of the natural-gas industry. During this period there have been some striking examples of natural-gas development. One of the most conspicuous was the overdevelopment of the field at McKeesport, Pa., where the number of producing wells was increased so rapidly in 1920 as to practically destroy the commercial value of the field within six months. In the Monroe field, Louisiana, and in some fields in Wyoming there are promising large supplies that have not been extensively developed because of the long distance to market, which makes the production of the gas and the installation of adequate transportation lines financially hazardous.

The figures here given to show production represent the quantity of natural gas marketed, exclusive of the quantity lost in the field, in transmission, and in distribution. The value of the gas as reported is the sum received for the gas at the points of consumption.

THE NATURAL-GAS INDUSTRY.

CHARACTER AND SCOPE.

The distribution of the natural-gas resources of the country is shown in the map forming figure 12. The extent to which natural gas has been produced has not been proportionate to the extent of its occurrence, largely because of the great difference in the demand for gas in different parts of the country. In many places the domestic as well as the industrial requirements are too great to be supplied by the gas available; in other places the gas found can not be developed profitably because the market is inadequate. The map forming figure 18 shows by States the quantity of gas produced in the United States in 1921 and discloses the fact that the industry is concentrated in and near the two chief producing States, West Virginia and Oklahoma.

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[1] The statistics here given were compiled by Miss H. Backus and Mrs. F. O. Weidman with the assistance of Miss E. M. Seeley and Mrs. M. McCaslin.

Most of the territory in which natural gas occurs is at some distance from large cities, and much of it is difficult of access. Partly on this account the development of methods of production has lagged behind the development of methods of transmission. Moreover, the inducements to improve methods of production have been slight, because the price paid to the producer has generally been small, so that it has often seemed to him hardly worth while to make much effort to conserve the supply.

The low price of natural gas has also caused a neglect of the study of economy in its utilization. Until the price charged for natural gas at the point of use increased considerably, as it has during the last few years, the user had little inducement to consider its most efficient application. At present, however, a marked improvement

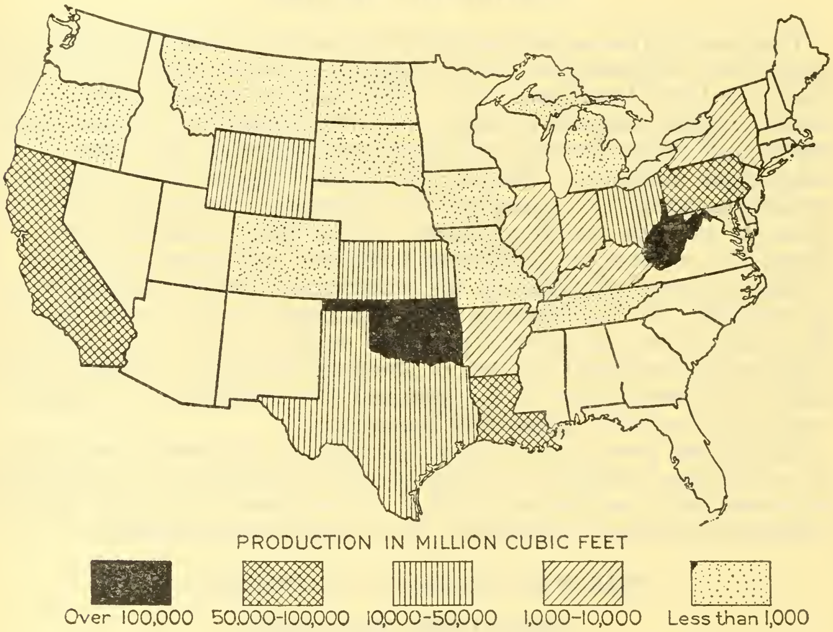
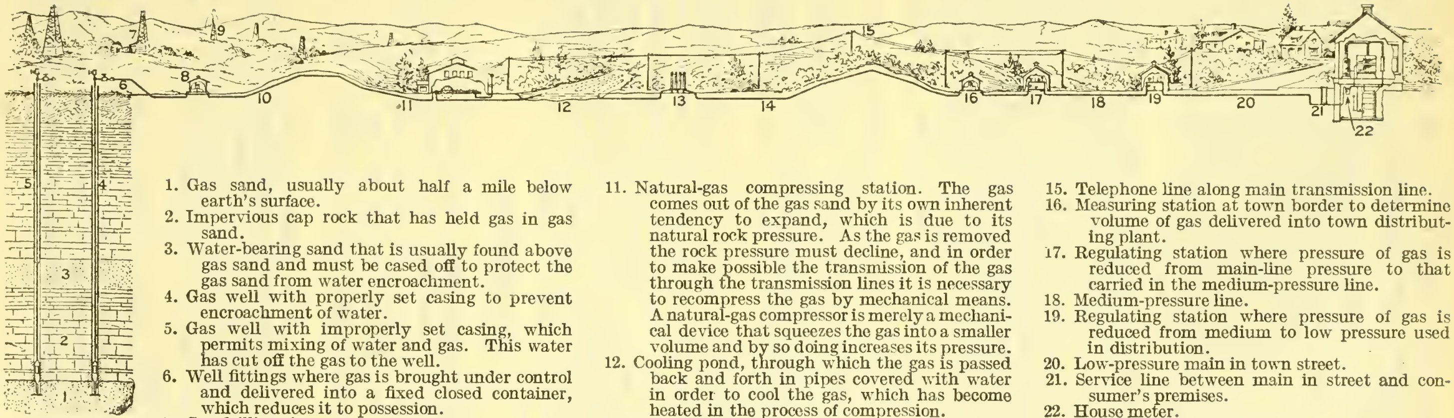


FIGURE 18.—Map showing production of natural gas in 1921, by States.

in efficiency is being made by the appliance of better methods of using the gas.

Figure 19, simplified from a diagram prepared by Samuel S. Wyer from the model in the Smithsonian Institution, at Washington, D. C., shows the principal parts of a complete natural-gas system. Natural gas is a very elusive mineral product. It lies underground in the pores and crevices of rocks, in which it is confined by the layers of rock above that are substantially impervious to it. The first well that taps a gas pool may obtain a large part of the gas it contains, for if no other wells draw from the pool the gas will continue to flow into the well from a considerable territory around it.

Because of the cost and risk involved in drilling and operating a gas well the small land-holder does not commonly undertake gas development but leases to a gas company the right to drill on his property, generally for a fixed sum per year or per well or a royalty



1. Gas sand, usually about half a mile below earth's surface.
2. Impervious cap rock that has held gas in gas sand.
3. Water-bearing sand that is usually found above gas sand and must be cased off to protect the gas sand from water encroachment.
4. Gas well with properly set casing to prevent encroachment of water.
5. Gas well with improperly set casing, which permits mixing of water and gas. This water has cut off the gas to the well.
6. Well fittings where gas is brought under control and delivered into a fixed closed container, which reduces it to possession.
7. Gas drilling rig.
8. Measuring station to determine volume of gas produced.
9. Well blowing into air.
10. Gathering line that takes gas from well to compressing station.
11. Natural-gas compressing station. The gas comes out of the gas sand by its own inherent tendency to expand, which is due to its natural rock pressure. As the gas is removed the rock pressure must decline, and in order to make possible the transmission of the gas through the transmission lines it is necessary to recompress the gas by mechanical means. A natural-gas compressor is merely a mechanical device that squeezes the gas into a smaller volume and by so doing increases its pressure.
12. Cooling pond, through which the gas is passed back and forth in pipes covered with water in order to cool the gas, which has become heated in the process of compression.
13. Gas drier for separating natural gasoline vapors mechanically mixed with natural gas.
14. Main transmission line connecting compressing station with town distributing plant. Many of these main transmission lines are more than 100 miles long.
15. Telephone line along main transmission line.
16. Measuring station at town border to determine volume of gas delivered into town distributing plant.
17. Regulating station where pressure of gas is reduced from main-line pressure to that carried in the medium-pressure line.
18. Medium-pressure line.
19. Regulating station where pressure of gas is reduced from medium to low pressure used in distribution.
20. Low-pressure main in town street.
21. Service line between main in street and consumer's premises.
22. House meter.

In order to enable the consumer to have gas to use, there must be continuity of service between this point and the gas sand (1) back in the field, perhaps more than 100 miles away.

FIGURE 19.—Diagram showing how natural gas is found, produced, transmitted, and delivered to consumer.

on the estimated production. Rarely he sells the gas rights to a company under an agreement which permits it to develop or to hold the gas, at its preference.

Because of the mode of occurrence of natural gas and of the methods of its development the industry is hazardous even for large operators. The investment in wells and pipe lines in the producing region must not be so great as to prevent the investors from realizing during the period of use a sum sufficient to repay the original investment and provide for interest and profit. In this respect the natural-gas business, perhaps even more than the petroleum business, has proved to be one of great uncertainty.

Once the gas has been gathered in pipe lines it must be used promptly. In general not more than 24 hours' supply of gas will be available in the pipes and holders of a company. In fact, during the winter, when the system is worked to its full capacity, only a small fraction of a day's consumption may be on hand at any moment. It is therefore evident that the production must be closely coordinated with the demand. In no other business, probably, except that of supplying electrical energy, must the producer control his output so exactly in accordance with the needs of the consumer, who may be a hundred miles or more away.

As natural gas has become largely a municipal fuel distributed through public-utility plants the industry has in large part become subject to State and municipal regulation. This regulation has been applied not only to the rates charged and the character of the service rendered but to many of the field methods, to conservation, and even to details of engineering.

The industry is so complicated that even a brief statistical presentation of all its phases can not be given in a short report like this, which deals principally with the quantities of gas produced, moved in interstate traffic, and used in different ways and the number of consumers. No attempt is here made to discuss technologic methods in detail, the public-utility laws or rules affecting the business, or the quantity of natural gas still available.

MAGNITUDE.

More than 2,600,000 domestic consumers and about 21,000 industrial or commercial consumers use natural gas as fuel. To supply these consumers there is produced annually in the United States about 700,000,000 M cubic feet of gas, which is more than half of all the gaseous fuel used for heat, light, and power in the country.

In 1920 the market value of the gas used was nearly $200,000,000, but in 1921, because of decrease in production, it was only $175,000,000. About $250,000,000 worth of manufactured gas has been used annually in the United States during recent years, but the unit value per M cubic feet of manufactured gas is much higher than that of natural gas.

Table 1 gives some of the salient figures derived from a statistical study of the industry. The terms used in this report to designate the uses to which the gas is put have the following significance:

Gas for domestic consumption means gas used in homes for heating, cooking, or lighting.

Gas for manufacturing includes that consumed in manufacturing processes, as in making carbon black, and used for heating in metallurgy, in ceramic kilns, cement plants, etc.

Gas used for drilling and pumping is that consumed in the field to run engines for drilling or pumping wells.

Gas used for gasoline is the actual loss in volume of the gas run through the gasoline plants, not the total volume treated.

Gas used for other industrial purposes is gas used for gas engines and steam boilers or for purposes that do not come under any of the other classes.

Gas wasted is either the difference between reported production and reported consumption or the actual quantity reported wasted by the operators.

The customary unit for measuring both natural and manufactured gas is 1,000 cubic feet, generally written "M cubic feet," which means the quantity of gas that would occupy that volume at ordinary standard temperature and pressure (60° F. and 30 inches of mercury).

TABLE 1.—*Salient figures of the natural-gas industry in the United States, 1919-1921.*

	1919	1920	1921
Gas used:			
Domestic consumption .... M cubic feet..	255,743,000	286,001,000	248,334,000
Carbon-black manufacture .... do....	49,896,000	40,599,000	50,565,000
Gasoline extraction .... do....	21,310,000	18,311,000	19,755,000
Drilling and pumping .... do....	148,477,000	183,797,000	162,550,000
Other industrial purposes .... do....	270,490,000	269,502,000	180,848,000
Number of consumers:			
Domestic .... do....	2,501,462	2,615,043	2,630,915
Industrial .... do....	24,387	20,925	20,989
Annual consumption per consumer:			
Domestic .... do....	102	109	94
Industrial .... do....	20,100	24,478	19,711
Value of gas consumed	$160,888,000	$196,194,000	$174,617,000
For domestic purposes	$88,414,000	$109,302,000	$110,337,000
For industrial purposes	$72,474,000	$86,892,000	$64,280,000
Average value of gas per M cu. ft .... cents..	21.6	24.6	26.4
By-products of natural gas:			
Natural-gas gasoline:			
Quantity .... gallons..	351,500,000	384,700,000	449,900,000
Market value	$64,197,000	$71,788,000	$61,815,000
Average value per gallon .... cents..	18.3	18.7	13.7
Carbon black:			
Quantity .... pounds..	52,100,000	51,300,000	59,800,000
Market value	$3,816,000	$4,032,000	$5,446,000
Average value per pound .... cents..	7.3	7.9	9.1

HISTORY, GROWTH, AND PROSPECTIVE DECLINE.

Natural gas has been produced in the United States for about 60 years with almost continuous growth in quantity and value, but the industry has now probably reached its peak, for during the last six years there has been little increase in production and in two of these years there has been a decrease.

No reliable figures are available to show either the quantity or the value of the natural gas produced annually prior to 1898, but rough estimates of the value of the gas as measured by the quantity of coal, wood, or other fuel which it had replaced indicate that in the period 1885 to 1897, inclusive, from $5,000,000 to $20,000,000 worth of gas was sold each year.

In 1898 the Geological Survey made its first canvass of the industry, but until 1906 only the value of the gas was reported. The data given in Table 2 and presented graphically in figure 20 show that the increase in the value of the gas was continuous from year to year until 1920, when nearly $200,000,000 worth of gas was marketed. In 1921, however, the total value fell off by 11 per cent, and the quantity decreased by more than 17 per cent.

A single year's decline does not warrant the assumption that the industry has already passed its peak of production in both quantity and value, but the data at hand in regard to the gas still available underground and its relation to municipal centers or industrial markets make it probable that the annual output will never be very

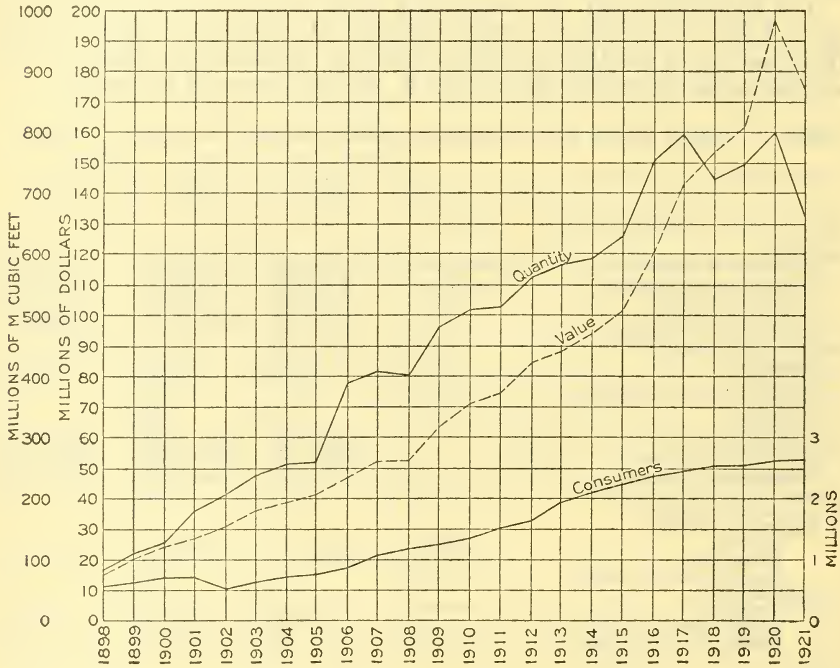


FIGURE 20.—Growth of the natural-gas industry, 1898–1921.

much more than it was during the period 1916–1920. It is likely, however, that the average value of the gas will increase more rapidly than the sales will decrease, so that the total value will more than hold its own.

The question naturally arises what is to be done to replace this valuable fuel as supplies decline in the future. In some localities it will be economically impracticable to replace by manufactured gas the natural gas now used for house heating and for industrial operations. In many localities, however, manufactured gas will undoubtedly replace natural gas, especially for domestic cooking, water heating, and similar uses. Already this replacement may be noted in certain parts of the country where the natural gas, which was once adequate to supply large areas, has to be less widely distributed or supplemented by mixing natural with manufactured gas.

TABLE 2.—*Natural gas sold in the United States, 1898–1921.*

Year.	Quantity (millions of M cubic feet).	Value at point of consumption. Total.	Value at point of consumption. Average per M cubic feet (cents).	Year.	Quantity (millions of M cubic feet).	Value at point of consumption. Total.	Value at point of consumption. Average per M cubic feet (cents).
1898	(a)	$15,300,000	(a)	1910	509	$70,800,000	13.9
1899	(a)	20,100,000	(a)	1911	513	74,600,000	14.5
1900	(a)	23,700,000	(a)	1912	562	84,600,000	15.0
1901	(a)	27,100,000	(a)	1913	582	87,800,000	15.1
1902	(a)	30,900,000	(a)	1914	592	94,100,000	15.9
1903	(a)	35,800,000	(a)	1915	629	101,300,000	16.1
1904	(a)	38,500,000	(a)	1916	753	120,200,000	16.0
1905	(a)	41,600,000	(a)	1917	795	142,100,000	17.9
1906	389	46,900,000	12.1	1918	721	153,600,000	21.3
1907	407	54,200,000	13.3	1919	746	160,900,000	21.6
1908	402	54,600,000	13.6	1920	798	196,200,000	24.6
1909	481	63,200,000	13.1	1921	662	174,600,000	26.4

[a] Available statistics on quantity, and hence average value, are rough approximations only and not comparable with statistics for later years.

FIELD DEVELOPMENTS.

The most important developments in the production of natural gas during the years 1919 to 1921 were in the Monroe field in Louisiana, the McKeesport field in Pennsylvania, and certain areas in California, Oklahoma, Texas, and Wyoming.

LOUISIANA.

Although the first well in the Monroe field was drilled in 1909, it was not until 1916 that any important developments took place. In 1918 there were 16 wells drilled, making a total of 33, and the proved productive area at the end of the year was 75 square miles. In 1919, 23 wells were drilled, most of them within the area already proved. Many of the wells had a large open flow and continued to show a large volume of gas. During 1920 there were 23 wells drilled in the productive area. According to reports on the field, at the beginning of 1921 there were 65 wells considered to be in condition to supply gas, but owing to lack of market only 36 of these were supplying gas to commercial consumers.

It is estimated that the Monroe field probably has a greater potential capacity than any other known gas field in the United States. The field is estimated to contain 4,750,000,000 M cubic feet of gas, or enough to supply 150,000 M cubic feet a day for 86 years.[2] Investigations conducted by the Bureau of Mines and the Louisiana Conservation Commission, however, indicate that although the potential supply of gas in this field is very great, the field is already being drawn on at an alarming rate, and every effort is being made to reduce the waste to a minimum and to seek a market for the gas wherever possible. The construction of pipe lines to a number of large cities, such as New Orleans, is being contemplated.[2]

[2] Bell, H. W., and Cattell, R. A., The Monroe gas field, published by the Louisiana Dept. Conservation in cooperation with the U. S. Bureau of Mines, Bull. 9, p. 17, 1921.

A strong sentiment has developed against the carbon-black industry, which is now well established in this field and consumes large volumes of natural gas.

PENNSYLVANIA.

One of the most interesting developments of natural gas in recent years is the McKeesport pool, just south of McKeesport, Pa. The first well in this pool was completed on August 29, 1919. It was drilled to the Speechley sand and came in with a yield of 4,000,000 cubic feet a day, but the production quickly increased to 62,000,000 cubic feet. According to data compiled by the State geologist of Pennsylvania, the output on November 10, 1919, was the peak for the pool, amounting to 71,530,000 cubic feet of gas. On May 1, 1920, 200 wells, 110 dry and 90 producing, had been drilled in the pool, yielding 30,900,000 cubic feet of gas daily, and the total production to that date was 12,792,100,000 cubic feet. On August 29, 1920, a year after the opening of the pool, there were 167 producing wells out of 528 wells completed to the Speechley sand. In this first year of production the pool yielded 15,225,100,000 cubic feet of gas, or 11 per cent of the maximum production for Pennsylvania and nearly 5 per cent of West Virginia's production in 1917. At the end of the year 1920 there were 180 producing wells and 441 dry wells.

The outstanding fact of interest in regard to the McKeesport pool is its short life, which had been predicted by geologists—in fact, the Pennsylvania Bureau of Topographic and Geological Survey warned the public against making investments in this pool too readily. The pool, which is barely a square mile in area, was nevertheless tremendously overdeveloped, and therefore, it is safe to say, many investors in it have suffered heavy financial losses. As a glaring example of extreme overdevelopment it rivals the Cleveland gas field, whose life was also cut short on account of too concentrated drilling.[3]

ARKANSAS.

The chief source of natural gas in Arkansas is the El Dorado field, in the southern part of the State. Although this is primarily an oil field, large quantities of gas have been discovered here, and without question it will be of considerable commercial importance as a gas field in the future. The chief drawback to the success of this gas field, as to that of the Monroe field, is the distance from a ready market for the gas.[4]

CALIFORNIA.

Most of the natural gas produced in California comes from the oil fields, as the gas is chiefly wet gas occurring in association with oil. The most notable gas development in California in recent years has been accomplished by the Standard Oil Co. in the Elk Hills field of Kern County, northeast of the Midway district, in 1919.

The discovery within the last few years of oil fields at Long Beach, Santa Fe Springs, Richfield (1918), Huntington Beach (1920), and Signal Hills and Redondo (1921), in Los Angeles and Orange coun-

[3] See reports on the McKeesport gas pool, by G. H. Ashley and J. F. Robinson, published by Pennsylvania Bur. Top. and Geol. Survey, 1920 and 1921.

[4] Bell, H. W., and Kerr, J. B., of U. S. Bur. Mines, The El Dorado, Ark., oil and gas field, Little Rock, Ark., 1922.

ties, has greatly increased the available supply of natural gas in southern California, a part of the State where there is a large market for gas.

OKLAHOMA.

A large part of the natural-gas development in Oklahoma has been connected with the exploitation of oil fields. The extension of older fields and the search for new fields are constantly going on and have been stimulated by the gas shortage in Oklahoma in the last few winters, but no large gas fields have been discovered recently. Much attention has been centered on the extension of pipe lines in order to supply the many towns demanding natural gas. Many plants for the removal of gasoline from natural gas have also been constructed.

TEXAS.

The Amarillo field, in Potter County, in the northwestern part of Texas, is believed to contain a considerable supply of natural gas. The first well was sunk in 1918, but the field did not become a commercial producer until 1919. The Three Rivers field, in Live Oak County, has also been recently developed. Although a small field it now supplies gas to the city of San Antonio.

MONTANA.

Natural gas was discovered in Montana as far back as 1892, but the development of gas fields has not been very rapid. Drilling during the last three years has resulted in bringing in wells on the Cabin Creek dome, Fallon County, the Cone Butte dome, Fergus County, and the Lake Basin dome, Stillwater County.

WEST VIRGINIA.

The development of natural gas in West Virginia in the last few years has been confined chiefly to extension of the present fields. No notable new supply of gas has been brought in.

WYOMING.

Although natural gas has long been known in Wyoming active drilling for it has been carried on chiefly during the last few years. The Big Sand Draw field, Fremont County, was drilled in 1917 and 1918, and the deepening of the wells in 1921 resulted in large flows of gas. A gas well completed in 1920 in Alkali Butte, Fremont County, had an estimated initial daily production of 50,000,000 cubic feet. Since Wyoming has become an important oil-producing State there has been an increase in drilling, which has disclosed new supplies of both oil and gas. The chief drawback to the production of natural gas in Wyoming is the lack of a market. As a result much of the gas has been wasted and the wells already drilled have been capped. Pipe lines have been constructed, however, and gasoline plants have been installed.

PRODUCTION.

The statistics of production here given represent only the gas marketed and do not include the gas that is wasted in the field or lost through leakage underground or at the well. Table 3 shows the quantity, total value, and average value per M cubic feet for each State in which gas is produced or consumed. The values given are values at the points of consumption, which may be in a different State from that in which the gas is produced. In its statistical reports the Geological Survey generally gives the value at the point of production, but for natural gas the only values considered and reported by most of the producers and distributors are those at the point of final sale.

Many of the large number of operators who are producing natural gas get only a small output from one or a few wells, and it is therefore very difficult—indeed, as to some wells or fields it is impossible—to obtain accurate data even from the producers themselves, for the gas is not measured either by the producer or the user and hence any figures showing production are necessarily estimates. For many small producers the operation of their wells is not their main business but is simply incidental to farming or other work. The gas from such wells is piped into neighboring houses, where it is used without any very clear idea of the quantities required or consumed, and payment is usually made by the month or year, often without any record of the transactions. Estimates of the quantities of gas marketed in this way are of course uncertain, but they are included in the total. Data regarding production by many small operators who can not themselves furnish the figures are supplied to the Geological Survey by the distributors who purchase this gas for transmission through their pipe lines.

TABLE 3.—*Natural gas marketed and consumed in the United States, 1919–1921.*

State.	Gas produced and marketed.				Gas consumed.			
	Quantity.		Value at point of consumption.		Quantity.		Value at point of consumption.	
	M cubic feet.	Per cent of total.	Total.	Average per M cubic feet (cents).	M cubic feet.	Per cent of total.	Total.	Average per M cubic feet (cents).
1919.[a]								
Arkansas	5,587,000	....	$947,000	17.0	13,708,000	....	$2,320,000	16.9
California	55,607,000	....	9,366,000	16.8	55,607,000	....	9,366,000	16.8
Colorado	10,000	....	2,000	20.0	10,000	....	2,000	20.0
Illinois	3,825,000	....	620,400	16.2	3,825,000	....	620,400	16.2
Indiana	1,407,000	....	534,000	38.0	3,941,400	....	1,498,000	38.0
Iowa	800	....	200	25.0	800	....	200	25.0
Kansas	16,150,200	....	5,492,000	34.0	40,581,000	....	9,273,000	22.9
Kentucky	2,057,000	....	695,000	33.8	12,246,000	....	4,108,000	33.5
Louisiana	47,062,000	....	4,045,000	8.6	37,024,000	....	2,328,000	6.3
Maryland	200	....	100	50.0	842,000	....	318,000	37.8
Michigan	1,000	....	900	90.0	1,000	....	900	90.0
Missouri	4,800	....	4,000	83.3	4,762,000	....	3,301,000	69.3
Montana	858,000	....	86,000	10.0	858,000	....	86,000	10.0
New York	8,124,000	....	2,870,000	35.3	19,768,000	....	7,009,000	35.5
North Dakota	2,000	....	800	40.0	2,000	....	800	40.0
Ohio	63,153,400	....	20,389,000	32.3	126,694,000	....	41,062,000	32.4
Oklahoma	163,649,000	....	23,650,000	14.5	123,275,000	....	14,609,000	11.9
Oregon	200	....	100	50.0	200	....	100	50.0
Pennsylvania	113,489,000	....	32,520,000	28.7	146,553,000	....	41,269,000	28.2
South Dakota	32,600	....	16,900	51.8	32,600	....	16,900	51.8
Tennessee	77,000	....	5,700	7.4	77,000	....	5,700	7.4
Texas	24,710,000	....	4,345,000	17.6	37,813,000	....	6,652,000	17.6
West Virginia	234,094,800	....	54,880,900	23.4	112,281,000	....	16,625,000	14.8
Wyoming	6,014,000	....	417,000	6.9	6,014,000	....	417,000	6.9
	745,916,000	....	160,888,000	21 6	745,916,000	....	160,888,000	21.6

[a] Revised figures.

TABLE 3.—*Natural gas marketed and consumed in the United States, 1919–1921*—Contd.

State.	Gas produced and marketed.				Gas consumed.			
	Quantity.		Value at point of consumption.		Quantity.		Value at point of consumption.	
	M cubic feet.	Per cent of total.	Total.	Average per M cubic feet (cents).	M cubic feet.	Per cent of total.	Total.	Average per M cubic feet (cents).
1920.								
Arkansas	9,027,000	....	$1,906,900	21.1	19,050,000	....	$4,021,900	21.1
California	66,041,000	....	12,528,000	19.0	66,041,000	....	12,528,000	19.0
Colorado	8,500	....	1,100	12.9	8,500	....	1,100	12.9
Illinois	3,013,000	....	477,000	15.8	3,013,000	....	477,000	15.8
Indiana	1,779,000	....	758,000	42.6	4,435,000	....	1,893,000	42.7
Iowa	800	....	300	37.5	800	....	300	37.5
Kansas	21,158,000	....	7,164,000	33.9	33,140,000	....	8,603,000	26.0
Kentucky	3,345,000	....	1,064,000	31.8	15,297,000	....	4,865,000	31.8
Louisiana	58,274,000	....	5,768,000	9.9	46,219,000	....	3,283,000	7.1
Maryland	200	....	100	50.0	569,000	....	324,000	56.9
Michigan	400	....	300	75.0	400	....	300	75.0
Missouri	3,800	....	3,000	78.9	5,429,000	....	3,684,000	67.9
Montana	818,000	....	88,000	10.8	818,000	....	88,000	10.8
New York	8,419,000	....	3,195,000	37.9	19,127,000	....	7,255,000	37.9
North Dakota	1,100	....	300	27.3	1,100	....	300	27.3
Ohio	58,938,000	....	21,587,000	36.6	136,872,000	....	50,374,000	36.8
Oklahoma	154,467,200	....	25,805,000	16.7	126,689,000	....	18,699,000	14.8
Oregon	200	....	100	50.0	200	....	100	50.0
Pennsylvania	125,787,000	....	40,726,000	32.4	161,397,000	....	51,863,000	32.1
South Dakota	20,000	....	12,000	60.0	20,000	....	12,000	60.0
Tennessee	15,000	....	3,000	20.0	15,000	....	3,000	20.0
Texas	37,063,000	....	7,042,000	19.0	49,467,000	....	9,398,000	19.0
West Virginia	239,718,800	....	67,259,900	28.1	100,289,000	....	18,016,000	18.0
Wyoming	10,312,000	....	805,000	7.8	10,312,000	....	805,000	7.8
	798,210,000	....	196,194,000	24.6	798,210,000	....	196,194,000	24.6
1921.								
Arkansas	4,260,000	0.6	984,000	23.1	10,637,000	1.6	2,451,000	23.0
California	75,942,000	11.5	16,496,000	21.7	75,942,000	11.5	16,496,000	21.7
Colorado	4,000	(b)	1,000	25.0	4,000	(b)	1,000	25.0
Illinois	2,646,000	.4	356,000	13.5	2,630,000	.4	348,000	13.2
Indiana	1,066,000	.2	547,000	51.3	2,954,000	.4	1,520,000	51.5
Iowa	700	(b)	300	42.9	700	(b)	300	42.9
Kansas	15,717,000	2.4	7,382,000	47.0	26,172,000	4.0	9,602,000	36.7
Kentucky	4,820,000	.7	1,597,000	33.1	13,667,000	2.1	4,526,000	33.1
Louisiana	58,004,000	8.8	5,460,000	9.4	53,027,000	8.0	3,926,000	7.4
Maryland	200	(b)	100	50.0	625,000	.1	418,000	66.9
Michigan	400	(b)	300	75.0	400	(b)	300	75.0
Missouri	4,000	(b)	3,000	75.0	4,467,000	.7	3,463,000	77.5
Montana	336,000	(b)	89,300	26.6	336,000	(b)	89,300	26.6
New York	6,583,000	1.0	2,798,000	42.5	15,541,000	2.3	6,596,000	42.4
North Dakota	1,000	(b)	400	40.0	1,000	(b)	400	40.0
Ohio	47,412,000	7.2	19,216,000	40.5	106,051,000	16.0	43,221,000	40.8
Oklahoma	124,058,000	18.7	23,429,000	18.9	100,903,000	15.2	15,989,000	15.8
Oregon	200	(b)	100	50.0	200	(b)	100	50.0
Pennsylvania	86,144,000	13.0	32,815,000	38.1	100,615,000	15.2	38,246,000	38.0
South Dakota	9,700	(b)	4,000	41.2	9,700	(b)	4,000	41.2
Tennessee	11,000	(b)	2,600	23.6	11,000	(b)	2,600	23.6
Texas	44,504,000	6.7	8,893,000	20.0	51,341,000	7.8	10,720,000	20.9
West Virginia	174,920,800	26.4	52,827,900	30.2	81,509,000	12.3	15,282,000	18.7
Wyoming	15,608,000	2.3	1,715,000	11.0	15,608,000	2.3	1,715,000	11.0
Combined States	....	[c].1	....	....	....	[d].1	....	....
	662,052,000	100.0	174,617,000	26.4	662,052,000	100.0	174,617,000	26.4

[b] Included under "Combined States."
[c] Includes Colorado, Iowa, Maryland, Michigan, Missouri, Montana, North Dakota, Oregon, South Dakota, and Tennessee.
[d] Includes Colorado, Iowa, Michigan, Montana, North Dakota, Oregon, South Dakota, and Tennessee.

INTERSTATE MOVEMENT.

From Table 3 it appears that the quantity of gas produced in 11 States in 1919 and 1920 was the same as that consumed there. One of these States, however (Illinois), now exports a small quantity, as do also Indiana and New York. Kansas, Louisiana, Ohio, Oklahoma, Pennsylvania, Texas, and West Virginia export large quantities.

This export of gas, some of it to points far from the place of production, is due in part to competition among producers who draw gas from a single pool. As already explained, the first producer from a pool may, if no others put down wells, obtain nearly all the gas in the pool, without regard to the ownership of the surface of the ground under which the gas occurs. Hence many wells may be sunk in a field in rapid succession after the gas pool is discovered, despite the fact that the interest of the owners of the land might be best served by more gradual production; and when the production thus grows rapidly it becomes necessary to look farther and farther away for markets.

The quantity of gas moved out of each producing State in 1921 is shown in Table 4 and graphically in figure 21. For most of the States the quantity exported is small in comparison with the total quantity produced, but more than half of the gas produced in West Virginia is used outside of the State, because of the enterprise of producers and distributing companies but more largely because of an exaggerated idea as to the distance over which it is profitable to send gas. Natural gas must be consumed as soon as it is produced. Hence the output in any district is limited by the amount that can be promptly marketed, either near by or through pipe lines. In fact the capacity of the pipe lines available has largely determined the quantity of gas handled, especially at times of peak demand, during the winter, when large quantities are used for heating.

West Virginia has not only been the greatest exporter, but also has sent gas the greatest distance. Some of the gas produced in West Virginia goes as far away as Indiana, and the natural-gas supply of Cleveland and other cities on the south shore of Lake Erie comes in large part from West Virginia fields. Interconnecting pipe-line systems to supply this territory form a complicated network over the entire region from the Allegheny Mountains west beyond the Ohio-Indiana line, and from northern Kentucky north to Lake Erie. These pipe lines form one of the most elaborate systems for the transfer of energy yet developed by engineering science. They cover an area almost as wide and deal with quantities of potential energy almost as great as those considered in the proposed Boston to Washington "superpower system" of interconnected electric-service facilities.

Several years ago the legislature of West Virginia, feeling that one of the State's most valuable natural resources was being taken from it at an unduly rapid rate through the export of natural gas, passed an act forbidding such export except under certain conditions. This act aroused great opposition from consumers in Pennsylvania and Ohio who obtained their supplies from West Virginia. An original case between the States is still pending before the United States Supreme Court to determine the constitutionality of such restrictive legislation, but pending its decision the export of gas continues.

In the interstate movement of natural gas some peculiar cross hauls occur—for example, Kansas exports gas to Oklahoma and Oklahoma exports gas simultaneously to Kansas—but in general in such cross hauls the principal movement is in one direction, and the movement in the other direction represents small local supplies sent from a State of small production to near-by points that lie in a

State of larger production but are too far from any natural-gas supply in their own State to be served by it. Some natural gas crosses State borders half a dozen or more times between the points of production and of use.

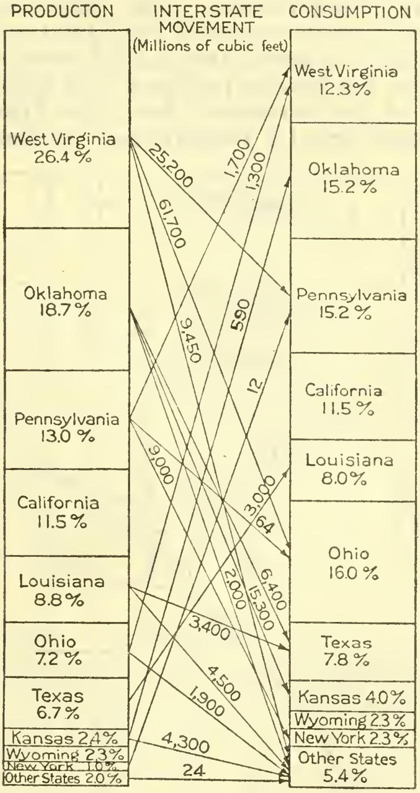


FIGURE 21.—Interstate movement of natural gas in 1921.

TABLE 4.—*Interstate transportation of natural gas in 1921.*

State in which produced.	State to which exported.	Quantity (M cubic feet).	State in which produced.	State to which exported.	Quantity (M cubic feet).
Illinois	Indiana	16,000	Oklahoma	Arkansas	1,843,000
Indiana	Kentucky	8,000		Kansas	15,307,000
				Missouri	199,000
Kansas	Missouri	4,264,000		Texas	6,394,000
	Oklahoma	588,000			23,743,000
		4,852,000	Pennsylvania	Ohio	64,000
Louisiana	Arkansas	4,534,000		New York	8,970,000
	Texas	3,396,000		West Virginia	1,700,000
		7,930,000			10,734,000
New York	Pennsylvania	12,000	Texas	Louisiana	2,953,000
Ohio	Indiana	1,880,000	West Virginia	Maryland	624,800
	West Virginia	1,276,000		Kentucky	8,839,000
		3,156,000		Ohio	61,731,000
				Pennsylvania	25,193,000
					96,387,800

RANK OF STATES IN PRODUCTION AND USE.

Table 5 shows the rank of the States in the production and consumption of gas for the four years 1918–1921. In 1921, as in many years past, West Virginia ranked first as a producer and was followed by Oklahoma and Pennsylvania. This table, taken in connection with Table 4, discloses the extent of the interstate movement of gas, for Ohio, though sixth in production in 1921, was first in consumption, and West Virginia, the leading producer, was fourth in consumption. The movement of gas northward from the Texas and Oklahoma fields permits much greater consumption in Kansas and Missouri

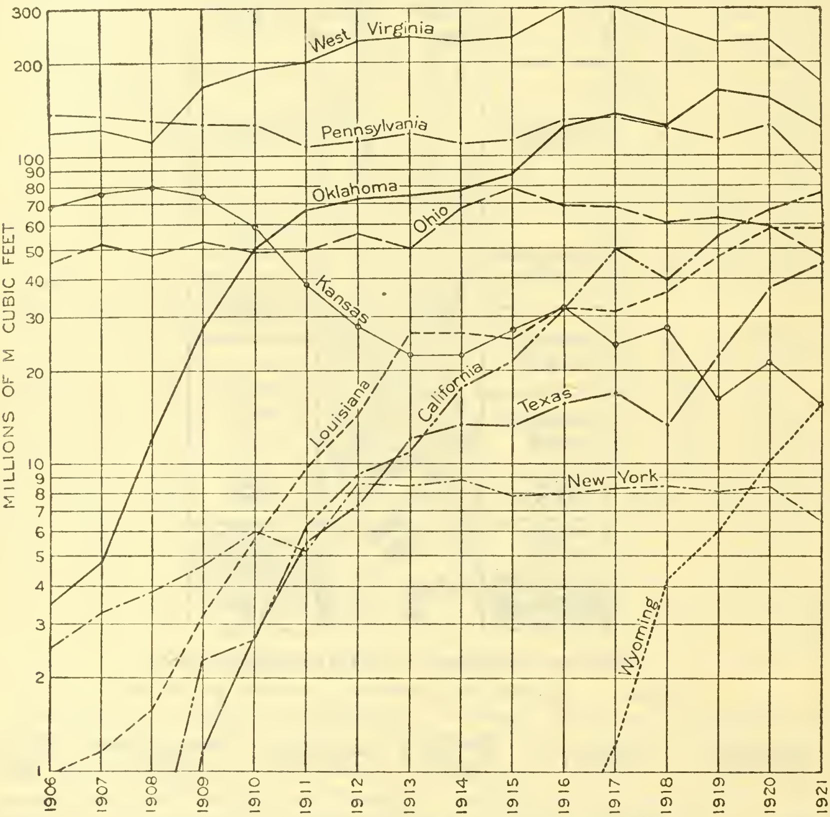


FIGURE 22.—Production of natural gas in ten leading States, 1906–1921.

than would be possible from gas produced in those States alone. Missouri, for example, though eighteenth in production, was thirteenth in consumption.

Figure 22 shows graphically in simple form the history of the production of gas in the leading States, which exhibits great differences in different parts of the country. In some States the production has been going on continuously at a more or less uniform rate for some time. In others the production was nominal for a considerable period and has become important only recently. In still other States the production of gas passed its peak some time ago and now continues on a much smaller scale. In a few States the small production of gas reported in times past seems to have been discontinued altogether.

TABLE 5.—*Rank of States in production and consumption of natural gas, 1918–1921.*

State.	Production.				State.	Consumption.			
	1918	1919	1920	1921		1918	1919	1920	1921
West Virginia	1	1	1	1	Ohio	2	2	2	1
Oklahoma	2	2	2	2	Oklahoma	4	3	3	2
Pennsylvania	3	3	3	3	Pennsylvania	1	1	1	3
California	5	5	4	4	West Virginia	3	4	4	4
Louisiana	6	6	6	5	California	5	5	5	5
Ohio	4	4	5	6	Louisiana	7	8	7	6
Texas	8	7	7	7	Texas	9	7	6	7
Kansas	7	8	8	8	Kansas	6	6	8	8
Wyoming	12	10	9	9	Wyoming	15	12	12	9
New York	9	9	11	10	New York	8	9	9	10
Kentucky	13	13	12	11	Kentucky	11	11	11	11
Arkansas	10	11	10	12	Arkansas	10	10	10	12
Illinois	11	12	13	13	Missouri	13	13	13	13
Indiana	15	14	14	14	Indiana	12	14	14	14
Montana	16	15	15	15	Illinois	14	15	15	15
Tennessee	14	16	17	16	Maryland	27	17	17	16
South Dakota	17	17	16	17	Montana	17	16	16	17
Colorado	20	18	18	18	Tennessee	16	18	19	18
Missouri	19	19	19	18	South Dakota	18	19	18	19
North Dakota	25	20	20	20	Colorado	20	20	20	20
Iowa	23	22	21	21	North Dakota	25	21	21	21
Michigan	24	21	22	22	Iowa	23	23	22	22
Maryland	27	23	23	23	Michigan	24	22	23	23
Oregon	22	23	23	23	Oregon	22	24	24	24
Alabama	21	......	......	......	Alabama	21	......	......	......
Utah	18	......	......	......	Utah	19	......	......	......
Washington	26	......	......	......	Washington	26	......	......	......

WASTE.

Undoubtedly the greatest problem of the natural-gas business has always been that of avoiding or reducing waste. At present probably 30 per cent of the gas produced and started on its way toward users never finds any useful application, and of the gas that reaches consumers as much as 50 per cent is used unnecessarily because of inefficient methods of consumption. Engineers have studied various phases of the problem at different times and have suggested many remedies, but it seems to have required the pressure of increased costs to bring about any marked improvement.

One of the greatest factors contributing to waste has probably been the lack of knowledge as to the quantities of gas handled or used. In general, producers do not meter the gas; and most of the pipeline and distributing companies have no accurate knowledge regarding the quantities of gas that they handle. In many distribution systems the gas is not measured until it reaches the domestic or industrial user's premises.

The Geological Survey has attempted from time to time to get figures on the quantity of gas wasted, but the returns made to it have been wholly inadequate for this purpose, because the operators generally have no idea as to the quantities of gas that are being lost or needlessly consumed. For the present the Geological Survey is compelled to limit its estimates to the gas wasted during transmission or distribution in the operations of companies that supply figures or estimates of both production and consumption. These companies form only a minor percentage of all the operating concerns. The data are given in Table 6 and represent simply the differences between the quantities reported by these companies as produced and as consumed. The waste thus shown amounts to less than 10 per cent of the total production for the United States, whereas it is believed that the gas that is actually wasted at some time during field operations, transmission, or distribution amounts to 25 per cent of the total and in many fields to much more.

Because of the competition to get gas from a pool that lies under the property of a large number of persons there has been a tendency, as set forth elsewhere in this report, to drill an excessive number of wells. This has inevitably resulted in waste, not only of gas but also of money spent for drilling and for pipe lines that serve no really useful purpose. Where a large area has been controlled by a single company this wasteful development has been in part avoided. But without unit control for a field as a whole it is practically impossible to eliminate the temptation that competition introduces, and in very few fields has such unit control been attainable.

The higher prices charged by producers to the distributing companies and by these companies in turn to the ultimate users have both been factors in emphasizing the need for care in control and operation of wells, in construction and maintenance of pipe lines, and in the efficient utilization of the gas. Appliances and methods of installation and utilization are receiving more and more attention not only from domestic and industrial users but also from gas-distributing companies.

Of course greater care in construction and operation of pipe lines and distribution systems, greater attention to the consumer's problems of gas utilization, and the giving of service of all sorts create expenses of operation that put a considerable burden upon the gas company. As a result there has been a demand for higher rates for gas in many localities, to cover not only increasing costs of operation but the extension of service to many details that manufactured-gas companies have furnished but that natural-gas companies have commonly ignored.

In the construction and maintenance of pipe lines and mains it is of course impossible to get a perfect or ideal system, which would cost far too much to justify the installation. In the manufactured-gas business it is regarded as impracticable to reduce the percentage of gas lost during distribution below 7 or 8 per cent of the amount sent out from the gas works or holder stations. In the natural-gas business some similar standards of operation have been established by a few companies, but there is by no means any general or uniform practice in this regard. In fact, the practice of paying pipe-line companies for gas on the basis of a "percentage of income from users" has led to very slovenly methods in some city distributing systems, and the waste there has been excessively high.

In any particular system it is desirable that leakage be eliminated down to that point at which further improvement would cost more than the gas that would be saved is worth. This principle is the only one that can safely be used as a guide, for the avoidance of waste of financial resources is quite as important as the elimination of waste of the commodity or the energy that the commodity represents. And this prevention of excessive investment is just as important to the user of gas as it is to the company that owns the pipe line or distribution system, because under modern public-utility regulation the customer has in the long run to pay interest, depreciation, and amortization on this investment as a part of the rate for gas.

There has been commendable and successful effort to check waste, but in some attempts to reduce leakage both effort and money have been spent in the wrong place. Unless leakage surveys are made and the principle of "measure in and measure out" of each system is applied, the location of the largest leaks may often be unknown. The cost of proper and adequate metering is so small a percentage of the total gas cost to the consumers that there is usually no real justification for neglecting it. In addition to metering the gas the more progressive companies are now making leakage surveys of their systems in order to determine just where leakages are occurring.

One method of improving distribution systems that seems to be increasingly used is the installation of welded pipe lines, which are tighter than lines with gasket joints. As a 16-inch pipe line of the ordinary type has 1¼ miles of possible leakage surface at the gaskets for each mile of line, the importance of high-grade construction of lines that use gaskets is clear.

In many systems the greatest losses are due to faulty drilling or well-operating methods, or to the failure of well owners to get the small remaining percentages of the gas after the rock pressure becomes low. In order to get the very last of the gas the use of small compressors serving individual wells or small groups of wells is often recommended. However, all field practices for preventing waste fall far short of success unless they are guided by adequate knowledge as to the quantities of gas handled, which means, of course, adequate facilities for metering.

In some pipe-line or distribution systems it has been found desirable to reduce the pressure in order that the quantity of gas lost might be reduced. Many other technical improvements have been suggested to aid in reducing waste, and all deserve encouragement so long as their cost does not exceed the value of the gas saved.

In any consideration of natural-gas waste some attention must be given to the recovery of by-products and the manufacture of carbon black. These phases of the general subject are discussed in another section of this report.

UTILIZATION.

Between 30 and 40 per cent of the natural gas consumed in the United States is used by domestic consumers; the remainder is used for industrial operations of various sorts. There is at present a strong tendency to curtail industrial consumption in order to conserve gas for domestic users. This tendency has resulted in a marked increase during recent years in the percentage of gas used for domestic purposes, and there is no doubt that both economic conditions and official regulations will continue to further this change. In some States the regulations of public-utility commissions prohibit the use of industrial gas during some seasons of the year, and certain applications are prohibited by law at all times.

In Table 6 are given by States the data for consumption and reported waste of natural gas during the three years covered by this report. As indicated in the preceding section, the figures for waste are far from complete.

TABLE 6.—*Consumption and reported waste of natural gas in 1919, 1920, and 1921.*

State.	1919			1920			1921		
	Consumption (M cubic feet).	Waste.		Consumption (M cubic feet).	Waste.		Consumption (M cubic feet).	Waste.	
		M cubic feet.	Per cent of total production.[a]		M cubic feet.	Per cent of total production.[a]		M cubic feet.	Per cent of total production.[a]
Arkansas	13,708,000	894,000	14	19,050,000	587,000	6	10,637,000	942,000	18
California	55,607,000	3,175,000	5	66,041,000	7,222,000	10	75,942,000	9,228,000	11
Colorado	10,000			8,500			4,000		
Illinois	3,825,000	12,000	.3	3,013,000	137,000	4	2,630,000	305,000	10
Indiana	3,941,400	156,000	10	4,435,000	74,000	4	2,954,000	319,000	23
Iowa	800			800			700		
Kansas	40,581,000	13,996,800	46	33,140,000	5,733,000	21	26,172,000	5,737,000	27
Kentucky	12,246,000	814,000	28	15,297,000	1,332,000	28	13,667,000	1,815,000	27
Louisiana	37,024,000	9,938,000	17	46,219,000	5,271,000	8	53,027,000	6,200,000	10
Maryland	842,000			569,000			625,000		
Michigan	1,000			400			400		
Missouri	4,762,000			5,429,000			4,467,000		
Montana	858,000			818,000	2,000	.2	336,000	26,000	7
New York	19,768,000	5,000	.1	19,127,000	103,000	1	15,541,000	153,000	2
North Dakota	2,000			1,100			1,000		
Ohio	126,694,000	8,237,600	12	136,872,000	12,916,000	18	106,051,000	10,822,000	19
Oklahoma	123,275,000	9,942,000	6	126,689,000	11,798,000	7	100,903,000	16,224,000	12
Oregon	200			200			200		
Pennsylvania	146,553,000	4,311,000	4	161,397,000	2,388,000	2	100,615,000	1,552,800	2
South Dakota	32,600	9,400	22	20,000			9,700		
Tennessee	77,000			15,000			11,000		
Texas	37,813,000	144,000	1	49,467,000	7,097,000	16	51,341,000	3,791,000	8
West Virginia	112,281,000	1,238,200	1	100,289,000	5,026,000	2	81,509,000	3,421,200	2
Wyoming	6,014,000	34,000	1	10,312,000	2,644,000	20	15,608,000	1,464,000	9
	745,916,000	52,907,000	7	798,210,000	62,330,000	7	662,052,000	62,000,000	9

[a] "Total production" determined by adding gas marketed, as shown in Table 3, to reported waste as shown in this table.

The domestic consumption of natural gas—for household cooking, lighting, water heating, house heating, and similar uses—is reported separately by most of the companies that make returns to the Geological Survey, and the figures thus obtained are given in Table 7. This consumption amounts to only 30 or 40 per cent of the total, but it involves by far the greatest number of people.

TABLE 7.—*Domestic consumption of natural gas in the United States, 1919–1921.*

State.	1919			1920			1921		
	Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.	
		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).
Arkansas	4,022,000	$1,184,000	29.4	5,130,000	$1,968,000	38.4	4,026,000	$1,596,000	39.6
California	9,397,000	5,089,000	54.2	12,084,000	7,419,000	61.4	11,091,000	8,684,000	78.3
Colorado	3,700	1,000	27.0	7,500	1,000	13.3	4,000	1,000	25.0
Illinois	495,000	225,000	45.5	388,000	178,000	45.9	208,000	102,000	49.0
Indiana	2,485,000	1,036,000	41.7	2,702,000	1,228,000	45.4	2,120,000	1,147,000	54.1
Iowa	800	200	25.0	800	300	37.5	700	300	42.9
Kansas	12,140,000	4,477,000	36.9	13,435,000	5,599,000	41.7	12,387,000	6,799,000	54.9
Kentucky	7,918,000	2,893,000	36.5	9,531,000	3,553,000	37.3	8,749,000	3,617,000	41.3
Louisiana	2,907,000	480,000	16.5	4,847,000	850,000	17.5	3,417,000	979,000	28.7
Maryland	654,000	260,000	39.8	486,000	277,000	57.0	559,000	382,000	68.3
Michigan	700	600	85.7	400	300	75.0	400	300	75.0
Missouri	4,316,000	3,109,000	72.0	4,750,000	3,484,000	73.3	4,449,000	3,452,000	77.6
Montana	192,000	73,000	38.0	153,000	73,000	47.7	138,000	82,100	59.5
New York	18,084,000	6,636,000	36.7	17,824,000	6,949,000	39.0	14,851,000	6,377,000	42.9
North Dakota	2,000	800	40.0	1,100	300	27.3	1,000	400	40.0
Ohio	90,473,000	30,813,000	34.1	96,740,000	37,038,000	38.3	83,753,000	35,529,000	42.4
Oklahoma	16,171,000	4,480,000	27.7	19,640,000	5,984,000	30.5	17,708,000	6,407,000	36.2
Oregon	200	100	50.0	200	100	50.0	200	100	50.0
Pennsylvania	58,653,000	19,752,000	33.7	66,161,000	24,659,000	37.3	53,950,000	23,518,000	43.6
South Dakota	14,600	11,400	78.1	14,000	10,000	71.4	4,100	2,000	48.8
Tennessee	3,000	900	30.0	4,000	2,000	50.0	3,600	1,600	44.4
Texas	8,728,000	3,522,000	40.4	9,894,000	4,318,000	43.6	10,089,000	5,680,000	56.3
West Virginia	18,744,000	4,270,000	22.8	21,150,000	5,347,000	25.3	19,470,000	5,517,200	28.3
Wyoming	339,000	100,000	29.5	1,058,000	364,000	34.4	1,355,000	463,000	34.2
	255,743,000	88,414,000	34.6	286,001,000	109,302,000	38.2	248,334,000	110,337,000	44.4

Figures for the consumption of gas in manufacturing or industrial operations are given in Table 8. The quantity of gas reported as consumed in the manufacture of natural-gas gasoline is the actual quantity of the gas used up in the processes of gasoline recovery; it does not include the gas treated at these plants but recovered after the gasoline has been extracted. As a matter of fact the quantity consumed in such plants is less than 5 per cent of the total treated.

The quantity of natural gas consumed in making carbon black is not separately given in Table 8, as that industry is not widely distributed and the totals of only a few States would be affected by these figures. The gas so used is included with that listed as consumed in manufacturing.

TABLE 8.—*Industrial consumption of natural gas in the United States, 1919–1921, by States.*

1919.

State.	Manufacturing.			Drilling and pumping.			Gasoline.[a]		
	Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.	
		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).
Arkansas	7,314,000	$766,000	10.5	40,000	$4,000	10.0	....	....	....
California	1,172,000	438,000	37.4	34,988,000	2,830,000	8.1	3,174,000	$175,000	5.5
Colorado	....	....	....	6,300	1,000	15.9	....	....	....
Illinois	....	....	....	2,273,000	285,400	12.6	829,000	79,000	9.5
Indiana	1,266,000	410,000	32.4	147,400	40,000	27.1	....	....	....
Iowa	....	....	....	....	....	....	....	....	....
Kansas	10,876,000	1,657,000	15.2	3,693,000	507,000	13.7	289,000	18,000	6.2
Kentucky	3,720,000	1,136,700	30.6	475,000	49,000	10.3	2,000	300	15.0
Louisiana	18,116,000	601,000	3.3	14,431,000	1,054,000	7.3	222,000	24,000	10.8
Maryland	179,000	55,000	30.7	....	....	....	....	....	....
Michigan	....	....	....	300	300	100.0	....	....	....
Missouri	294,000	93,000	31.6	....	....	....	....	....	....
Montana	620,000	12,000	1.9	....	....	....	....	....	....
New York	67,000	26,000	38.8	1,162,000	191,000	16.4	21,000	2,000	9.5
North Dakota	....	....	....	....	....	....	....	....	....
Ohio	24,114,000	7,699,000	31.9	4,619,000	749,000	16.2	650,000	130,000	20.0
Oklahoma	30,475,000	3,134,000	10.3	47,937,000	4,254,000	8.9	13,824,000	886,000	6.4
Oregon	....	....	....	....	....	....	....	....	....
Pennsylvania	72,227,000	18,591,000	25.7	8,232,000	1,285,000	15.6	776,000	114,000	14.7
South Dakota	....	....	....	....	....	....	....	....	....
Tennessee	67,000	4,000	6.0	2,000	300	15.0	....	....	....
Texas	3,555,000	519,000	14.6	17,942,000	1,491,000	8.3	602,000	41,000	6.8
West Virginia	70,029,000	8,715,300	12.4	10,630,000	1,828,000	17.2	921,000	93,700	10.2
Wyoming	3,722,000	90,000	2.4	1,899,000	218,000	11.5	....	....	....
	247,813,000	43,947,000	17.7	148,477,000	14,787,000	10.0	21,310,000	1,563,000	7.3

State.	Other operations.			Total.		
	Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.	
		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).
Arkansas	2,332,000	$366,000	15.7	9,686,000	$1,136,000	11.7
California	6,876,000	834,000	12.1	46,210,000	4,277,000	9.3
Colorado	....	....	....	6,300	1,000	15.9
Illinois	228,000	31,000	13.6	3,330,000	395,400	11.9
Indiana	43,000	12,000	27.9	1,456,400	462,000	31.7
Iowa	....	....	....	....	....	....
Kansas	13,583,000	2,614,000	19.2	28,441,000	4,796,000	16.9
Kentucky	131,000	29,000	22.1	4,328,000	1,215,000	28.1
Louisiana	1,348,000	169,000	12.5	34,117,000	1,848,000	5.4
Maryland	9,000	3,000	33.3	188,000	58,000	30.9
Michigan	....	....	....	300	300	100.0
Missouri	152,000	99,000	65.1	446,000	192,000	43.0
Montana	46,000	1,000	2.2	666,000	13,000	2.0
New York	434,000	154,000	35.5	1,684,000	373,000	22.1
North Dakota	....	....	....	....	....	....
Ohio	6,838,000	1,671,000	24.4	36,221,000	10,249,000	28.3
Oklahoma	14,868,000	1,855,000	12.5	107,104,000	10,129,000	9.5
Oregon	....	....	....	....	....	....
Pennsylvania	6,665,000	1,527,000	22.9	87,900,000	21,517,000	24.5
South Dakota	18,000	5,500	30.6	18,000	5,500	30.6
Tennessee	5,000	500	10.0	74,000	4,800	6.5
Texas	6,986,000	1,079,000	15.4	29,085,000	3,130,000	10.8
West Virginia	11,957,000	1,718,000	14.4	93,537,000	12,355,000	13.2
Wyoming	54,000	9,000	16.7	5,675,000	317,000	5.6
	72,573,000	12,177,000	16.8	490,173,000	72,474,000	14.8

[a] Figures represent only actual decrease in volume of gas treated for gasoline.

TABLE 8.—*Industrial consumption of natural gas in the United States, 1919–1921, by States*—Continued.

1920.

State.	Manufacturing.			Drilling and pumping.			Gasoline.[a]		
	Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.	
		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).
Arkansas	13,636,000	$2,031,000	14.9	17,000	$1,900	11.2	...	...	...
California	488,000	117,000	24.0	36,838,000	3,530,000	9.6	3,569,000	$255,000	7.1
Colorado	...	...	...	1,000	100	10.0	...	...	...
Illinois	5,000	1,000	20.0	1,534,000	191,000	12.5	1,069,000	101,000	9.4
Indiana	1,577,000	635,000	40.3	83,000	14,000	16.9	...	...	...
Iowa	...	...	...	...	...	...	...	...	...
Kansas	9,736,000	1,440,000	14.8	6,478,000	873,000	13.5	116,000	11,000	9.5
Kentucky	4,493,000	968,000	21.5	318,000	88,000	27.7	202,000	20,000	9.9
Louisiana	25,357,000	1,226,000	4.8	14,453,000	1,038,000	7.2	12,000	1,000	8.3
Maryland	76,000	43,000	56.6	...	...	...	...	...	...
Michigan	...	...	...	...	...	...	...	...	...
Missouri	184,000	57,000	31.0	...	...	...	...	...	...
Montana	651,000	13,000	2.0	...	...	...	...	...	...
New York	67,000	35,000	52.2	892,000	156,000	17.5	34,000	4,000	11.8
North Dakota	...	...	...	...	...	...	...	...	...
Ohio	27,386,000	10,292,000	37.6	6,641,000	1,382,000	20.8	436,000	127,000	29.1
Oklahoma	29,899,000	3,933,000	13.2	53,598,000	6,473,000	12.1	10,788,000	768,000	7.1
Oregon	...	...	...	...	...	...	...	...	...
Pennsylvania	76,242,000	22,073,000	29.0	11,778,000	3,116,000	26.5	541,000	87,000	16.1
South Dakota	...	...	...	...	...	...	...	...	...
Tennessee	...	...	...	...	...	...	...	...	...
Texas	3,679,000	691,000	18.8	30,634,000	3,271,000	10.7	845,000	85,000	10.1
West Virginia	57,120,000	9,290,000	16.3	14,256,000	1,915,000	13.4	699,000	71,000	10.2
Wyoming	2,896,000	81,000	2.8	6,276,000	347,000	5.5	...	...	...
	253,492,000	52,926,000	20.9	183,797,000	22,396,000	12.2	18,311,000	1,530,000	8.4

State.	Other operations.			Total.		
	Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.	
		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).
Arkansas	267,000	$21,000	7.9	13,920,000	$2,053,900	14.8
California	13,062,000	1,207,000	9.2	53,957,000	5,109,000	9.5
Colorado	...	...	...	1,000	100	10.0
Illinois	17,000	6,000	35.3	2,625,000	299,000	11.4
Indiana	73,000	16,000	21.9	1,733,000	665,000	38.4
Iowa	...	...	...	...	...	...
Kansas	3,375,000	680,000	20.1	19,705,000	3,004,000	15.2
Kentucky	753,000	236,000	31.3	5,766,000	1,312,000	22.8
Louisiana	1,550,000	168,000	10.8	41,372,000	2,433,000	5.9
Maryland	7,000	4,000	57.1	83,000	47,000	56.6
Michigan	...	...	...	...	...	...
Missouri	495,000	143,000	28.9	679,000	200,000	29.5
Montana	14,000	2,000	14.3	665,000	15,000	2.3
New York	310,000	111,000	35.8	1,303,000	306,000	23.4
North Dakota	...	...	...	...	...	...
Ohio	5,669,000	1,535,000	27.1	40,132,000	13,336,000	33.2
Oklahoma	12,764,000	1,541,000	12.1	107,049,000	12,715,000	11.9
Oregon	...	...	...	...	...	...
Pennsylvania	6,675,000	1,928,000	28.9	95,236,000	27,204,000	28.6
South Dakota	6,000	2,000	33.3	6,000	2,000	33.3
Tennessee	11,000	1,000	9.1	11,000	1,000	9.1
Texas	4,415,000	1,033,000	23.4	39,573,000	5,080,000	12.8
West Virginia	7,064,000	1,393,000	19.7	79,139,000	12,669,000	16.0
Wyoming	82,000	13,000	15.9	9,254,000	441,000	4.8
	56,609,000	10,040,000	17.7	512,209,000	86,892,000	17.0

[a] Figures represent only actual decrease in volume of gas treated for gasoline.

TABLE 8.—*Industrial consumption of natural gas in the United States, 1919–1921, by States*—Continued.

1921.

State.	Manufacturing.			Drilling and pumping.			Gasoline.[a]		
	Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.	
		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).
Arkansas	6,203,000	$835,000	13.5	391,000	$16,000	4.1	....	....	....
California	5,353,000	1,209,000	22.6	42,698,000	4,987,000	11.7	3,661,000	$252,000	6.9
Colorado	....	....	....	....	....	....	....	....	....
Illinois	....	....	....	1,328,000	137,000	10.3	1,077,000	104,000	9.7
Indiana	669,000	316,000	47.2	92,000	22,000	23.9	....	....	....
Iowa	....	....	....	....	....	....	....	....	....
Kansas	8,270,000	1,732,000	20.9	2,543,000	311,000	12.2	140,000	14,000	10.0
Kentucky	3,153,000	475,000	15.1	719,000	208,000	28.9	357,000	36,000	10.1
Louisiana	37,850,000	1,616,000	4.3	10,516,000	1,177,000	11.2	214,000	21,000	9.8
Maryland	66,000	36,000	54.5	....	....	....	....	....	....
Michigan	....	....	....	....	....	....	....	....	....
Missouri	....	....	....	....	....	....	....	....	....
Montana	182,000	4,000	2.3	2,000	300	15.0	....	....	....
New York	71,000	30,000	42.3	351,000	80,000	22.8	13,000	1,000	7.7
North Dakota	....	....	....	....	....	....	....	....	....
Ohio	13,082,000	5,187,000	39.6	3,297,000	823,000	25.0	313,000	114,000	36.4
Oklahoma	17,212,000	2,175,000	12.6	45,718,000	5,211,000	11.4	10,565,000	979,000	9.3
Oregon	....	....	....	....	....	....	....	....	....
Pennsylvania	34,466,000	11,491,000	33.3	7,041,000	1,623,000	23.1	704,000	110,000	15.6
South Dakota	....	....	....	....	....	....	....	....	....
Tennessee	....	....	....	6,000	900	15.0	....	....	....
Texas	4,183,000	670,000	16.0	31,114,000	3,383,000	10.9	1,572,000	150,000	9.5
West Virginia	46,265,000	7,243,000	15.7	10,488,000	1,562,800	14.9	229,000	24,000	10.5
Wyoming	6,499,000	827,000	12.7	6,246,000	287,000	4.6	910,000	15,000	1.6
	183,524,000	33,846,000	18.4	162,550,000	19,829,000	12.2	19,755,000	1,820,000	9.2

State.	Other operations.			Total.		
	Quantity (M cubic feet).	Value at point of consumption.		Quantity (M cubic feet).	Value at point of consumption.	
		Total.	Average per M cubic feet (cents).		Total.	Average per M cubic feet (cents).
Arkansas	17,000	$4,000	23.5	6,611,000	$855,000	12.9
California	13,139,000	1,364,000	10.4	64,851,000	7,812,000	12.0
Colorado	....	....	....	....	....	....
Illinois	17,000	5,000	29.4	2,422,000	246,000	10.2
Indiana	73,000	35,000	47.9	834,000	373,000	44.7
Iowa	....	....	....	....	....	....
Kansas	2,832,000	746,000	26.3	13,785,000	2,803,000	20.3
Kentucky	689,000	190,000	27.6	4,918,000	909,000	18.5
Louisiana	1,030,000	133,000	12.9	49,610,000	2,947,000	5.9
Maryland	....	....	....	66,000	36,000	54.5
Michigan	....	....	....	....	....	....
Missouri	18,000	11,000	61.1	18,000	11,000	61.1
Montana	14,000	2,900	20.7	198,000	7,200	3.6
New York	255,000	108,000	42.4	690,000	219,000	31.7
North Dakota	....	....	....	....	....	....
Ohio	5,606,000	1,568,000	28.0	22,298,000	7,692,000	34.5
Oklahoma	9,700,000	1,217,000	12.5	83,195,000	9,582,000	11.5
Oregon	....	....	....	....	....	....
Pennsylvania	4,454,000	1,504,000	33.8	46,665,000	14,728,000	31.6
South Dakota	5,600	2,000	35.7	5,600	2,000	35.7
Tennessee	1,400	100	7.1	7,400	1,000	13.5
Texas	4,383,000	837,000	19.1	41,252,000	5,040,000	12.2
West Virginia	5,057,000	935,000	18.5	62,039,000	9,764,800	15.7
Wyoming	598,000	123,000	20.6	14,253,000	1,252,000	8.8
	47,889,000	8,785,000	18.3	413,718,000	64,280,000	15.5

[a] Figures represent only actual decrease in volume of gas treated for gasoline.

The number of consumers using natural gas in various ways is given by States for each of the three years in Table 9. These data show that the domestic consumers are several times as numerous as the industrial users. As the tendency to limit the use of natural gas for manufacturing operations becomes more general, the number of industrial users will no doubt decrease, but there has been no great change in the number of such users during recent years, as is indicated clearly by the data in Table 10.

TABLE 9.—*Number of natural-gas consumers in the United States, 1919–1921, by States.*

State.	1919			1920			1921		
	Domestic.	Industrial.		Domestic.	Industrial.		Domestic.	Industrial.	
		Gasoline and other manufacturing.	Other.		Gasoline and other manufacturing.	Other.		Gasoline and other manufacturing.	Other.
Arkansas	28,601	238	69	34,318	308	69	34,794	170	62
California	202,077	294	1,069	215,769	235	1,167	217,568	536	992
Colorado	9	....	3	10	....	1	10	....	....
Illinois	5,294	17	205	4,436	20	164	4,058	25	80
Indiana	34,246	248	114	35,166	186	102	35,183	33	263
Iowa	4	....	....	4	....	....	4	....	....
Kansas	116,469	147	678	115,750	70	488	128,830	60	331
Kentucky	97,017	33	107	100,308	44	81	100,800	31	86
Louisiana	28,270	97	635	22,266	226	651	23,043	174	539
Maryland	11,913	11	17	10,276	22	17	10,795	19	....
Michigan	10	....	1	9	....	....	8	....	....
Missouri	74,360	138	45	75,991	198	38	78,525	....	76
Montana	1,171	1	1	1,040	1	1	1,018	1	2
New York	182,245	17	868	190,185	64	430	169,957	40	346
North Dakota	7	....	....	4	....	....	4	....	....
Ohio	889,511	3,616	1,869	937,267	2,596	1,488	959,240	1,476	1,264
Oklahoma	115,980	655	3,422	122,947	645	2,722	135,778	380	2,315
Oregon	2	....	....	2	....	....	2	....	....
Pennsylvania	498,816	1,909	3,597	510,178	1,660	3,258	468,615	5,418	2,446
South Dakota	528	....	1	521	....	5	42	....	1
Tennessee	23	1	4	71	....	3	73	....	1
Texas	86,851	111	1,058	105,599	145	1,235	117,843	105	1,404
West Virginia	126,575	972	2,069	131,093	929	1,598	139,010	906	1,338
Wyoming	1,483	8	42	1,833	6	52	5,715	14	55
	2,501,462	8,513	15,874	2,615,043	7,355	13,570	2,630,915	9,388	11,601

TABLE 10.—*Number of natural-gas consumers in the United States, 1894–1921.*

Year.	Domestic.	Industrial.	Total.	Year.	Domestic.	Industrial.	Total.
1894	278,646	1,152	279,798	1908	1,166,008	11,965	1,177,973
1895	370,130	1,417	371,547	1909	1,223,438	17,259	1,240,697
1896	524,385	2,815	527,200	1910	1,327,722	15,120	1,342,842
1897	602,174	2,739	604,913	1911	1,498,110	14,114	1,512,224
1898	571,998	3,512	575,510	1912	1,622,528	14,965	1,637,493
1899	630,186	4,219	634,405	1913	1,910,627	16,390	1,927,017
1900	706,309	5,679	711,988	1914	2,077,526	17,886	2,095,412
1901	709,921	5,742	715,663	1915	2,195,081	18,358	2,213,439
1902	509,695	8,103	517,798	1916	2,362,494	18,278	2,380,772
1903	627,047	7,222	634,269	1917	2,431,275	18,620	2,449,895
1904	712,577	6,333	718,910	1918	2,508,543	16,581	2,525,124
1905	779,638	8,569	788,207	1919	2,501,462	24,387	2,525,849
1906	874,944	9,074	884,018	1920	2,615,043	20,925	2,635,968
1907	1,058,181	13,005	1,071,186	1921	2,630,915	20,989	2,651,904

Figure 23, showing the quantity and value of natural gas used in the United States during the 16 years 1906–1921, brings out more clearly than the tables the fact that the production of gas has practically reached a constant level; but the unit value of the gas produced is still continuing to increase markedly from year to year, making a corresponding increase in total value.

Among the most serious problems to be considered with reference to the industry as a whole is the question of permitting or prohibiting the use of natural gas for the manufacture of carbon black. The recovery of gasoline from natural gas is an operation of conservation, for it makes available for most efficient application constituents that are not at all essential to the use of the rest of the gas as domestic or industrial fuel. The treatment of gas for the recovery of gasoline has therefore been encouraged wherever the real significance of this by-product has been understood. When carbon black is made from natural gas, however, the gas is burned and only that portion of it which is recovered as carbon can be further employed. Because the carbon black recovered represents only a small percentage of the total carbon in the gas the argument has been advanced that this use of

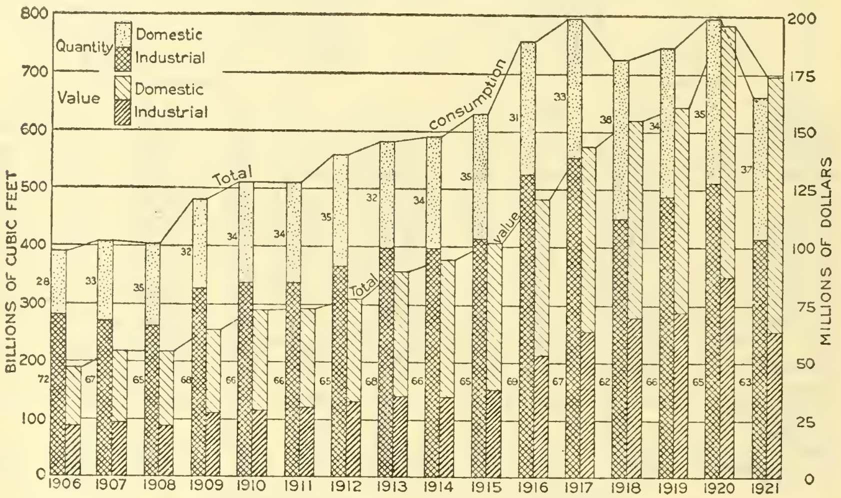


FIGURE 23.—Quantity and value of natural gas consumed in the United States, 1906–1921.

gas is contrary to the best interest of the public and should be prohibited, and, in fact, it has been prohibited in some parts of the country. The objections to this use of gas offered by State and municipal officials are warmly seconded by public-utility managers who are confronted with the difficulty of getting adequate gas supplies for the city gas-distributing systems which they maintain and operate. One such manager says:

> The carbon-black factories draw on the gas day, night, and Sunday, and because they use it at atmospheric pressure they are able to take much larger quantities than a pipe line can take. The pipe-line companies are able to pay higher prices per thousand cubic feet than the carbon-black factories can pay; but because the use by the carbon-black factories is continuous and that by the pipe-line companies intermittent, landholders get more money per year during the few years that their fields last from the lampblack people than they do from the pipe-line companies. Generally speaking a single lampblack factory uses or destroys more gas in a year than would be taken by all the domestic consumers in a city of 250,000 inhabitants.

Some other industrial uses of gas, as for drilling and pumping or for crude heating operations such as the burning of brick, metallurgical heating, or the operation of glass works, have often consumed gas for which other markets were available. Where these other markets were in territory served through existing pipe lines it has generally been recognized that the municipal supply companies could afford to pay more for the gas than many of the industries. Hence in a considerable number of places such industries have been automatically eliminated from the competition and have either turned to other fuels, such as producer gas or powdered coal, or have moved to localities where there are still available supplies of natural gas for which markets offering higher prices do not yet exist. The removal of carbon-black and certain other industrial plants from West Virginia to the territory in Louisiana and Wyoming where the newly discovered sources of natural gas have promised cheap prices has been one of the most striking examples of this economic tendency. But high cost does not alone depend upon the distance from the source to the market; the existence or absence of pipe lines connecting the producing fields with cities also largely determines the immediate market value of gas.

Some years ago a very large percentage of the gas produced in West Virginia was used for crude heating operations or in the manufacture of carbon black or was wasted in the most careless fashion in outdoor flares that were allowed to burn continuously the year around. These wasteful practices are diminishing, partly because of the better appreciation of the value of the gas, and partly by compulsion through the operation of State laws and conservation regulations of various sorts. Whether or not the States where newly discovered supplies afford great opportunity for waste will pass through the same cycle of progress can not be forecast. The existence of State conservation commissions and the general recognition that natural gas in the field is worth many times as much as was paid for it 20 or 25 years ago in West Virginia make it seem unlikely that Louisiana, Wyoming, and other States of large production where new sources of gas have been discovered will allow any such gross waste as occurred in the earlier years of the industry.

The price charged for gas has also been a factor in determining the application to which it would be put. In some places higher rates are charged in winter than in summer, and in others the rates for large industrial use are higher than those for domestic use.

Where local or State rules do not preclude the industrial use of large quantities of gas during the winter the companies themselves often establish such regulations by contract with their industrial consumers, whom they decline to serve unless they will agree to curtail their use of gas in the winter, when the demand is greatest.

The diminishing supply of gas in old fields and the high cost of delivery that resulted in increasing the prices of gas put a certain almost automatic check upon the demand, for in some localities the price became so high that the use of natural gas rather than coal or oil was no longer justified, even in view of the greater advantage and convenience of gas for heating. Thus many former consumers of gas for heating used coal instead, and conditions were thereby improved, because the gas service, relieved of this demand, became more reliable and satisfactory for other purposes.

One of the specialized uses of natural gas for which a few data are available is in the production of electric power for public utilities. In Table 11 and figure 24 are given some of the important data regarding this use of natural gas. It is not, however, one of the principal uses and probably never will be. Where there is a demand for electric power there is generally an almost equally strong demand for natural gas, and except under very unusual circumstances those who desire to use the gas direct can afford to pay more for it than the equivalent fuel value of the gas as compared with other fuels for producing power.

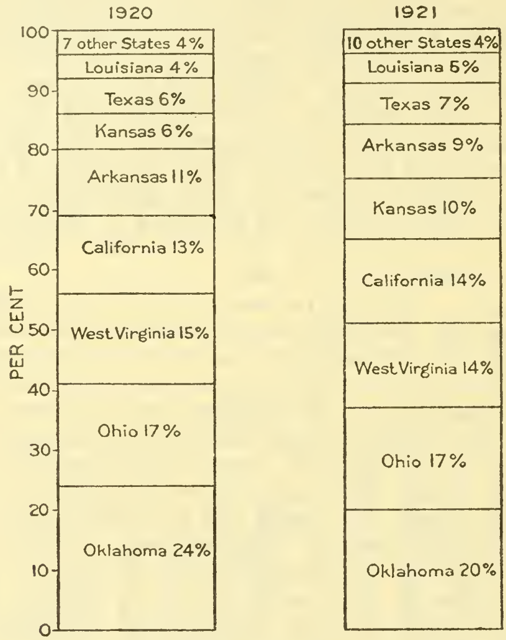


FIGURE 24.—Natural gas consumed in the production of electric power by public-utility plants, 1920 and 1921, by States.

TABLE 11.—*Natural gas consumed in the production of electric power by public utility plants, 1920 and 1921, by States in M cubic feet.*

State.	1920	1921	State.	1920	1921
Arkansas	2,699,000	1,954,000	Montana	14,000	14,000
California	2,971,000	3,167,000	New York	151,000	89,000
Florida	....	20	Ohio	3,922,000	3,879,000
Indiana	24,000	24,000	Oklahoma	5,609,000	4,503,000
Kansas	1,481,000	2,160,000	Pennsylvania	566,000	493,000
Kentucky	157,000	164,000	Texas	1,414,000	1,546,000
Louisiana	1,060,000	1,200,000	West Virginia	3,558,000	3,168,000
Maryland	10,000	7,080	Wyoming	57,000	354,000
Minnesota	....	2,000			
Missouri	....	10,900		23,693,000	22,735,000

PRICES.

The average price received for natural gas from both domestic and industrial users in the several States is given in Tables 7 and 8. From these data it is evident that the average price differs greatly in different States but is almost invariably much higher for domestic users than for industrial users. If the industrial user had to pay as much for gas as the domestic user he would not find it a desirable fuel for most purposes, as it would cost more per unit of fuel value than other fuels and therefore could be economically used only when the convenience of its application was much greater than that of some other fuel.

More complete data regarding the range of prices within the States for domestic and industrial users are given in Table 12. The trend of these prices for the years 1906–1921 is shown in figures 25

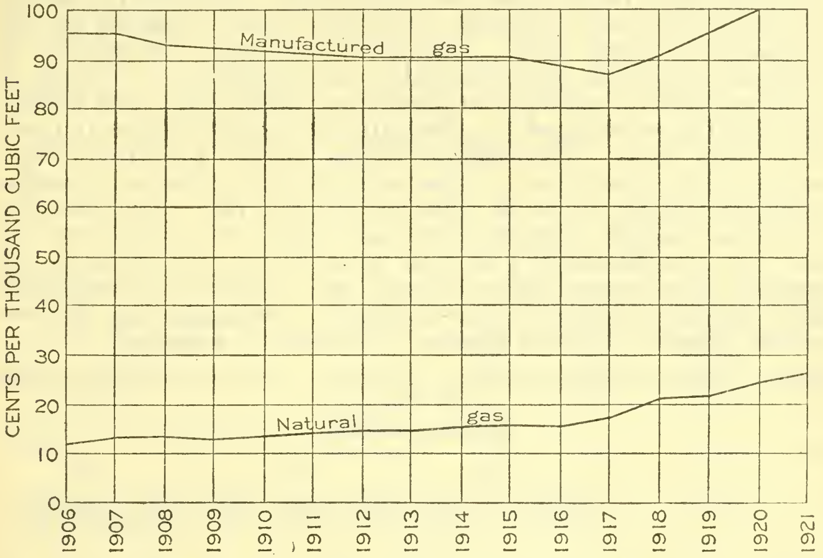


FIGURE 25.—Prices of natural gas and manufactured gas, 1906–1921.

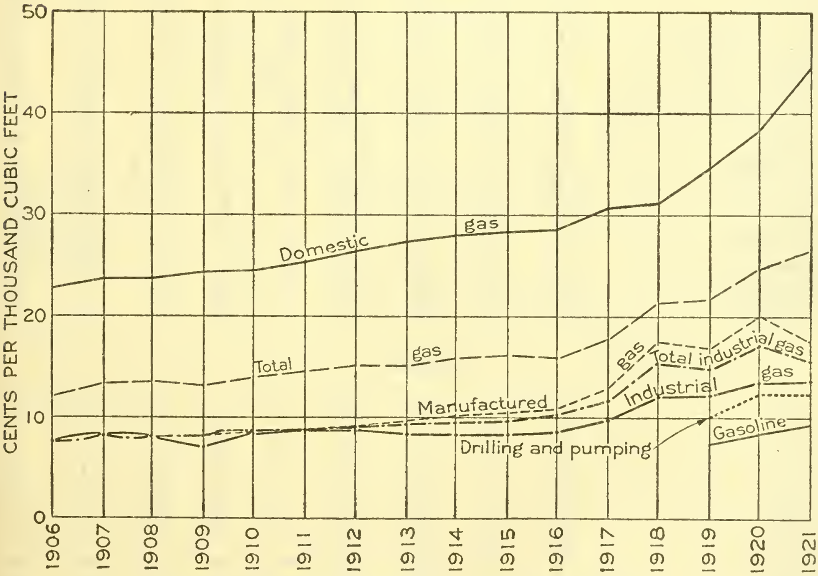


FIGURE 26.—Prices of natural gas for different uses, 1906–1921.

and 26. In figure 25 the prices of natural gas for all uses are contrasted with the corresponding prices of manufactured gas. Figure 26 shows the relation between the prices of natural gas for different applications.

The increase in the price of natural gas during recent years has been due in part to the increase in cost of production that has affected the price of all other commodities but in part also to the realization that natural gas was worth much more than its market price had previously indicated, which has made it possible for the producers to charge more. This advance in price has resulted in economies of various sorts, has led to the abandonment of some of the most wasteful practices in production, distribution, and utilization, and has encouraged the elimination of industrial users in favor of domestic users. Furthermore, it has enabled natural-gas companies to give much more in the way of service than was feasible when gas sold for 10 to 20 cents per M cubic feet. Thus practice in the distribution of natural gas has come to be much more like that for manufactured gas than ever before. As natural gas becomes more scarce this tendency will continue, because only when the gas companies give attention to utilization on the customers' premises can the greatest economies be expected.

TABLE 12.—*Prices of natural gas in the United States, 1919–1921, by States, in cents per M cubic feet.*

State.	1919			1920			1921		
	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.
Domestic consumption.									
Arkansas	75	8	29	55	15	38	86	10	40
California	125	3	54	115	5	61	126	10	78
Colorado	30	6	27	30	12	13	30	24	25
Illinois	50	8	45	80	8	46	60	10	49
Indiana	150	5	42	125	15	45	129	15	54
Iowa	25	25	25	38	35	38	44	35	43
Kansas	80	4	37	100	10	42	102	7	55
Kentucky	60	20	37	65	11	37	60	11	41
Louisiana	17	3	17	50	3	18	50	3	29
Maryland	41	30	40	67	30	57	69	30	68
Michigan	100	60	86	90	73	75	100	60	75
Missouri	80	25	72	80	29	73	80	29	78
Montana	50	15	38	90	33	48	93	35	59
New York	69	15	37	100	14	39	120	13	43
North Dakota	60	25	40	35	25	27	41	35	40
Ohio	85	8	34	110	15	38	126	10	42
Oklahoma	48	3	28	62	5	30	128	3	36
Oregon	50	50	50	50	50	50	50	50	50
Pennsylvania	80	6	34	80	10	37	83	6	44
South Dakota	86	25	78	85	40	71	82	46	49
Tennessee	60	6	30	50	50	50	50	43	44
Texas	75	3	40	94	4	44	68	6	56
West Virginia	40	15	23	60	17	25	68	2	28
Wyoming	70	25	29	75	25	34	70	5	34
Industrial.									
Arkansas	53	6	12	29	6	15	28	6	13
California	81	3	9	50	4	9	28	3	12
Colorado	16	15	16	15	8	10	....	....	....
Illinois	80	4	12	35	7	11	40	8	10
Indiana	65	7	32	60	10	38	67	3	45
Kansas	64	2	17	50	4	15	85	5	20
Kentucky	40	4	28	31	8	23	35	3	18
Louisiana	91	2	5	27	2	6	50	2	6
Maryland	31	33	31	60	54	57	55	54	55
Michigan	100	100	100	....	....	....	....	....	....
Missouri	80	13	43	55	25	29	62	58	61
Montana	2	2	2	18	2	2	19	2	4
New York	60	5	22	50	10	23	58	10	32
Ohio	80	5	28	59	10	33	80	8	34
Oklahoma	49	2	9	25	4	12	79	2	12
Pennsylvania	60	5	24	45	7	29	70	6	32
South Dakota	85	30	31	75	30	33	36	30	36
Tennessee	55	6	6	25	9	9	15	10	14
Texas	47	3	11	43	4	13	44	3	12
West Virginia	36	3	13	43	4	16	75	4	16
Wyoming	50	2	6	50	2	5	27	1	9

BY-PRODUCTS.

The two principal by-products of natural gas are natural-gas gasoline and carbon black. These products are discussed in detail in separate chapters of Mineral Resources, but a study of the important figures regarding their production and the gas used or treated in producing them is essential to a comprehensive understanding of the natural-gas industry itself. Such data are given in Tables 13 and 14.

TABLE 13.—*Salient figures of the natural-gas gasoline industry in the United States, 1911 and 1919–1921.*

	1911 [a]	1919	1920	1921
Natural-gas gasoline produced:				
Quantity....gallons..	7,400,000	351,500,000	384,700,000	449,900,000
Value....	$532,000	$64,197,000	$71,788,000	$61,815,000
Average value per gallon....cents..	7.2	18.3	18.7	13.7
Volume of natural gas treated at plant.M cubic feet..	2,476,000	480,404,000	496,431,000	479,618,000
Number of producers....	132	611	576	458
Number of plants operated....	176	1,191	1,154	[b] 1,056
Compression....	176	1,025	967	863
Absorption....	....	166	187	200
Average production per plant....gallons..	42,000	295,000	333,000	426,000
Average yield of gasoline per M cubic feet of gas treated....gallons..	3.00	0.73	0.78	0.94

[a] The first year for which statistics are available.
[b] Total number of plants does not equal sum of compression and absorption plants, as some combination plants use both processes.

TABLE 14.—*Carbon black produced from natural gas in the United States, 1921.*

State.	Number of producers.[a]	Number of plants.	Production.[b]				Average yield per M cubic feet (pounds).	Gas used (M cubic feet).[b]
			Average per plant (pounds).	Total (pounds).	Value.	Average value (cents).		
Louisiana....	9	13	2,385,000	31,000,000	$2,949,000	9.5	1.0	32,072,000
West Virginia....	19	21	1,194,000	25,100,000	2,204,000	8.8	1.6	15,476,000
Kentucky....	2	2	1,348,000	2,700,000	216,000	8.0	1.8	1,519,000
Oklahoma....	1	} 3	191,000	600,000	39,000	6.8	.9	629,000
Pennsylvania....	1							
Montana....	1							
Wyoming....	2	2	210,000	400,000	38,000	8.9	.5	869,000
	22	41	1,458,000	59,800,000	5,446,000	9.1	1.2	50,565,000
Total, 1920....	17	35	1,466,000	51,300,000	4,032,000	7.9	1.3	40,599,000
Total, 1919....	15	36	1,446,000	52,100,000	3,816,000	7.3	1.0	49,896,000

[a] Total for United States is not sum of producers shown by States, as one producer may operate in more than one State.
[b] Figures rounded. For more exact figures see chapter on carbon black.

Another product from the treatment of natural gas that has attracted a great deal of attention during the last few years is helium. This rare gas is the only noninflammable gas that is lighter than air. Such a gas is greatly needed to prevent recurrence of the disastrous accidents to balloons and similar craft. In 1921 the Geological Survey published a paper setting forth the chief sources of helium in the United States and discussing some of the broader scientific problems involved in its origin.[5]

[5] Rogers, G. S., Helium-bearing natural gas: U. S. Geol. Survey Prof. Paper 121, 1921.

Helium has been separated from natural gas only at three plants in Texas, all owned by the Government. Thus far only a few million cubic feet has been isolated. Work on this problem is in progress under the direction of the Helium Board, which consists of representatives of the Army, Navy, and Bureau of Mines. The following brief summary of this work by the chief chemist of the Bureau of Mines has recently been issued:

Early in 1915 word came to an official of the Bureau of Mines that the British were interested in sources of helium for use in dirigibles. When the United States entered the war in 1917, helium for use in the dirigibles was discussed among Bureau of Mines officials, and in June the matter was presented to the Army and Navy air services as a war project. These services enthusiastically approved the proposition, and allotments of money were made from the Army and Navy appropriations to carry it forward.

Three experimental plants were constructed in Texas, under the direction of the Bureau of Mines—two at Fort Worth, for economic reasons. One plant used the Linde system of liquefaction, the other the Claude system, and the supply of gas was piped to the plants from Petrolia, Tex. Analysis had showed that this gas contained 0.95 per cent of helium. Another plant was later constructed at Petrolia, near the gas wells, and use was made of a new method of liquefaction, called the Jefferies-Norton process. All three plants produced helium, but the Linde plant proved the most efficient, and it was decided to construct, under the cognizance of the Navy, a much enlarged plant for obtaining helium in greater quantities. The construction of this plant was started in October, 1918; it was completed in December, 1920, and was operated during part of 1921. It produced altogether about 2,000,000 cubic feet of helium, which, with the helium obtained at the smaller plants during the experimental period, makes available at the present time a total of about 2,400,000 cubic feet of helium over 90 per cent in purity. Most of the gas is around 95 per cent grade.

Before the completion of the large plant the two experimental plants at Fort Worth were shut down and dismantled. The plant at Petrolia, Tex., was continued, however, until July, 1921, on a purely experimental basis. It was then shut down and at the present time is being kept in a stand-by condition.

Although thus far little has been done in the commercial recovery or manufacture of other natural-gas products many such products have been suggested. Some of them can be made by the fractional separation of those constituents of the crude gas that are heavier than methane and ethane (the principal constituents of natural gas) or lighter than petane and hexane (the principal constituents of natural-gas gasoline). Some of these intermediate hydrocarbons and the products that may be made by the chemical treatment of them are of great industrial importance. The products of chlorination of natural gas are also chemical compounds of wide industrial use, such as methyl chloride, chloroform, carbon tetrachloride, ethyl chloride, and compounds like formaldehyde, formic acid, and other oxidation products derived from the chlorine compounds directly or indirectly. As yet most of these compounds are produced only on a minor scale in one or two establishments, but the interest that has been shown in some of these processes suggests a large industrial development of chemical products made from natural gas or its constituents.

RELATION OF NATURAL GAS TO MANUFACTURED GAS.

More communities in the United States are supplied with natural gas than with any variety of manufactured gas, and the distribution of the natural gas is subject to the same municipal and State regulations as that of the manufactured gas. In almost every State the operations of the gas companies are under the control of public-utility commissions that regulate their operations, including the price at which gas may be sold.

The practice of natural-gas companies has differed from the practice of manufactured-gas companies in one important respect, namely, the service rendered to the customer on the customer's premises. Most manufactured-gas companies install or at least inspect the underground pipe lines and meter on the customer's premises; and in many places such equipment is maintained at the company's expense. Moreover, manufactured-gas companies commonly give much attention to the form and installation of gas-burning appliances, thereby seeking to extend the use of their product more widely through favorable conditions of utilization. The price obtained for natural gas has commonly not permitted the company to render any such service to the customer; and in many places it does not even install or inspect the service line that leads from the main to the customer's meter. Until recently very few of the natural-gas companies gave any attention to conditions or methods of gas use beyond the meter.

During the last few years, however, there has been an increasing appreciation of the fact that the current practice did not encourage efficiency in the burning of the gas, and the companies have undertaken to obtain permission to charge such rates for their gas as would allow them to make additional expenditures on the customer's premises. With the recognition that the supplies of natural gas can not last indefinitely, there has come some encouragement from the users and much encouragement from public officials for any effective measures of conservation. The result of such measures will be increasingly evident, for in many districts the supplies of natural gas are already inadequate, even for those domestic uses that are given priority in supply when any distinction between classes of users is made. In practically all the States east of Mississippi River the question is no longer whether the industrial users can have the gas that they desire the year around but whether they can have any gas, even at times of minimum demand from domestic users.

With the waning of natural-gas supplies attention has been given to means of supplementing the natural gas available or for replacing it with some form of manufactured gas. In a number of communities a mixture of natural and manufactured gases has been supplied with considerable success. Undoubtedly the largest city in the United States so supplied is Los Angeles, where it has been necessary for some years to provide a mixture of natural gas and oil gas.

In 1921 at least seven companies in the United States were making a regular practice of mixing manufactured gas with natural gas. It is believed that several other companies follow this practice, but have not reported it to the Geological Survey, because the questionnaire that has been sent out did not specifically request such information. The reports received show that more than 25,000,000 M cubic feet of manufactured gas is mixed with natural gas each year. Besides the oil gas used for this purpose in Los Angeles, "blue" water gas, producer gas, and coke-oven gas have been employed in other districts.

Table 15 shows that the quantity of gas handled by these two companion industries is of the same order of magnitude, the production of natural gas being only slightly more than that of manufactured gas, but the sales of natural gas are considerably higher because large quantities of coke-oven gas are used by the producers and not sold. However, the value of the manufactured gas sold is 79 per cent more than that of the natural gas sold because of the much higher unit price charged for the manufactured product.

TABLE 15.—*Statistics of natural gas and manufactured gas in 1920.*

	Natural gas.	Manufactured gas, including coke-oven gas.
Gas produced .... M cubic feet..	860,540,000	766,200,000
Gas sold:[a]		
Quantity .... do....	614,000,000	492,900,000
Value	$173,800,000	$311,100,000
Average value per M cubic feet .... cents..	28.3	63.1
Gas wasted or unaccounted for .... M cubic feet..	62,000,000	37,000,000
Number of States producing gas	24	49
Value of by-products	$75,800,000	$394,900,000

[a] Does not include gas used for drilling and pumping.

RELATION OF NATURAL GAS TO OTHER MINERAL FUELS.

Because of its convenient form for heating, cooking, and lighting in household use natural gas has been the preferred form of natural mineral fuel. However, its higher price per unit of heat supply has prevented its use in competition with coal or oil except where its greater convenience has been sufficient to offset this difference. Moreover, the limited supplies of natural gas available and the great investment required for production and delivery to distant municipal centers have materially curtailed the operations of the industry. Nevertheless, natural gas has been one of the principal natural fuel supplies of the country as a whole.

Taken together coal, petroleum, natural gas, and water power must furnish practically all the energy used for domestic and industrial operations in the United States, whether by heating, lighting, or power-driven equipment. Coal is by far the most abundant and has consequently borne the greater share of this burden, followed in order by petroleum, natural gas, and water power. The relative magnitude of three of these natural sources of energy for the period 1906–1921 is shown in Table 16. The estimated average thermal values used in the comparisons between natural gas, coal, and petroleum are 1,000,000 British thermal units per M cubic feet for gas; 24,000,000 British thermal units per ton for coal; 6,000,000 British thermal units per barrel for petroleum.

TABLE 16.—*Energy resources of the United States in 1906–1921, as measured by three primary fuel supplies.*

Year.	Coal (bituminous and anthracite)			Petroleum.			Natural gas.		
	Quantity (millions of tons).	Value (millions of dollars).	Energy equivalent (billions of British thermal units).	Quantity (millions of barrels).	Value (millions of dollars).	Energy equivalent (billions of British thermal units).	Quantity (millions of M cubic feet).	Value (millions of dollars).	Energy equivalent (billions of British thermal units).
1906	414	513	9,900,000	126	92	760,000	389	47	389,000
1907	480	615	11,500,000	166	120	1,000,000	407	54	407,000
1908	416	532	10,000,000	179	129	1,070,000	402	55	402,000
1909	461	555	11,100,000	183	128	1,100,000	481	63	481,000
1910	502	630	12,000,000	210	128	1,260,000	509	71	509,000
1911	496	627	11,900,000	220	134	1,320,000	513	75	513,000
1912	534	696	12,800,000	223	164	1,340,000	562	85	562,000
1913	570	760	13,700,000	248	237	1,490,000	582	88	582,000
1914	514	681	12,300,000	266	214	1,600,000	592	94	592,000
1915	532	687	12,800,000	281	179	1,690,000	629	101	629,000
1916	590	867	14,200,000	301	331	1,810,000	753	120	753,000
1917	651	1,533	15,600,000	335	523	2,010,000	795	142	795,000
1918	678	1,828	16,300,000	356	704	2,140,000	721	154	721,000
1919	554	1,526	13,300,000	378	760	2,270,000	746	161	746,000
1920	658	2,564	15,800,000	443	1,361	2,660,000	798	196	798,000
1921	506	1,652	12,200,000	472	815	2,830,000	662	175	662,000

Figures 27, 28, and 29 show graphically some of the more important relations between the chief mineral sources of energy. Figure 27 gives the relation between the fuels and some of the products derived from them, which may be called secondary fuels or secondary sources of power, on the basis of the value of these commodities. Any comparison on a money basis, however, may be misleading. For example, manufactured gas often furnishes only 500,000 to 600,000 British thermal units per dollar of cost to the user, whereas from bituminous coal, at such prices as often prevail when neither war nor strikes interfere with commercial supplies, the user can get as much as 10,000,000 British thermal units per dollar of cost, or 16 to 20 times as much as from gas. Hence a comparison of these fuels on an energy basis is more significant. Such a comparison is given in figure 28.

In figure 29 these energy units are shown on a basis more convenient for ready interpretation by giving them in percentage of the total energy produced during each year. This diagram, even more strongly than the other two, shows how small a percentage of the entire energy requirement of the country is met by natural gas. Nevertheless, a large percentage of the people in some of the most thickly populated States depend upon natural gas for comfort and convenience, if not for health and safety, in domestic heating, cooking, and lighting.

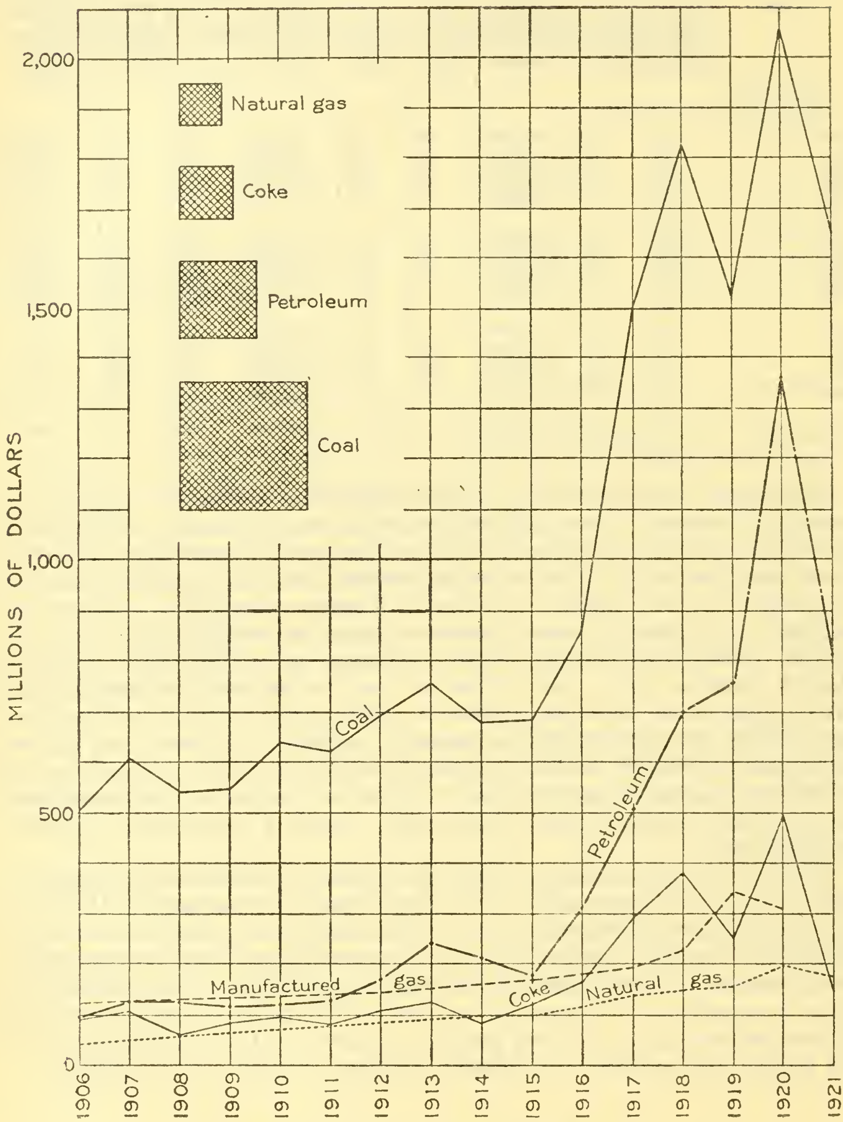


FIGURE 27.—Values of the mineral fuels, 1906–1921.

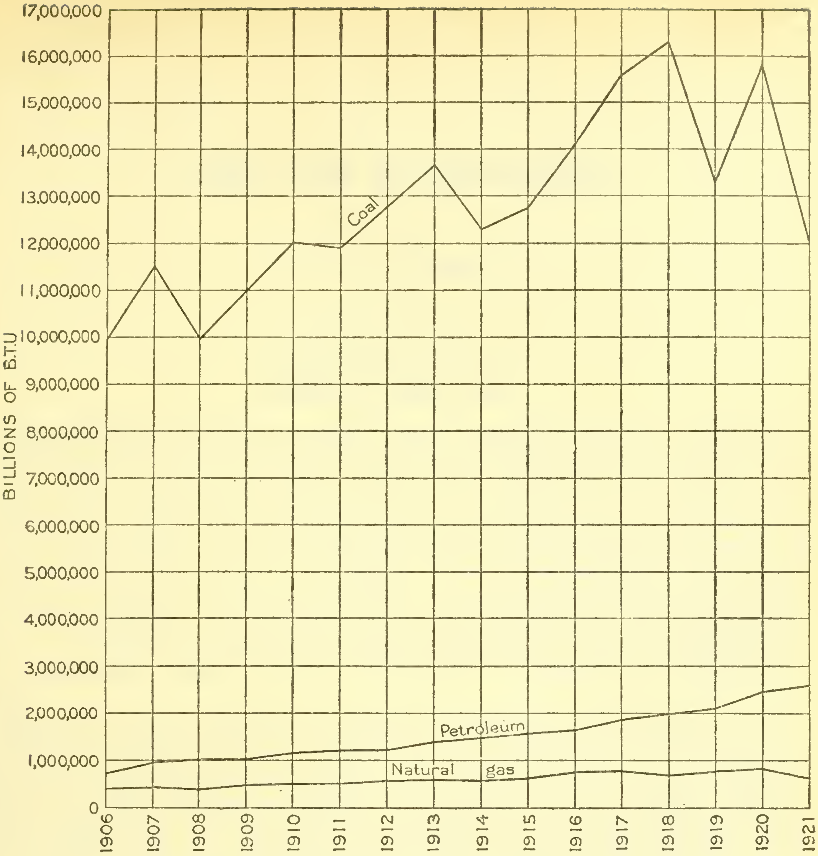


FIGURE 28.—Comparative fuel values of primary mineral fuels, 1906–1921.

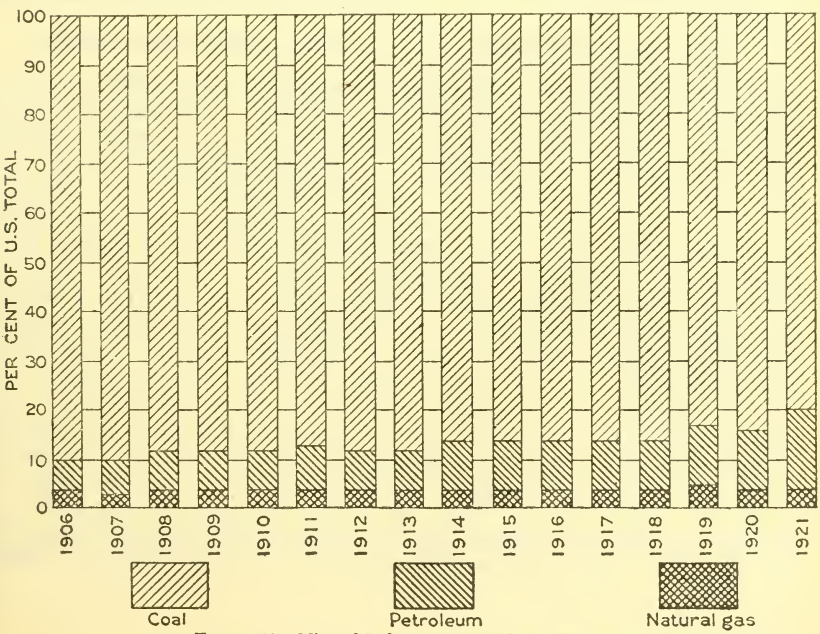


FIGURE 29.—Mineral fuels as sources of heat, 1906–1921.

COKE AND BY-PRODUCTS.

By R. S. McBride.[1]

INTRODUCTION.

SCOPE OF REPORT.

The statistics here given, which show the production, distribution, and utilization of coke and the by-products obtained from coke ovens in the United States in 1921, cover both beehive and by-product coke but not coke produced in gas plants. In gas plants the manufacture of gas is the primary end in view and the production of coke is only an incident, so that gas-house coke is somewhat different in quality from that produced in coke ovens, and the quantities obtained are much smaller. Coke produced by the distillation of petroleum is also not considered here, for its output is small, and it is not marketed in competition with beehive or by-product coke or as a substitute for it.

More attention is given to by-products and gas made in by-product coke ovens than in similar reports for previous years, for in 1921 by-product ovens were much more active than beehive ovens, largely because of the greater stability of business in by-product plants. Some engineering and technical problems are discussed briefly; and for the first time in a Survey report some data on the efficiency of by-product recovery are presented.

IMPORTANT FACTS OF THE COKE INDUSTRY IN 1921.

The year 1921 was one of great depression in the coke industry as in most other industries. The output of by-product coke was only about 20,000,000 tons and that of beehive coke was only about 5,500,000 tons; the corresponding figures for 1920 were 31,000,000 tons and 20,500,000 tons. The salient figures for both branches of the coke industry for 1921 are given in Table 1.

The output of beehive coke was less than in any other year since 1885 and was only 27 per cent of the output in 1920. The extreme depression in the industry during 1921 was reached in July, when the beehive ovens of the country produced on the average only 7,000 tons of coke a day. This is less than 7 per cent of the average daily rate of production during the four years 1915–1918 and therefore represents one of the most remarkable slumps in the history of any industry. During the last half of the year, however, there was a gradual recovery, so that in December the average daily rate of beehive coke production was 19,000 tons, or almost three times the mini-

[1] The statistics in this report have been prepared by Mrs. H. L. Bennit, except the data for imports and exports, which were compiled by James A. Dorsey from the records of the Bureau of Foreign and Domestic Commerce. All the work has been done under the general supervision of F. G. Tryon.

mum. Further recovery was expected for 1922 but was not realized until very late in that year.

Although the output of by-product coke in 1921 also showed a marked decline, being only 64 per cent of the output in 1920, the minimum average daily rate, in July, was 73 per cent of the average daily rate in the four years 1915–1918. In December the average daily rate was nearly one and one-half times the minimum. As 1920 was easily the banner year in the production of by-product coke in the United States, the record for 1921 was surprisingly good in view of the extraordinary slump in business in general. The production in 1921 was almost equal to that in 1917, was more than 75 per cent of that in 1918 and 1919, and was more than in any year preceding 1917.

TABLE 1.—*Salient figures of the coke industry in 1921.*

	Beehive.	By-product.	Total.
Coke produced....net tons..	5,538,042	19,749,580	25,287,622
Screenings and breeze produced....do....	58,267	1,831,110	1,889,377
Coal charged into ovens....do....	8,475,446	28,713,111	37,188,557
Average value of coal charged into ovens....net ton..	$2.52	$4.84	$4.31
Average yield of coke and breeze from coal....per cent..	66.0	75.2	73.1
Number of ovens:			
In existence Jan. 1, 1921....	75,298	10,881	86,179
In existence Dec. 31, 1921....	66,014	11,141	77,155
Completed and put in operation....	....	483	483
Dismantled during year....	8,138	140	8,278
In course of construction Dec. 31....	....	85	85
Daily coke capacity, ovens in existence Dec. 31....net tons..	149,550	120,149	269,699
Coke sold:			
Furnace....do....	3,957,709	2,593,318	6,551,027
Foundry....do....	1,011,343	736,391	1,747,734
Domestic and other....do....	56,874	1,679,911	1,736,785
Screenings and breeze....do....	12,910	205,867	218,777
Used by producer:			
Coke....do....	495,481	13,470,396	13,965,877
Screenings and breeze....do....	10,520	1,472,619	1,483,139
Estimated value of coke produced....	$30,166,449	$117,506,646	$147,673,095
Estimated value of screenings and breeze produced....	$162,593	$3,160,887	$3,323,480
Average price received per ton sold:			
Furnace coke....	$5.30	$6.63	$5.83
Foundry coke....	$5.87	$10.41	$7.78
Domestic and other coke....	$4.79	$8.22	$8.11
Screenings and breeze....	$3.06	$2.30	$2.35
By-products produced:			
Gas....M cubic feet..	....	310,188,713	310,188,713
Tar....gallons..	....	253,051,649	253,051,649
Ammonium sulphate or equivalent....pounds..	....	657,001,003	657,001,003
Crude light oil....gallons..	....	76,917,269	76,917,269
By-products sold:			
Gas (surplus)....	....	$25,963,252	$25,963,252
Tar....	....	$5,645,309	$5,645,309
Ammonium sulphate or equivalent....	....	$16,626,254	$16,626,254
Crude light oil and derivatives....	....	$11,574,715	$11,574,715

The business depression prevented any additions to plants other than a part of the new by-product ovens that were under construction at the end of 1920. At the end of 1921 only 85 ovens were under construction, some of which had been begun before the slump in the metallurgical industry became evident about the end of 1920.

Not only was there a decline in production, but the price realized for coke sold during 1921 was much below that realized during 1920, which was a year of abnormally great activity. The average price per ton for both beehive and by-product coke was about $3 less than in 1920. However, the prices in 1921 were not very different from those realized in 1918 and 1919.

The continued operation of by-product ovens during the period of depression resulted in accumulation of unusually large stocks of coke. At least 1,000,000 tons of surplus coke was on hand unsold at by-product plants December 31, 1921, much more than at any previous time in the history of the industry. At some plants the accumulation of stock was necessary because of the relation of the plants to city gas-supply systems. At others it appeared more economical to continue operation at a minimum safe rate, despite the fact that current business conditions did not provide a ready market for the product, rather than to shut down the plants altogether. Operators who followed this policy were rewarded in 1922, when the protracted coal strike created a demand for coke as a substitute for anthracite.

As the ratio of by-products to coke produced is more or less constant from year to year the natural result of reduced activity of by-product ovens was a reduced output of all by-products. The gross value of the by-products sold in 1921 was only $60,000,000, in contrast with nearly $94,000,000 in 1920.

RELATION OF COKE TO OTHER FUELS AND TO METALLURGY.

In normal years the coke industry consumes approximately 15 per cent of the bituminous coal produced in the United States. During 1921 this industry used 37,000,000 tons of coal, or about 9 per cent of the total, which was 416,000,000 tons.

Coke is used principally in the metallurgical industry, where it is employed for furnace fuel to the exclusion of almost any other fuel, and it is also used widely in foundry and other metallurgical operations. Manufacturers of water-gas are also largely dependent upon coke for generator fuel, for which it is practically interchangeable with anthracite, the choice hinging largely on the relative cost per unit quantity of gas made, though there are slight differences in convenience of operation and in capacity of gas-making equipment. Under ordinary circumstances about half the water gas made is produced from coke. With the increasing number and size of by-product oven plants it is likely that the use of coke will be extended more widely, particularly if the price of anthracite continues to increase.

The coke industry also supplies to the distributors of gas for many municipalities large quantities of coke-oven gas. In 1921 over 43,000,000 M cubic feet of coke-oven gas was distributed through city mains. Many large cities are entirely dependent upon such supplies, and in others a large percentage of the gas used is obtained from coke ovens. The other by-products of coke-oven operations are very similar to the by-products obtained in the manufacture of coal gas, but as a rule the output from the ovens is so much greater than that from the gas works that the gas-house by-products have little influence on market conditions.

The coke industry is essentially a producer of industrial raw materials. Just as pig iron is really a raw mineral material from which steel and foundry products are made, so coke is a raw material used in metallurgy and for making gas. The other products of the coke ovens—tar, ammonium sulphate, and crude light oil—enter the chemical and fertilizer industries as raw materials, just as the metals and nonmetallic minerals enter industries of many kinds. Hence any picture of the mineral industries of the country is not complete without a thorough presentation of the facts concerning coke and the important by-products of its manufacture.

RELATION OF BEEHIVE AND BY-PRODUCT BRANCHES OF THE INDUSTRY.

Until about 1905 less than 10 per cent of all the coke produced in the United States was made in by-product ovens. Since that time, however, the increase in by-product coke ovens has been very rapid and continuous until in 1921 the by-product ovens produced 78 per cent of the total. During the early years of by-product operation in this country there was always a question as to whether by-product coke was as satisfactory for metallurgical fuel as beehive coke. As a consequence the development of by-product ovens required a study of the use of this fuel in blast furnaces, but it has now been thoroughly demonstrated by long experience to be at least as good as beehive coke for practically all the applications to which either is put, and under some conditions it is even better.

The limitation upon substitution of by-product ovens for beehive ovens has been largely that of conservatism in making new investments. The investment in a by-product plant is so much greater than in a beehive plant of the same capacity that regular operation for a considerable period of time must be assured before a change from a beehive to a by-product plant is justified. Of course, the investor must also be assured of reasonably regular and favorable markets for gas, tar, ammonium sulphate, and other by-products, as well as a regular demand for the coke. The interrelation of the by-product coke industry with so many other industries demands a careful selection of location, plant facilities, and adequate provision for financing over long periods.

Despite the limitations above indicated, definite progress has been made annually for many years toward a more complete development of the by-product oven industry. This development was somewhat retarded during 1921, but not by any means arrested. The conditions at the end of the year seemed to discourage much further development, but early in 1922 it became evident that the coke industry as a whole could count upon increasing demands for coke as a substitute for anthracite.

DEFINITIONS.

In this report the term "coke" does not include breeze or the fine coke screenings, because operators in general, especially those in the beehive industry, do not regard this fine material as properly so classified. No effort has been made to define accurately the limitation as to size between coke and breeze. Each operator has followed his own regular practice in reporting his output of fine material to the Geological Survey. It is probably safe to say, however, that coke breeze and screenings correspond closely in size to the anthracite usually classified as steam sizes—in other words, they include the material smaller than pea coal.

Throughout this report the unit of measurement employed for both coke and coal is the "short" or net ton of 2,000 pounds. The unit of measurement of gas is the usual commercial unit of 1,000 cubic feet, known in the trade as "M."

PRODUCTION.

MAGNITUDE AND HISTORY OF THE INDUSTRY.

The history of the coke industry in the United States is a close parallel to that of the pig-iron industry, because producers of pig iron are the principal users of coke. This relationship is shown clearly by the curves in figure 30. The data on which the curves for coke production are based are given in detail in Table 2.

In 1921 the by-product ovens produced 78 per cent of the coke, thus showing an increase of 18 per cent over their proportion in the preceding year. The beehive ovens produced only about one-fifth of the country's coke supply, making their smallest output since 1885—a decrease of 18 per cent from their proportion in 1920.

TABLE 2.—*Statistics of the manufacture of coke in the United States, 1880–1921.*

Year.	Plants.	Ovens in existence.	Coal used (net tons).	Yield of coke from coal (per cent).	Coke produced (net tons).	Value of coke at ovens.[a]	
						Total.	Per ton.
1880	186	12,372	5,237,741	63.7	3,338,300	$6,631,267	$1.99
1890	253	37,158	18,005,209	63.9	11,508,021	23,215,302	2.02
1900	396	58,484	32,113,553	63.9	20,533,348	47,443,331	2.31
1910	578	104,440	63,088,327	66.1	41,708,810	99,742,701	2.39
1911	570	103,879	53,278,248	66.7	35,551,489	84,130,849	2.37
1912	559	102,230	65,577,862	67.1	43,983,599	111,805,113	2.54
1913	551	102,650	69,239,190	66.9	46,299,530	128,922,273	2.78
1914	536	99,755	51,623,750	66.9	34,555,914	88,334,217	2.56
1915	532	99,378	61,832,898	67.2	41,581,150	105,503,868	2.54
1916	499	98,864	81,609,460	66.8	54,533,585	170,841,197	3.13
1917	482	95,896	83,752,371	66.4	55,606,828	298,243,017	5.36
1918	466	93,914	85,028,018	66.4	56,478,372	382,324,368	6.77
1919	464	92,939	65,587,918	67.4	44,180,557	258,339,740	5.85
1920	416	86,179	76,190,832	67.4	51,345,043	494,246,254	9.62
1921	374	77,155	37,188,557	68.0	25,287,622	147,673,095	5.84

Year.	By-product coke.				Beehive coke.			
	Quantity.		Value.[a]		Quantity.		Value.[a]	
	Net tons.	Per cent.	Dollars.	Per cent.	Net tons.	Per cent.	Dollars.	Per cent.
1880					3,338,300	100.0	6,631,267	100.0
1885					5,106,696	100.0	7,629,118	100.0
1890					11,508,021	100.0	23,215,302	100.0
1893	12,850	0.1	(b)	(b)	9,464,730	99.9	(b)	(b)
1900	1,075,727	5.2	2,635,531	5.6	19,457,621	94.8	44,807,800	94.4
1905	3,462,348	10.7	10,351,730	15.0	28,768,781	89.3	61,624,466	85.0
1910	7,138,734	17.1	24,793,016	24.9	34,570,076	82.9	74,949,685	75.1
1911	7,847,845	22.1	27,297,897	32.4	27,703,644	77.9	56,832,952	67.6
1912	11,115,164	25.3	42,632,930	38.1	32,868,435	74.7	69,172,183	61.9
1913	12,714,700	27.5	48,637,852	37.7	33,584,830	72.5	80,284,421	62.3
1914	11,219,943	32.5	38,080,167	43.1	23,335,971	67.5	50,254,050	56.9
1915	14,072,895	33.8	48,558,325	46.0	27,508,255	66.2	56,945,543	54.0
1916	19,069,361	35.0	75,373,070	44.1	35,464,224	65.0	95,468,127	55.9
1917	22,439,280	40.4	138,643,153	46.5	33,167,548	59.6	159,599,864	53.5
1918	25,997,580	46.0	193,018,785	50.5	30,480,792	54.0	189,305,583	49.5
1919	25,137,621	56.9	160,244,768	62.0	19,042,936	43.1	98,094,972	38.0
1920	30,833,951	60.0	313,028,732	63.3	20,511,092	40.0	181,217,522	36.7
1921	19,749,580	78.1	117,506,646	79.6	5,538,042	21.9	30,166,449	20.4

[a] The figures of value are not strictly comparable because the value of that part of the product consumed by the producer in associated iron furnaces but not sold has been arrived at in different ways. Prior to 1918, and also in 1919 and 1921, the value of this coke is that reported by the producer. For 1918 and 1920 it has been estimated by the Geological Survey for each State at the average value for that State of the part of the product reported sold. Value of screenings and breeze not included.

[b] Figures not available.

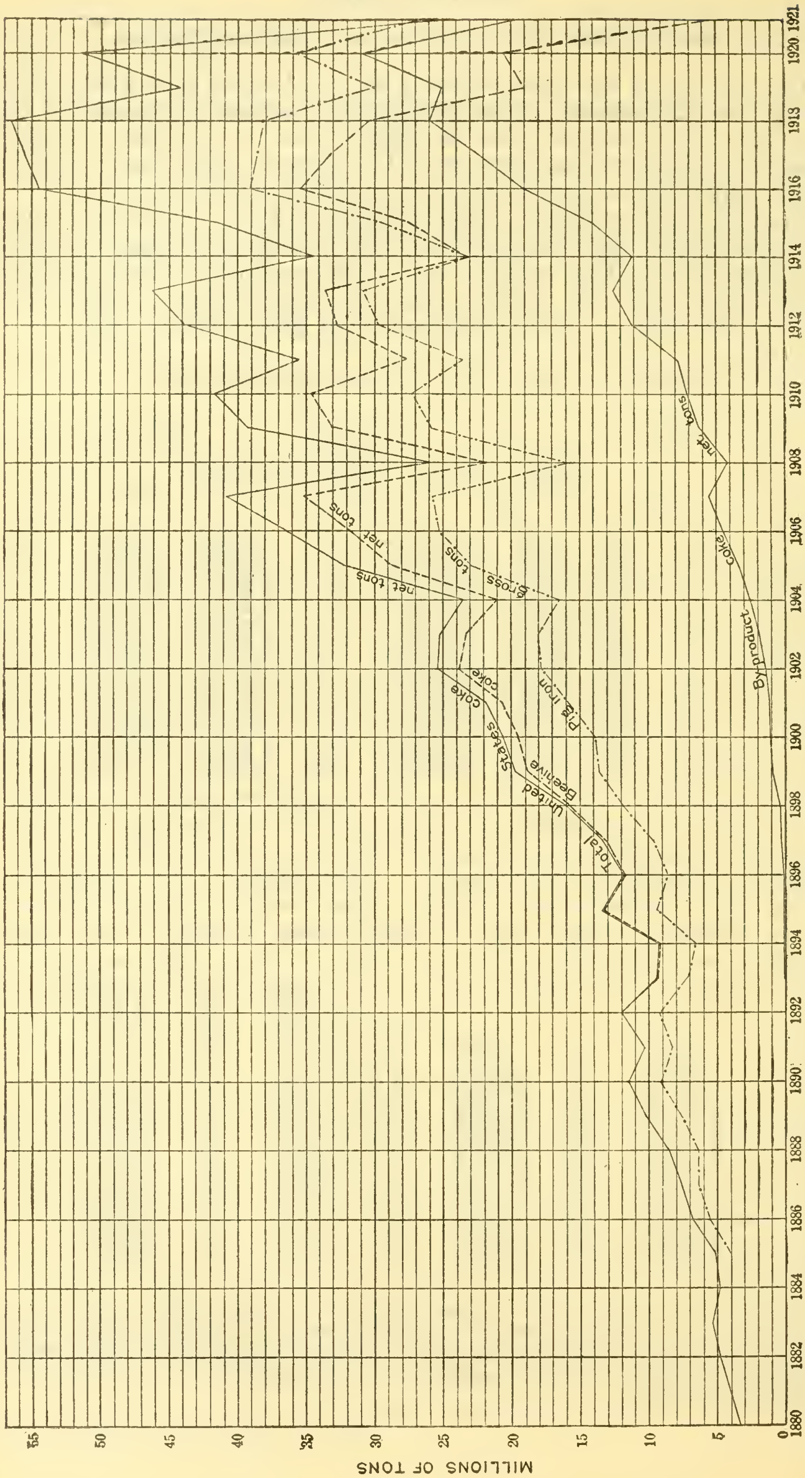


FIGURE 30.—Coke and pig iron produced in the United States, 1880-1921.

PRODUCTION BY WEEKS AND MONTHS.

Each week the principal railroads that transport beehive coke report to the Geological Survey data on beehive-coke car loadings. From these data is made up and published each week an estimate of the total production of beehive coke in the United States. At the end of the year the total of the weekly estimates does not exactly equal the actual total production as reported to the Geological Survey by the operators, and a slight adjustment is therefore made in the weekly figures. The data so revised are given in Table 3.

TABLE 3.—*Beehive coke produced in the United States in 1921, by weeks.*

[Estimated from railroad shipments.]

Week ended—	Net tons.	Week ended—	Net tons.
Jan. 1	46,000	July 16	44,000
8	270,000	23	41,000
15	266,000	30	45,000
22	257,000	Aug. 6	55,000
29	247,000	13	50,000
Feb. 5	234,000	20	57,000
12	227,000	27	57,000
19	219,000	Sept. 3	58,000
26	192,000	10	60,000
Mar. 5	177,000	17	64,000
12	162,000	24	70,000
19	118,000	Oct. 1	78,000
26	92,000	8	86,000
Apr. 2	81,000	15	93,000
9	78,000	22	101,000
16	74,000	29	102,000
23	73,000	Nov. 5	115,000
30	76,000	12	103,000
May 7	70,000	19	110,000
14	69,000	26	110,000
21	72,000	Dec. 3	113,000
28	68,000	10	112,000
June 4	61,000	17	125,000
11	58,000	24	116,000
18	52,000	31	103,000
25	50,000		
July 2	46,000		5,538,000
9	35,000		

Corresponding data for by-product coke are prepared monthly from reports made to the Geological Survey by oven operators. These data for the five years 1917–1921 are given in Table 4. Figures for the beehive coke produced in 1915-1921, by months, are given in Table 5. As by-product ovens are run continuously, the daily averages in Table 4 are based on the total number of days in each month. The averages for beehive ovens in Table 5 are based on the number of working days in the month.

TABLE 4.—*By-product coke produced in the United States, 1917–1921, by months, and average per day, in net tons.*[a]

Month.	1917		1918		1919		1920		1921	
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.
January	1,788,000	58,000	1,638,000	53,000	2,445,000	79,000	2,426,000	78,000	2,259,000	73,000
February	1,807,000	65,000	1,534,000	55,000	2,153,000	77,000	2,343,000	81,000	1,872,000	67,000
March	1,813,000	58,000	2,028,000	65,000	2,285,000	74,000	2,646,000	85,000	1,757,000	57,000
April	1,859,000	62,000	2,002,000	67,000	2,025,000	68,000	2,267,000	75,000	1,506,000	50,000
May	1,879,000	61,000	2,106,000	68,000	1,906,000	61,000	2,400,000	77,000	1,577,000	51.000
June	1,880,000	63,000	2,080,000	69,000	1,935,000	65,000	2,487,000	83,000	1,396,000	47,000
July	1,882,000	61,000	2,288,000	74,000	2,244,000	72,000	2,658,000	86,000	1,286,000	41,000
August	1,915,000	62,000	2,366,000	76,000	2,266,000	73,000	2,742,000	88,000	1,371,000	44,000
September	1,919,000	64,000	2,392,000	80,000	2,168,000	72,000	2,744,000	91,000	1,411,000	47,000
October	1,898,000	61,000	2 547,000	82,000	1,748,000	56,000	2,915,000	94,000	1,720,000	55,000
November	1,900,000	63,000	2,496,000	83,000	1,971,000	66,000	2,679,000	89,000	1,751,000	58,000
December	1,899,000	61,000	2,521,000	81,000	1,992,000	64,000	2,527,000	82,000	1,844,000	59,000
	22,439,000	61,000	25,998 000	71,000	25,138,000	69,000	30,834,000	84,000	19,750,000	54,000

[a] Exclusive of screenings and breeze.

TABLE 5.—*Beehive coke produced in the United States, 1915–1921, by months, and average per working day, in net tons.*[a]

Month.	1915		1916		1917		1918	
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.
January	1,446,000	55,000	2,919,000	112,000	2,923,000	108,000	2,256,000	87,000
February	1,583,000	66,000	2,887,000	115,000	2,490,000	104,000	2,225,000	93,000
March	1,865,000	69,000	3,263,000	121,000	3,139,000	116,000	2,652,000	102,000
April	1,841,000	71,000	2,875,000	115,000	2,814,000	113,000	2,591,000	100,000
May	1,936,000	74,000	3,044,000	113,000	2,861,000	106,000	2,743,000	102,000
June	2,210,000	85,000	2,918,000	112,000	2,755,000	106,000	2,713,000	109,000
July	2,345,000	90,000	2,721,000	109,000	2,754,000	110,000	2,835,000	109,000
August	2,553,000	98,000	2,999,000	111,000	2,650,000	98,000	2,650,000	98,000
September	2,582,000	99,000	3,016,000	116,000	2,727,000	109,000	2,591,000	104,000
October	3,029,000	116,000	3,079,000	118,000	2,780,000	103,000	2,621,000	97,000
November	3,025,000	116,000	2,934,000	113,000	2,677,000	103,000	2,348,000	90,000
December	3,093,000	119,000	2,809,000	108,000	2,598,000	104,000	2,256,000	87,000
	27,508,000	88,000	35,464,000	114,000	33,168,000	107,000	30,481,000	98,000

Month.	1919		1920		1921	
	Total	Daily average.	Total.	Daily average.	Total.	Daily average.
January	2,366,000	88,000	1,946,000	72,000	1,088,000	44,000
February	1,767,000	74,000	1,705,000	71,000	870,000	36,000
March	1,714,000	66,000	1,976,000	73,000	578,000	21,000
April	1,277,000	49,000	1,579,000	61,000	330,000	13,000
May	1,101,000	41,000	1,671,000	64,000	302,000	12,000
June	1,143,000	46,000	1,683,000	65,000	233,000	9,000
July	1,457,000	56,000	1,666,000	64,000	181,000	7,000
August	1,681,000	65,000	1,749,000	67,000	250,000	9,000
September	1,736,000	67,000	1,731,000	67,000	291,000	11,000
October	1,504,000	56,000	1,716,000	66,000	418,000	16,000
November	1,629,000	65,000	1,605,000	62,000	480,000	18,000
December	1,668,000	64,000	1,484,000	57,000	517,000	19,000
	19,043,000	61,000	20,511,000	66,000	5,538,000	18.000

[a] Based on railroad shipments and prorated to the total production reported by operators.

Figure 31 shows these monthly production figures graphically. This chart and the tables on which it is based bring out clearly the details of the fluctuation in coke production during the last few years. Unfortunately, the detailed monthly figures for by-product coke in 1915 and 1916 are not available, but the fluctuations in by-product oven activity during those years were not anything like as great as they have been recently, and hence the average figure shown for monthly production of by-product coke is sufficiently significant.

In general industrial activity, particularly the demand for coke for blast-furnace operation, has been the dominating factor in the production of coke, but at a few points in the curve decrease in production is shown because of inadequacy of coal supply—for example, there was a marked decrease in daily average production of both beehive and by-product coke during January and February, 1918,

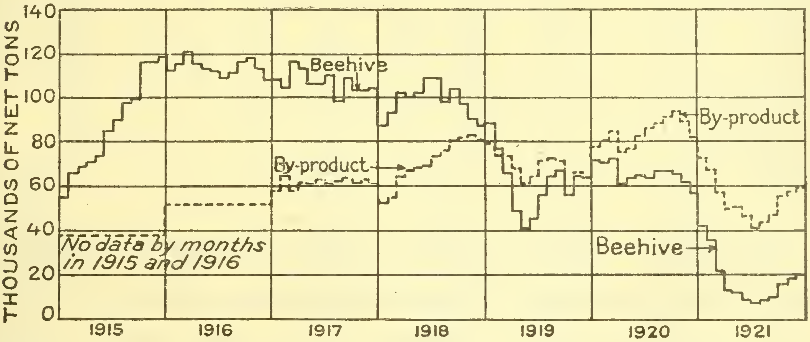


FIGURE 31.—Beehive coke produced in the United States, 1915–1921, and by-product coke produced, 1917–1921, by months.

when transportation conditions were so bad as to prevent the maintenance of adequate stocks of coal at the coke plants. The decrease in daily average production since the peak of 1920, particularly the great decrease in beehive coke, has been largely an indication of the decline in market demand. These data show that for both by-product and beehive ovens the low point of industrial depression was reached in July, 1921. The increase in average daily production indicated during the later half of 1921 in both branches of the business continued into 1922, but was even more marked in beehive coke than in by-product coke.

RANK OF STATES.

Because the industrial depression was so uniform throughout the country there was no marked change in the relative rank of the States in the production of coke in 1921 as compared with 1920. Pennsylvania, Ohio, Indiana, and Alabama retained their places as the leading producing States, with Pennsylvania still very far in the lead, producing more than the other three States combined—in fact, more than one-third of the entire coke output of the United States.

TABLE 6.—*Rank of the States in the production of coke, 1912, 1915, 1918, 1920, and 1921.*

State.	1912	1915		1918		1920		1921	
	All coke.	All coke.	By-product coke.	All coke.	By-product coke.	All coke.	By-product coke.	All coke.	By-product coke.
Pennsylvania	1	1	1	1	2	1	1	1	1
Indiana	3	3	2	4	3	3	3	2	2
Ohio	13	7	7	2	1	2	2	3	3
Alabama	2	2	3	3	4	4	4	4	4
Illinois	5	4	4	6	5	5	5	5	5
Michigan	11	6	5	9	7	7	6	6	6
New York	8	8	6	8	6	8	7	7	7
New Jersey	17	17	11	14	10	12	8	8	8
Minnesota	19	21	15	13	9	15	11	9	9
West Virginia	4	5	13	5	11	6	15	10	15
Colorado	6	9	....	11	16	10	12	11	13
Wisconsin	9	11	8	10	8	13	9	12	10
Massachusetts	10	13	9	16	12	16	13	13	11
Maryland	16	16	10	17	14	14	10	14	12
Kentucky	18	12	12	12	13	11	14	15	16
Virginia	7	10	....	7	....	9	....	16	....
Missouri	....	20	14	20	15	19	16	17	14
Utah	15	15	....	19	....	20	....	18	....
Rhode Island	....	....	....	....	....	21	18	19	17
Tennessee	14	18	17	18	17	17	17	20	18
Washington	20	19	16	21	18	22	19	21	19
New Mexico	12	14	....	15	....	18	....	22	....
Georgia	21	22	....	23	....	23	....	23	....
Oklahoma	....	....	....	22	....	....	....	....	....
Kansas	22	....	....	....	....	....	....	....	....

The production of coke by States in 1921, with comparable statistics for 1915, 1918, and 1920, is given in Table 7. Table 8 shows the production of by-product coke and beehive coke separately.

TABLE 7.—*Coke produced in the United States, 1915, 1918, 1920, and 1921, in net tons.*

State.	1915	1918	1920	1921	Increase or decrease, 1921.			
					Quantity.	Percentage.		
						Total.	Beehive.	By-product.
Alabama	3,071,811	4,352,172	4,013,891	2,534,039	−1,479,852	−37	−85	−23
Colorado	670,938	989,447	789,499	368,131	−421,368	−53	−70	−44
Georgia	20,039	22,048	16,523	6,943	−9,580	−58	−58	......
Illinois	1,686,998	2,285,610	2,136,793	1,322,178	−814,615	−38	......	−38
Indiana	2,768,099	3,898,215	4,553,697	3,091,263	−1,462,434	−32	......	−32
Kentucky	526,097	818,785	739,577	284,825	−454,752	−61	−64	−60
Maryland	313,283	474,368	682,132	292,439	−389,693	−57	......	−57
Massachusetts	504,438	556,397	488,089	294,059	−194,030	−40	......	−40
Michigan	(a)	(a)	1,393,445	777,125	−616,320	−44	......	−44
Minnesota	127,847	784,065	674,801	435,866	−238,935	−35	......	−35
Missouri	(a)	(a)	(a)	(a)	(a)	(a)	......	(a)
New Jersey	269,448	682,148	725,571	739,768	+14,197	+2	......	+2
New Mexico	389,411	597,072	(a)	(a)	(a)	(a)	(a)	......
New York	684,461	1,069,587	1,040,192	746,916	−293,276	−28	......	−28
Ohio	684,658	5,365,243	5,701,810	3,028,423	−2,673,387	−47	−29	−47
Oklahoma	....	(a)	....	....	....	......	......	......
Pennsylvania	25,622,862	26,723,645	23,638,739	9,769,476	−13,869,263	−59	−72	−31
Rhode Island	....	....	(a)	(a)	(a)	(a)	......	(a)
Tennessee	256,973	427,106	301,708	85,728	−215,980	−72	−83	−59
Utah	(a)	(a)	(a)	(a)	(a)	(a)	(a)	......
Virginia	629,807	1,234,256	1,027,788	280,476	−747,312	−73	−73	......
Washington	136,552	123,788	59,395	27,260	−32,135	−54	−89	−10
West Virginia	1,391,446	3,320,006	1,828,336	397,892	−1,430,444	−78	−85	−58
Wisconsin	(a)	(a)	(a)	(a)	(a)	(a)	......	(a)
Combined States	1,825,982	2,754,414	1,533,057	804,815	−728,242	−48	−64	−41
	41,581,150	56,478,372	51,345,043	25,287,622	−26,057,421	−51	−73	−36

a Included under "Combined States."

TABLE 8.—*By-product and beehive coke produced in the United States, 1912, 1915, 1918, 1920, and 1921, in net tons.*

State.	1912	1915	1918	1920	1921
By-product.					
Alabama	1,349,797	2,070,334	2,634,451	3,123,890	2,401,127
Colorado	....	....	230,663	516,673	286,755
Illinois	1,764,944	1,686,998	2,285,610	2,136,793	1,322,178
Indiana	2,616,339	2,768,099	3,898,215	4,553,697	3,091,263
Kentucky	....	241,581	517,749	466,985	185,383
Maryland	304,715	313,283	474,368	682,132	292,439
Massachusetts	511,596	504,438	556,397	488,089	294,059
Michigan	(a)	(a)	(a)	1,393,445	777,125
Minnesota	(a)	127,847	784,065	674,801	435,866
Missouri	....	(a)	(a)	(a)	(a)
New Jersey	304,715	269,448	682,148	725,571	739,768
New York	794,618	684,461	1,069,587	1,040,192	746,916
Ohio	241,725	665,557	5,226,334	5,614,877	2,966,273
Pennsylvania	1,974,619	3,092,295	4,586,981	7,730,256	5,303,371
Rhode Island	....	....	....	(a)	(a)
Tennessee	....	23,268	124,469	139,121	57,723
Washington	....	(a)	30,129	26,284	23,765
West Virginia	188,373	141,211	603,393	447,392	188,355
Wisconsin	578,875	(a)	(a)	(a)	(a)
Combined States	484,848	1,484,075	2,293,021	1,073,753	637,214
	11,115,164	14,072,895	25,997,580	30,833,951	19,749,580
Beehive.					
Alabama	1,625,692	1,001,477	1,717,721	890,001	132,912
Colorado	972,941	670,938	758,784	272,826	81,376
Georgia	43,158	20,039	22,048	16,523	6,943
Kansas	(a)	....	....	....	....
Kentucky	191,555	284,516	301,036	272,592	99,442
New Mexico	413,906	389,411	597,072	(a)	(a)
Ohio	146,944	19,101	138,909	86,933	62,150
Oklahoma	....	....	(a)	....	....
Pennsylvania	25,464,074	22,530,567	22,136,664	15,908,483	4,466,105
Tennessee	370,076	233,705	302,637	162,587	28,005
Utah	(a)	(a)	(a)	(a)	(a)
Virginia	967,947	629,807	1,234,256	1,027,788	280,476
Washington	(a)	(a)	93,659	33,111	3,495
West Virginia	2,277,613	1,250,235	2,716,613	1,380,944	209,537
Combined States	394,529	478,459	461,393	459,304	167,601
	32,868,435	27,508,255	30,480,792	20,511,092	5,538,042

a Included under "Combined States."

To bring out more clearly the history of production in the leading coke-producing States, data for the period 1880–1921 are shown graphically in figure 32, which indicates clearly, for example, the rapid increase in production in Ohio as compared with Pennsylvania, whose output was relatively constant for many years preceding 1921.

The decrease in coke production was smaller in those States where the ovens are not used primarily as parts of metallurgical plants. Thus, in Massachusetts, Minnesota, New York, and a few other States the percentage of decrease was much smaller than in others, because in these States the output of coke was dependent quite as much upon the demand for gas as upon the immediate requirements of coke for blast furnaces and foundries. The most conspicuous State

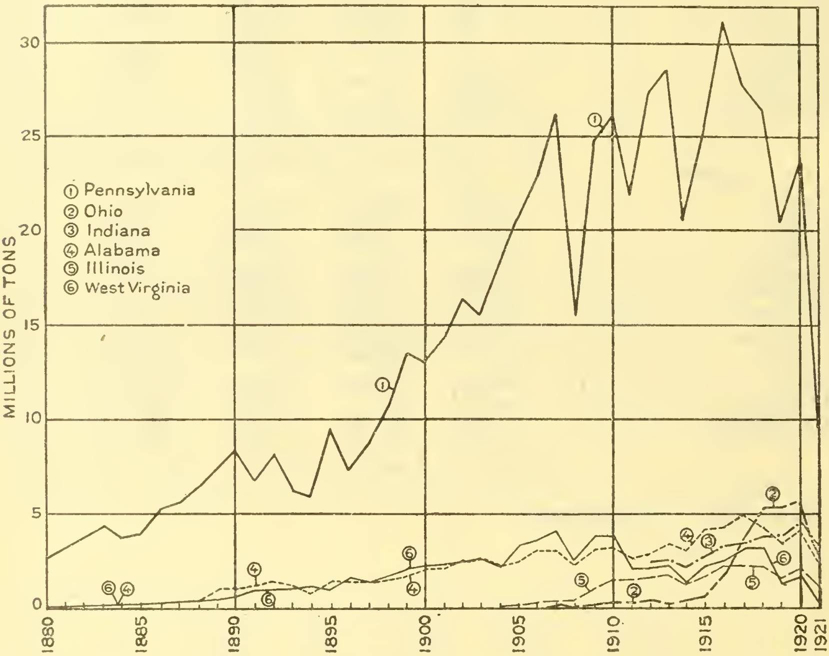


FIGURE 32.—Coke produced in six leading States, 1880–1921.

in this respect is New Jersey, the only one in which the output of coke increased in 1921. This increase was due principally to the fact that the ovens in New Jersey operated regularly even when there was little market demand for the coke, because the gas produced from the coking of coal was essential to the supply of large city-gas systems.

Pennsylvania, West Virginia, and Ohio include industrially distinct coke-producing districts, for which the data are presented separately in Tables 9, 10, and 11. From Table 9 the leading position of the Connellsville and Lower Connellsville districts of Pennsylvania is made clear. Data for those districts are presented separately in Table 12.

TABLE 9.—*Beehive and by-product coke produced in Pennsylvania in 1920 and 1921, by districts.*

District.	Plants.	Ovens.		Coal used (net tons).	Yield of coke from coal (per cent).	Coke produced (net tons).	Value of coke at ovens.	
		Built.	Under construction.				Total.[a]	Per ton.[b]
1920.								
Beehive:								
Allegheny Mountain and Allegheny Valley	7	711	....	297,426	63.2	187,984	(c)	$10.24
Connellsville	81	19,245	....	10,743,658	66.4	7,134,781	(c)	8.87
Lower Connellsville	64	15,146	....	7,592,680	66.0	5,008,158	(c)	7.96
Pittsburgh	10	3,314	....	2,648,064	59.8	1,583,029	(c)	11.26
Upper Connellsville	12	1,709	....	941,001	65.2	613,767	(c)	8.22
Other districts[d]	15	4,444	302	2,121,328	65.1	1,380,764	(c)	8.55
	[e]189	44,569	302	24,344,157	65.3	15,908,483	$139,822,353	8.79
By-product:								
Pittsburgh[f]	7	2,052	148	8,239,850	56.2	5,508,802	(c)	(c)
Other districts[g]	6	954	....	3,085,655	71.2	2,221,454	(c)	(c)
	13	3,006	148	11,325,505	68.3	7,730,256	77,843,678	10.07
Grand total	[e]202	47,575	450	35,669,662	66.3	23,638,739	217,666,031	9.21
1921.								
Beehive:								
Allegheny Mountain and Allegheny Valley	7	661	....	121,943	59.7	72,809	644,884	8.86
Connellsville	70	16,719	....	3,309,159	67.1	2,219,547	11,425,864	5.15
Lower Connellsville	59	13,426	....	2,451,640	67.1	1,645,373	7,163,360	4.35
Pittsburgh	9	3,213	....	110,155	58.0	63,907	337,077	5.27
Upper Connellsville	11	1,549	....	170,319	60.0	102,263	617,934	6.04
Other districts[d]	13	4,238	....	559,275	64.8	362,206	2,182,169	6.02
	169	39,806	....	6,722,491	66.4	4,466,105	22,371,288	5.01
By-product:								
Pittsburgh[f]	7	2,200	....	6,156,833	66.4	4,088,023	13,359,931	3.27
Other districts[g]	6	954	....	1,708,562	71.1	1,215,348	8,380,612	6.90
	13	3,154	....	7,865,395	67.4	5,303,371	21,740,543	4.10
Grand total	182	42,960	....	14,587,886	67.0	9,769,476	44,111,831	4.52

[a] 1921, includes operators' statement of value of that part of product consumed in associated iron furnaces but not sold.
[b] 1920, average value of coke sold.
[c] Data not available.
[d] Includes Bedford, Cameron, Clearfield, Elk, Huntingdon, Jefferson, and parts of Allegheny, Indiana, and Westmoreland counties.
[e] Revised figures.
[f] Includes plants at Glassport, Franklin, Rosedale, Clairton, Farrell, Pittsburgh, and Midland.
[g] Includes plants at Bethlehem, Lebanon, Steelton, Chester, Dunbar, and Swedeland.

TABLE 1 .—*Beehive and by-product coke produced in West Virginia in 1920 and 1921, by districts.*

District.	Plants.	Ovens.		Coal used (net tons).	Yield of coke from coal (per cent).	Coke produced (net tons).	Value of coke at ovens.	
		Built.	Under construction.				Total.[a]	Per ton.[b]
1920.								
Beehive:								
Flat Top	23	3,941	....	922,095	59.5	549,258	([c])	$7.06
Tug River	1	2,137	....					
Kanawha	4	583	....	307,372	62.1	190,997	([c])	8.88
New River	13	1,261	....	350,297	58.4	204,399	([c])	10.97
Upper Monongahela and Panhandle	24	2,228	....	524,099	60.5	316,833	([c])	10.08
Upper Potomac and Tygarts Valley	8	766	....	179,874	66.4	119,457	([c])	8.70
	73	10,916	....	2,283,737	60.4	1,380,944	$12,266,370	8.88
By-product:								
Fairmont, Benwood, and Follansbee	3	[d] 274	....	626,196	71.4	447,392	4,608,138	10.30
Grand total	76	11,190	....	2,909,933	62.8	1,828,336	16,874,508	9.23
1921.								
Beehive:								
Flat Top	14	2,316	....	97,588	62.5	61,019	377,184	6.18
Tug River	1	2,137	....	54,548	60.0	32,742	188,686	5.76
Kanawha	4	583	....	27,379	60.9	16,664	93,758	5.63
New River	13	1,261	....	103,151	61.4	63,341	516,939	8.16
Upper Monongahela and Panhandle	20	1,739	....	52,442	58.8	30,829	196,761	6.38
Upper Potomac and Tygarts Valley	6	607	....	8,118	60.9	4,942	33,838	6.85
	58	8,643	....	343,226	61.0	209,537	1,407,166	6.72
By-product:								
Fairmont, Benwood, and Follansbee	3	[d] 274	....	277,345	67.9	188,355	845,878	4.49
Grand total	61	8,917	....	620,571	64.1	397,892	2,253,044	5.66

[a] 1921, includes operators' statement of value of that part of product consumed in associated iron furnaces but not sold.
[b] 1920, average value of coke sold.
[c] Data not available.
[d] Includes 154 Koppers and 120 Semet-Solvay ovens.

TABLE 11.—*Beehive and by-product coke produced in Ohio in 1920 and 1921, by districts.*

District.	Plants.	Ovens.		Coal used (net tons).	Yield of coke from coal (per cent).	Coke produced (net tons).	Value of coke at ovens.	
		Built.	Under construction.				Total.[a]	Per ton.[b]
1920.								
Beehive	3	222	....	139,144	62.5	86,933	$686,771	$7.90
By-product:								
Canton and Cleveland	4	531	....	2,669,412	69.2	1,847,933	(c)	(c)
Youngstown	3	533	....	2,649,793	68.8	1,823,452	(c)	(c)
Other districts	5	494	....	2,832,782	68.6	1,943,492	(c)	(c)
	12	1,558	....	8,151,987	68.9	5,614,877	52,555,249	9.36
Grand total	15	1,780	....	8,291,131	68.8	5,701,810	53,242,020	9.34
1921.								
Beehive	2	205	....	99,787	62.3	62,150	434,950	7.00
By-product:								
Canton and Cleveland	4	531	....	1,337,064	69.1	925,218	4,929,087	5.33
Youngstown	3	533	....	1,592,766	65.6	1,044,825	5,487,035	5.25
Other districts	5	494	....	1,446,162	68.9	996,230	5,421,381	5.44
	12	1,558	....	4,375,992	67.8	2,966,273	15,837,503	5.34
Grand total	14	1,763	....	4,475,779	67.7	3,028,423	16,272,453	5.37

[a] 1921, includes operators' statement of value of that part of product consumed in associated iron furnaces but not sold.
[b] 1920, average value of coke sold.
[c] Data not available.

TABLE 12.—*Coke shipped from the Connellsville and Lower Connellsville districts, Pa., 1915, 1918, 1920, and 1921, in net tons.*[a]

Month.	1915	1918	1920	1921
January	940,781	1,021,055	1,082,289	735,897
February	1,045,739	991,871	967,122	552,568
March	1,258,559	1,436,821	1,110,550	361,646
April	1,268,292	1,459,248	799,578	198,966
May	1,310,639	1,532,634	749,537	186,256
June	1,486,845	1,438,700	796,698	130,324
July	1,618,199	1,578,130	778,345	92,880
August	1,657,203	1,492,065	909,270	158,250
September	1,683,414	1,423,236	879,297	188,664
October	1,851,938	1,410,403	921,753	257,499
November	1,873,405	1,136,355	889,173	303,532
December	1,926,202	1,160,072	854,615	405,935
	17,921,216	16,080,590	10,738,227	3,572,417

[a] Statistics from the Weekly Courier, Connellsville, Pa.

COKE OVENS.

At the end of 1921 there were in existence in the United States 11,141 by-product coke ovens, a few more than at any previous time during the history of the industry, and 85 by-product ovens were under construction. Because of the abandonment of many beehive ovens during 1921 the number remaining at the end of the year was the smallest since 1901, and apparently none were under construction. There were no new beehive ovens installed or put into operation during 1921 so far as reports to the Geological Survey show. The curves in figures 33 and 34 show graphically the history of the two branches of the industry. The continued upward trend in installation of by-product ovens and the continued downward trend in number of beehive ovens is evident from these charts.

At the end of 1921 there were 19 States in which by-product ovens were installed or operating but only 13 States in which beehive ovens were still installed. There were no new States added and none of the old States dropped from either list in 1921. Tables 13 and 14 show by States the number of coke ovens at the end of the year for 1915, 1918, 1920, and 1921. These data indicate which of the States are contributing most to the increase in by-product ovens and to the decrease in beehive ovens.

FIGURE 33.—By-product coke ovens completed and under construction in the United States at the end of each year, 1893-1921.

Table 15 shows the number of establishments in each State and gives more details regarding the changes in number of ovens, also the total capacity by States for each type of oven.

It is not feasible to strike a balance to show the number of ovens at the end of any year by adding to the number in existence at the end of the previous year the number under construction at the end of the previous year and subtracting the number of ovens abandoned during the current year, for the reason that, particularly in the beehive industry, it is possible to construct and put into operation a battery of ovens inside of the period under discussion; also it is possible to reconstruct and put into operation an old oven reported as abandoned in some previous year. Some operators occasionally neglect to report as in existence "end ovens" used solely for the purpose of keeping the inside ovens warm.

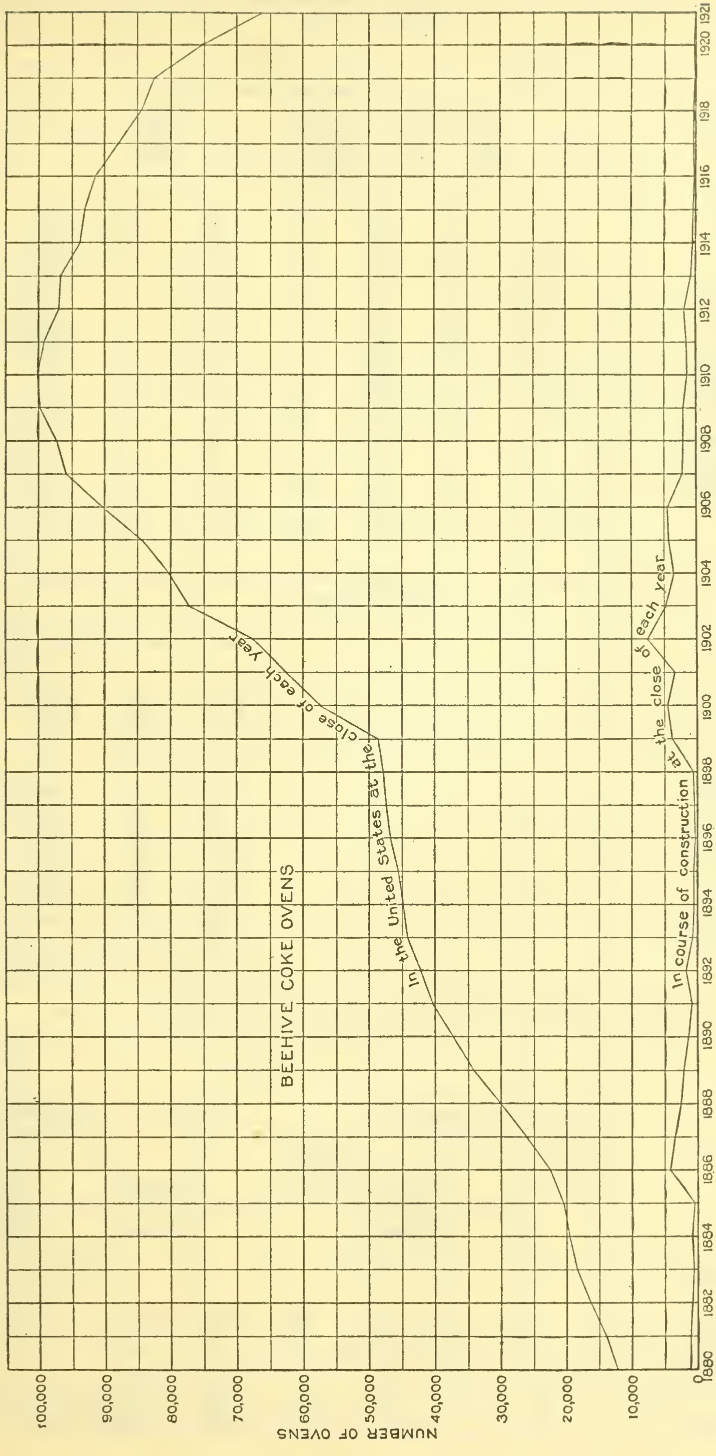


FIGURE 34.—Beehive coke ovens completed and under construction in the United States at the end of each year, 1880-1921.

TABLE 13.—*By-product coke ovens in the United States at end of each year, 1915, 1918, 1920, and 1921.*

State.	1915		1918		1920		1921	
	Built.	Under construction.	Built.	Under construction.	Built.	Under construction.	Built.	Under construction.
Alabama	750	....	847	324	1,081	90	1,141	30
Colorado	....	....	120	....	120	....	120	....
Illinois	626	....	626	88	794	100	894	5
Indiana	812	30	1,026	190	1,216	....	1,213	....
Kentucky	54	54	108	....	108	....	108	....
Maryland	120	....	180	180	300	....	300	....
Massachusetts	400	....	400	....	400	....	400	....
Michigan	205	24	269	120	389	....	390	....
Minnesota	120	20	220	....	220	....	220	....
Missouri	56	....	56	....	56	8	64	....
New Jersey	150	....	260	55	315	....	252	....
New York	555	100	615	60	732	....	731	....
Ohio	343	657	1,658	....	1,558	....	1,558	....
Pennsylvania	1,744	212	2,368	638	3,006	148	3,154	....
Rhode Island	....	....	....	40	40	....	40	....
Tennessee	12	....	24	....	24	....	24	....
Washington	5	....	20	....	20	....	20	....
West Virginia	120	94	214	120	274	....	274	....
Wisconsin	196	....	268	....	228	50	238	50
	6,268	1,191	9,279	1,815	10,881	396	11,141	85

TABLE 14.—*Beehive coke ovens in the United States at end of each year, 1915, 1918, 1920, and 1921.*

State.	1915	1918	1920	1921
Alabama	8,568	8,586	8,482	6,717
Colorado	3,573	2,724	1,793	1,758
Georgia	201	201	151	151
Kansas	2	2	....	....
Kentucky	1,097	1,077	855	855
Montana	112	....	....	....
New Mexico	1,030	1,154	1,030	1,030
Ohio	321	272	222	205
Oklahoma	50	304	300	300
Pennsylvania	53,112	48,588	44,569	39,806
Tennessee	2,302	2,328	1,848	1,848
Utah	726	819	819	819
Virginia	5,229	4,042	3,906	3,474
Washington	331	408	407	408
West Virginia	16,228	14,130	10,916	8,643
Wisconsin	228	....	....	....
	93,110	84,635	75,298	66,014

TABLE 15.—*Status of coke ovens in the United States, 1920 and 1921.*

State.	Number of plants in existence.	Ovens.						
		New (completed during the year).		Abandoned during the year.	In existence Dec. 31.		Under construction Dec. 31.	
		Number.	Capacity per day (net tons of coke).		Number.	Capacity per day (net tons of coke).	Number.	Capacity per day (net tons of coke).
1920.								
Beehive:								
Alabama	32	....	....	253	8,482	13,571	....	....
Colorado	8	....	....	931	1,793	6,007	....	....
Georgia	1	....	....	....	151	242	....	....
Kansas	....	....	....	2	....	....	....	....
Kentucky	5	....	....	272	855	1,684	....	....
New Mexico	3	....	....	....	1,030	1,710	....	....
Ohio	3	....	....	50	222	444	....	....
Oklahoma	2	....	....	....	300	335	....	....

TABLE 15.—*Status of coke ovens in the United States, 1920 and 1921*—Continued.

State.	Number of plants in existence.	Ovens. New (completed during the year). Number.	Ovens. New (completed during the year). Capacity per day (net tons of coke).	Ovens. Abandoned during the year.	Ovens. In existence Dec. 31. Number.	Ovens. In existence Dec. 31. Capacity per day (net tons of coke).	Ovens. Under construction Dec. 31. Number.	Ovens. Under construction Dec. 31. Capacity per day (net tons of coke).
1920—Continued.								
Beehive—Continued.								
Pennsylvania	[a]189			2,412	44,569	[a]107,921	302	1,750
Tennessee	11			480	1,848	[a]2,402		
Utah	1				819	819		
Virginia	15			135	3,906	7,270	30	60
Washington	4			25	407	545		
West Virginia	73			2,146	10,916	[a]20,415		
	[a]347			6,706	75,298	[a]163,365	332	1,810
By-product:								
Alabama	7	247	4,707	90	1,081	11,665	90	777
Colorado	1				120	1,656		
Illinois	6	[b]80	1,600		794	9,347	100	1,500
Indiana	7				1,216	14,390		
Kentucky	1				108	1,400		
Maryland	1				300	4,200		
Massachusetts	1				400	1,800		
Michigan	3				389	4,660		
Minnesota	3				220	1,952		
Missouri	1				56	980	8	140
New Jersey	2				315	3,077		
New York	5	210	2,454	70	732	7,822		
Ohio	12			100	1,558	19,234		
Pennsylvania	13	160	1,710		3,006	29,973	148	1,694
Rhode Island	1				40	456		
Tennessee	1				24	252		
Washington	1				20	70		
West Virginia	3	60	699		274	2,028		
Wisconsin	2			40	228	2,357	50	583
	71	757	11,170	300	10,881	117,319	396	4,694
1921.								
Beehive:								
Alabama	24			492	6,717	13,300		
Colorado	8				1,758	2,770		
Georgia	1				151	347		
Kentucky	5				855	1,426		
New Mexico	3				1,030	1,545		
Ohio	2			17	205	408		
Oklahoma	2				300	385		
Pennsylvania	169			5,044	39,806	101,887		
Tennessee	11				1,848	2,042		
Utah	1				819	819		
Virginia	14			482	3,474	6,526		
Washington	5				408	602		
West Virginia	58			2,103	8,643	17,493		
	303			8,138	66,014	149,550		
By-product:								
Alabama	7	60	780		1,141	13,057	30	390
Colorado	1				120	1,680		
Illinois	7	[c]180	2,520		894	10,667	5	84
Indiana	6				1,213	14,476		
Kentucky	1				108	1,400		
Maryland	1				300	4,200		
Massachusetts	1				400	1,650		
Michigan	3				390	4,700		
Minnesota	3				220	2,360		
Missouri	1	8	101		64	813		
New Jersey	2	37	344	100	252	2,524		
New York	5				731	7,170		
Ohio	12				1,558	19,269		
Pennsylvania	13	148	1,694		3,154	31,158		
Rhode Island	1				40	510		
Tennessee	1				24	326		
Washington	1				20	70		
West Virginia	3				274	2,076		
Wisconsin	2	50	583	40	238	2,043	50	583
	71	483	6,022	140	11,141	120,149	85	1,057

[a] Revised figures.
[b] Completed in 1920, but not put into operation until 1921.
[c] Includes 80 ovens reported as new in 1920, but not put into operation until 1921.

The five ovens listed as under construction in Illinois on December 31, 1921, are of particular interest. They constitute a small experimental battery of a distinctly new type of Koppers oven, which had not been described publicly until after the end of that calendar year. The distinctive feature of the oven is the form of heating flues. This small battery began operations early in 1922, and results have proved so satisfactory that arrangements have already been made for several plants using ovens of this type. One of these installations will consist of 366 ovens added to the present by-product coke plant of the Carnegie Steel Co., at Clairton, Pa., which is already the largest in the world and which with the new ovens will be more than double the size of any other with one exception.

TABLE 16.—*By-product coke plants in the United States, December 31, 1921.*

State.	Town.	Name of company owning plant.	Number of ovens.	Type of oven.	Year put in operation.[a]
Alabama	Alabama City	Gulf States Steel Co	37	Koppers	1917.
	Birmingham	Alabama By-Products Corporation.	50	.....do	1920.
	.....do	Sloss Sheffield Steel & Iron Co.	120	Semet-Solvay	1920.
	Ensley	Tennessee Coal, Iron & R. R. Co.	240	.....do	1898–1902.
	Fairfield	.....do	434	Koppers	1912–1920.
	Tuscaloosa	Central Iron & Coal Co	60	Semet-Solvay	1906–1914.
	Woodward	Woodward Iron Co	140	Koppers	1917–1921.
	.....do	.....do	60	Wilputte	1917.
Colorado	Minnequa	Colorado Fuel & Iron Co.	120	Koppers	1918.
Illinois	Chicago	Chicago By Product Coke Co.	100	.....do	1921.
	Granite City	St. Louis Coke & Chemical Co.	80	Roberts	1921.
	Joliet	Coal Products Manufacturing Co.	18	Wilputte	1914.
	.....do	.....do	35	Koppers	1912.
	.....do	Illinois Steel Co	280	.....do	1908–9.
	South Chicago	By-Products Coke Corporation.	280	Semet-Solvay	1905–1915.
	.....do	International Harvester Co.	88	Wilputte	1919.
	Waukegan	North Shore Gas Co	13	Semet-Solvay	1912.
Indiana	Gary	Illinois Steel Co	700	Koppers	1911–1918.
	Indiana Harbor	Inland Steel Co	130	.....do	1913–1917.
	.....do	Steel & Tube Co. of America.	120	Semet-Solvay	1919.
	Indianapolis	Citizens Gas Co	100	United-Otto	1909–1913.
	.....do	.....do	41	Semet-Solvay	1914.
	.....do	.....do	40	Wilputte	1919.
	Muncie	Central Indiana Gas Co	22	Klönne	1912.
	Terre Haute	Indiana Coke & Gas Co	30	Gas machinery	1916.
	.....do	.....do	30	Koppers	1919.
Kentucky	Ashland	Kentucky Solvay Coke Co.	108	Semet-Solvay	1913–1916.
Maryland	Sparrows Point	Bethlehem Steel Co	300	Koppers	1914–1919.
Massachusetts	Everett	New England Fuel & Transportation Co.	400	United-Otto	1899.
Michigan	Dearborn	Ford Motor Co	120	Semet-Solvay	1919.
	Detroit	Solvay Process Co	216	.....do	1901–1917.
	Wyandotte	Michigan Alkali Co	54	United-Otto	1902–1916.
Minnesota	Duluth	Minnesota Steel Co	90	Koppers	1915–16.
	St. Paul	Minnesota By-Product Coke Co.	65	.....do	1918.
	West Duluth	Zenith Furnace Co	65	United-Otto	1904–1916.
Missouri	St. Louis	Laclede Gas Light Co	56	Koppers	1915.
	.....do	.....do	8	Piette	1921.
New Jersey	Camden	Camden Coke Co	50	United-Otto	1903–1906.
	.....do	.....do	37	Koppers	1921.
	Kearney	Seaboard By-Product Coke Co.	165	.....do	1917–1919.
New York	Buffalo	Donner Union Coke Corporation.	150	.....do	1920.
	.....do	Wickwire Spencer Steel Corporation.	60	Semet-Solvay	1917.

[a] The first and last years are given for those plants that have two or more installations.

TABLE 16.—*By-product coke plants in the United States, December 31, 1921*—Contd.

State.	Town.	Name of company owning plant.	Number of ovens.	Type of oven.	Year put in operation.[a]
New York—Cont'd.	Geneva	Empire Coke Co	46	Semet-Solvay	1904–1909.
	Lackawanna	Lackawanna Steel Co	94	United-Otto	1904.
	do	do	60	Semet-Solvay	1920.
	do	do	281	Rothberg	
	Solvay	Solvay Process Co	40	Semet-Solvay	1893–1903.
Ohio	Canal Dover	Penn Iron & Coal Co	24	Roberts	1916.
	Canton	United Alloy Steel Corp.	47	Koppers	1916.
	Cleveland	American Steel & Wire Co.	180	do	1918.
	do	Otis Steel Co	100	Semet-Solvay	1910–1915.
	do	McKinney Steel Co	204	Koppers	1916.
	Ironton	Ironton Solvay Coke Co.	60	Semet-Solvay	1918.
	Lorain	National Tube Co	208	Koppers	1918.
	Portsmouth	Portsmouth By-Product Coke Co.	108	Semet-Solvay	1917.
	Toledo	Toledo Furnace Co	94	Koppers	1910.
	Youngstown	Brier Hill Steel Co	84	do	1917.
	do	Republic Iron & Steel Co.	143	do	1914–15.
	do	Youngstown Sheet & Tube Co.	306	do	1916–1918.
Pennsylvania	Chester	Philadelphia Suburban Gas & Electric Co.	40	Semet-Solvay	1904.
	Clairton	Carnegie Steel Co	768	Koppers	1918–19.
	Farrell	do	212	Otto-Hoffmann	1903.
	Dunbar	American Manganese Manufacturing Co.	110	Semet-Solvay	1896–1903.
	Glassport	Allegheny By-Product Coke Co.	120	United-Otto	1897.
	Franklin	Cambria Steel Co	92	Koppers	1915.
	do	do	210	United-Otto	1895–1907.
	do	do	190	Cambria	1918–1920.
	Rosedale	do	88	Semet-Solvay	1921.
	do	do	120	Cambria	1918–1921.
	South Bethlehem	Bethlehem Steel Co	424	Koppers	1915–16.
	Lebanon	do	90	Semet-Solvay	1904–1921.
	Steelton	do	120	do	1907.
	do	do	60	Koppers	1918.
	Midland	Pittsburgh Crucible Steel Co.	100	do	1920.
	Pittsburgh	Jones & Laughlin Steel Co.	300	do	1919–20.
	Swedeland	Rainey-Wood Coke Co	110	do	1919.
Rhode Island	Sassafras Point	Providence Gas Co	40	do	1919.
Tennessee	Altonpark	Chattanooga Coke & Gas Co.	24	Semet-Solvay	1915.
Washington	Seattle	Seattle Lighting Co	20	Klönne	1914.
West Virginia	Benwood	National Tube Co	120	Semet-Solvay	1898–1901.
	Fairmont	Domestic Coke Corporation.	60	Koppers	1920.
	Follansbee	La Belle Iron Works	94	do	1917.
Wisconsin	Mayville	Steel & Tube Co. of America.	108	Otto-Hoffmann	1914–1917.
	Milwaukee	Milwaukee Coke & Gas Co.	80	Semet-Solvay	1904–1906.
	do	do	50	Koppers	1921.

[a] The first and last years are given for those plants that have two or more installations.

TABLE 17.—*By-product ovens under construction in the United States, December 31, 1921.*

State.	Town.	Name of company owning plant.	Number of ovens.	Type of oven.	Probable date of operation.
Alabama	Woodward	Woodward Iron Co	30	Koppers	
Illinois	Chicago	Chicago By-Product Coke Co	5	do	Feb. 2, 1922
Wisconsin	Milwaukee	Milwaukee Coke & Gas Co	50	do	May 15, 1922

In Table 18 are summarized by States and by types of ovens the number of by-product ovens in the United States at the end of 1921. As in previous years, the number of Koppers ovens is by far the greatest, representing more than half of the total. The number of ovens of this type will be largely increased by the additions referred to in a preceding section.

TABLE 18.—*By-product ovens in the United States at the end of the year in 1920 and 1921.*

State.	Koppers.	Semet-Solvay.	United Otto.[a]	Rothberg.	Gas machinery.	Roberts.	Klönne.	Wilputte.	Piette.	Cambria-Belgian.	Total.
1920.											
Alabama	601	420						60			1,081
Colorado	120										120
Illinois	315	293				80		106			794
Indiana	860	161	100		33		22	40			1,216
Kentucky		108									108
Maryland	300										300
Massachusetts			400								400
Michigan		335	54								389
Minnesota	155		65								220
Missouri	56										56
New Jersey	165		150								315
New York	150	206	94	282							732
Ohio	1,266	268				24					1,558
Pennsylvania	1,854	360	542							250	3,006
Rhode Island	40										40
Tennessee		24					20				24
Washington											20
West Virginia	154	120									274
Wisconsin		120	108								228
	6,036	2,415	1,513	282	33	104	42	206		250	10,881
1921.											
Alabama	661	420						60			1,141
Colorado	120										120
Illinois	415	293				80		106			894
Indiana	860	161	100		30		22	40			1,213
Kentucky		108									108
Maryland	300										300
Massachusetts			400								400
Michigan		336	54								390
Minnesota	155		65								220
Missouri	56								8		64
New Jersey	202		50								252
New York	150	206	94	281							731
Ohio	1,266	268				24					1,558
Pennsylvania	1,854	448	542							310	3,154
Rhode Island	40										40
Tennessee		24									24
Washington							20				20
West Virginia	154	120									274
Wisconsin	50	80	108								238
	6,283	2,464	1,413	281	30	104	42	206	8	310	11,141

[a] Includes the Otto-Hoffman and Schniewind types.

The total capacity of the coke ovens in the United States as shown in Table 15 does not indicate the actual output that could be expected from the United States as a whole, even if the market demand for coke were maintained throughout the year. In practice it is impossible to operate at 100 per cent of capacity, for most plants are handicapped from time to time by inadequate coal supply, mechanical breakdown, labor shortage, and other difficulties. Average operation in by-product plants seldom exceeds 90 to 95 per cent of the maximum capacity for a longer time than one month. For the United States as a whole, even in times of great demand for coke, the operation of all plants can not be expected to continue long at much above 85 per cent of the maximum capacity. In many States not more than 75 per cent can be expected. During times when coke is greatly in demand the railroads are called upon to handle very large tonnages of coal, ore, and other bulky, heavy freight. Thus almost inevitably there are shortages of coal at many coke plants and other calls for labor which preclude capacity operation.

In Table 19 is shown the estimated annual potential production of coke of beehive and by-product ovens run at different percentages of their maximum rated capacity. The output of the beehive ovens has reached 70 per cent of the rated capacity only once during recent years—in 1916. Even if many old and practically obsolete beehive ovens are abandoned during the next few years it is unlikely that this percentage will be exceeded over any long period. Any condition that would make large demands on the beehive industry, such as would result in operation at more than 50 per cent of capacity for the country as a whole, would doubtless also be favorable for the installation and operation of new by-product ovens. Hence a large part of any new demand would doubtless be met by new by-product installations rather than by greatly increased activity of beehive plants.

TABLE 19.—*Estimated annual potential production of coke and coal required for charge, in millions of net tons, of coke ovens in the United States at the end of 1920 and 1921, when operated at different percentages of maximum capacity.*

Percentage of maximum capacity.	1920				1921			
	By-product.		Beehive.		By-product.		Beehive.	
	Coke.	Coal.[a]	Coke.	Coal.[a]	Coke.	Coal.[a]	Coke.	Coal.[a]
100	42.8	61.2	50.1	78.3	43.9	62.7	46.5	72.7
90	38.5	55.0	45.1	70.5	39.5	56.4	41.9	65.4
85	36.4	52.0	42.6	66.6	37.3	53.3	39.5	61.8
75	32.1	45.9	37.6	58.7	32.9	47.0	34.9	54.5
50	21.4	30.6	25.1	39.2	22.0	31.4	23.3	36.4

[a] Coal for charge estimated for by-product ovens on basis of 70 per cent yield in coke; for beehive ovens on basis of 64 per cent yield.

The capacity of coke ovens as discussed above refers to the maximum quantity of coke that the operator believes his plant is capable of producing when all the conditions are favorable for regular operation and when the demand justifies operation at the most rapid rate at which a satisfactory and marketable coke can be produced. This capacity depends not only upon the amount of coal space in the oven, but upon many other factors, which are discussed in the following paragraphs.

The time required for completion of the coking of a coal charge depends upon the temperature that can be maintained in the walls of the oven, from which the heat passes to the coal. This temperature is limited by the character of the refractory material used in building the oven. In many ovens of the old types fire-clay refractories were used, and it is unsafe to maintain such ovens at as high a temperature as can be used with refractories of silica brick. Moreover, there are wide variations in heat resistance of both fire-clay and silica refractories. The design of the heating system also affects the speed of coking, because some ovens are so designed that the difference in temperature between the hottest parts of the refractory and the rest of the heated surface is great, whereas in others the temperature is more nearly uniform. As it is the temperature of the coolest part of the heated surface that limits the operation, it is evident that the oven in which the distribution of temperature throughout the system is more nearly uniform has a decided advantage when it is desired to operate at the highest possible temperature in order to gain maximum speed of coking. In this particular the newer types of oven are more satisfactory than the older types.

To a large extent the character and quality of the coal used determine the capacity of a coke oven. Coal of certain types produces a satisfactory coke only at relatively low temperatures, and therefore the coking of such coal must go on much more slowly. For example the coals from Illinois and Indiana generally require a slower rate of coking to yield satisfactory metallurgical coke than it is necessary to maintain with the eastern coking coals. A coal that contains a low percentage of volatile matter can be coked more rapidly than coal containing a high percentage of volatile matter. For this reason many operators mix low-volatile coal with high-volatile coal in order to improve the quality of coke produced when the plants are run at relatively high coking speeds. The Pocahontas coal is the most conspicuous example of low-volatile fast-coking coal thus used. The Pittsburgh coal is a high-volatile but relatively fast-coking coal. The coals of Illinois and Indiana are high-volatile and slow-coking and therefore require the longest time in the oven, not only because they must be heated slowly, but also because they contain more volatile matter to be driven off than the low-volatile coals. Although there are numerous exceptions, it is a general rule that high-volatile coal requires a slow rate of coking and low-volatile coal permits a high rate of coking.

The coke-producing capacity of an oven is also affected by the character of the coal in another way, namely, by the percentage of the coal charged, which remains as coke. Low-volatile coal of course gives more pounds of coke per ton of coal charged and so permits a higher output per day.

Still another important factor that affects the daily coke output from an oven is the width of the oven chamber. The coking of the coal mass does not go on uniformly throughout the oven space, but progresses gradually from the hot oven wall inward to the center of the mass. The heat that causes the coal to turn to coke must thus travel constantly longer distances to get from the hot refractory wall to the point of coking. Hence, the number of inches of coke that can be produced per hour at any given heating-wall temperature ranges from a maximum at the beginning of the coking period to a minimum at the end, when the coking is going on in the center of the mass. In an oven that has a wide coal chamber, say 19 or 20 inches across, the rate of coking during the later part of any charge will be less than in an oven where the distance between the heating walls is only 12 to 14 inches. For this reason the proportions of width, height, and length of ovens have been varied by different companies according to the result desired. Where quick coking is deemed essential and the character of the coke to be made permits, a narrow oven is built. Where the character of the coal used permits very rapid coking, but the character of the coke required demands a long time in the oven, a wider oven may be economically more desirable. In general, however, there is a tendency at present to attain increased oven capacity by raising the temperature of coking and increasing the height or length of the oven rather than by widening the coking space. Hence most of the ovens that have been built during recent years have been narrower than those built before 1915.

In the forms sent out by the Geological Survey each coke oven company was asked to give its estimate of the maximum capacity of its plant. In so far as these data can be separated according to types of ovens they have been summarized in Table 20.

TABLE 20.—*By-product coke plants in the United States, grouped by the type of ovens and by average daily capacity per oven.*

[Plants consisting of more than one type of oven are excluded from this tabulation.]

	Koppers.	Semet-Solvay.	United-Otto.	Willputte.	Roberts.	Klönne.
Number of plants included [a]	30	21	8	2	2	2
Total number of ovens at these plants [a]	5,783	2,075	959	128	104	42
Average capacity per oven, in tons of coke per day:						
At plant reporting minimum capacity per oven	9.0	3.8	4.1	10.0	12.5	3.5
At plant reporting maximum capacity per oven	15.0	17.0	9.7	12.5	14.6	5.9
At average plant [b]	12.0	10.2	5.9	11.3	13.6	4.7
Number of plants reporting an average capacity per oven of—						
Less than 4 tons of coke per day	....	1	....	....	....	1
4–5.9 tons	....	4	5	....	....	1
6–7.9 tons	....	2	2	....	....	....
8–9.9 tons	3	2	1	....	....	....
10–11.9 tons	9	4	....	1	....	....
12–13.9 tons	12	4	....	1	1	....
14–15.9 tons	6	2	....	....	1	....
16 tons or more	....	2	....	....	....	....

[a] The total number of plants and ovens of these types in the United States are: Koppers, 37 plants, 6,283 ovens; Semet-Solvay, 25 plants, 2,464 ovens; United-Otto, 10 plants, 1,413 ovens; Willputte, 4 plants, 206 ovens; Roberts, 2 plants, 104 ovens; Klönne, 2 plants, 42 ovens.

[b] Sum of averages for each plant divided by the number of plants.

In considering this table it should be borne in mind that the estimated capacities are not inherent in any particular type of oven. A Koppers oven, for example, can be built of any desired capacity, according to the local conditions that it must meet. However, during recent years oven companies have been giving particular attention to small-capacity ovens, which are well suited to gas works in the smaller cities and towns. Such ovens are essentially coke ovens, but they can be operated with principal attention to the quality and quantity of the gas produced rather than to the quality and quantity of the coke produced. In any case, the choice of oven capacity is a matter of economic conditions. Under different circumstances the choice of coal, choice of operating temperature, character of coke required, or even limitations of plant space or available labor may determine what is the best capacity for any particular plant.

COAL USED.

The quantity of coal used in the coke industry has been increasing markedly during the last 20 years, as is shown clearly by the curves in figure 35.

From the data in Table 21 it is evident that the cost of coal per ton of coke made varies largely from State to State, not only because of the difference in the price of coal per ton but also because of the

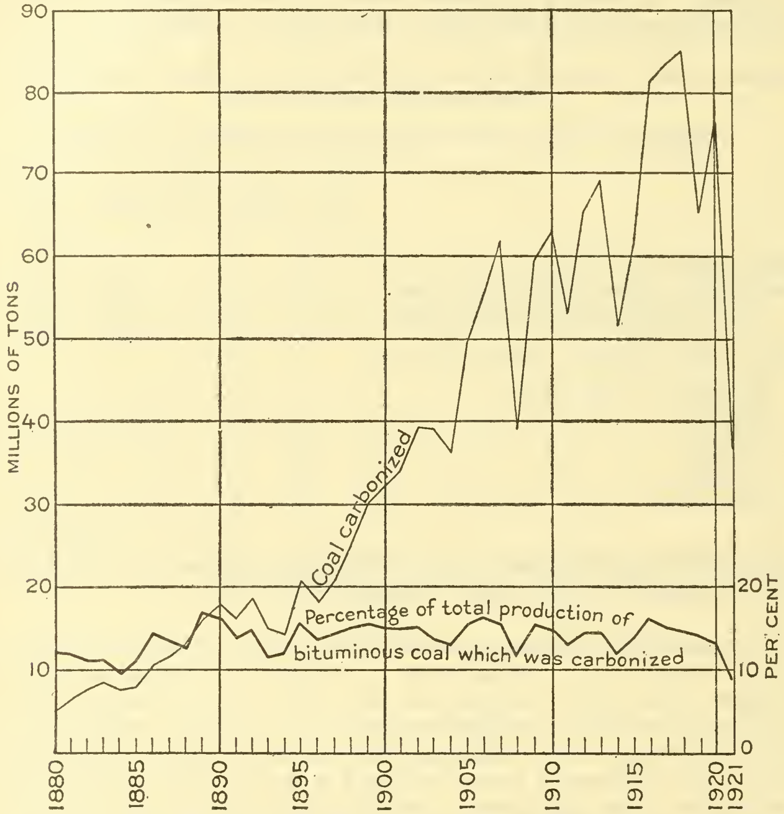


FIGURE 35.—Coal consumed in the manufacture of coke, 1880–1921.

large variation in the quantity of coal required to make a ton of coke. This variation in the quantity of coal required is due both to differences in the volatile matter in the coal used and to differences in the proportion of coke made in beehive or in by-product ovens. The yield of coke per ton of coal is more fully discussed in the succeeding section of this report.

TABLE 21.—*Coal used in the manufacture of coke in the United States in 1920 and 1921.*

State.	Coal used (net tons).	Cost.		Coal per ton of coke.	
		Total.	Per ton.	Net tons.	Cost.
1920.					
Alabama	6,031,034	$23,903,853	$3.96	1.502	$5.95
Colorado	1,153,114	5,880,554	5.09	1.460	7.43
Georgia	29,804	152,648	5.12	1.803	9.23
Illinois	3,090,862	20,064,551	6.49	1.446	9.38
Indiana	6,355,846	37,633,801	5.92	1.396	8.26
Kentucky	1,119,284	4,660,248	4.16	1.513	6.29
Maryland	953,404	6,013,632	6.31	1.398	8.82
Michigan	1,902,224	13,363,816	7.03	1.365	9.60
Minnesota	942,869	6,135,070	6.50	1.397	9.08
New York	1,504,902	9,328,079	6.20	1.447	8.97
Ohio	8,291,131	47,625,210	5.74	1.454	8.35
Pennsylvania	35,669,662	119,312,015	3.34	1.509	5.04
Tennessee	493,783	1,730,133	3.50	1.637	5.73
Virginia	1,645,253	5,437,447	3.30	1.600	5.28
Washington	92,470	581,375	6.28	1.557	9.78
West Virginia	2,909,933	10,076,932	3.46	1.592	5.51
Combined States:					
New Mexico and Utah	826,865	2,392,187	2.89	1.800	5.20
Massachusetts, Missouri, New Jersey, Rhode Island, and Wisconsin	3,178,392	24,688,085	7.77	1.389	10.79
	76,190,832	338,979,636	4.44	1.483	6.58
1921.					
Alabama	3,700,042	12,149,816	3.28	1.46	4.79
Colorado	540,940	2,848,694	5.27	1.47	7.75
Georgia	12,708	79,228	6.23	1.83	11.40
Illinois	1,952,358	11,514,557	5.90	1.48	8.73
Indiana	4,342,467	25,558,874	5.89	1.40	8.25
Kentucky	419,361	1,535,943	3.66	1.47	5.38
Maryland	395,526	2,467,128	6.24	1.35	8.42
Michigan	1,103,524	6,373,182	5.77	1.42	8.19
Minnesota	630,173	4,487,979	7.12	1.45	10.32
New York	1,098,014	6,431,632	5.86	1.47	8.61
Ohio	4,475,779	21,838,429	4.88	1.48	7.22
Pennsylvania	14,587,886	42,890,233	2.94	1.49	4.38
Tennessee	134,239	414,171	3.09	1.57	4.85
Virginia	442,038	1,255,795	2.84	1.58	4.49
Washington	49,861	318,619	6.39	1.83	11.69
West Virginia	620,571	1,949,084	3.14	1.56	4.90
Combined States:					
New Mexico and Utah	286,123	900,028	3.15	1.71	5.39
Massachusetts, Missouri, New Jersey, Rhode Island, and Wisconsin	2,396,947	17,322,520	7.23	1.43	10.34
	37,188,557	160,335,912	4.31	1.47	6.34

Statistics of the coal consumed for coke making during several recent years are given in Table 22, which also indicates what proportion of the coal so used in 1921 was washed in preparation for coking. It is notable that the quantity of coal thus washed for by-product coke plants was large only in Alabama. In most of the other principal producing States washing is not necessary, but Georgia, Tennessee, and Washington use washed coal exclusively.

TABLE 22 —*Coal used in the manufacture of coke in the United States, 1912, 1915, 1918, 1920, and 1921, in net tons.*

State.	1912	1915	1918	1920	1921		
					Unwashed.	Washed.	Total.
By-product ovens:							
Alabama	1,873,581	2,987,710	3,877,634	4,542,279	106,078	3,370,845	3,476,923
Colorado			345,877	730,870		417,112	417,112
Illinois	[a]2,316,307	2,335,933	3,199,620	3,090,862	1,820,679	131,679	1,952,358
Indiana	3,198,874	3,685,774	5,318,900	6,355,846	3,984,958	357,509	4,342,467
Kentucky		337,679	723,113	671,866	257,854		257,854
Maryland	462,998	470,326	696,576	953,404	395,526		395,526
Massachusetts	677,793	666,930	676,866	630,365	399,935		399,935
Michigan	(b)	(b)	(b)	1,902,224	1,103,524		1,103,524
Minnesota	(b)	180,767	1,069,775	942,869	630,173		630,173
Missouri		(b)	(b)	(b)	(b)		(b)
New Jersey	462,998	349,976	994,300	1,012,562	1,043,322	21,638	1,064,960
New York	1,095,198	975,656	1,516,580	1,504,902	888,169	209,845	1,098,014
Ohio	337,987	956,656	7,775,623	8,151,987	4,375,992		4,375,992
Pennsylvania	2,676,751	4,301,726	6,514,868	11,325,505	7,493,074	372,321	7,865,395
Rhode Island				(b)	(b)		(b)
Tennessee		32,084	166,157	183,200		79,911	79,911
Washington		(b)	47,410	44,594		43,570	43,570
West Virginia	252,849	202,762	853,684	626,196	269,989	7,356	277,345
Wisconsin	831,984	(b)	(b)	(b)	(b)		(b)
Combined States	579,223	2,070,403	3,090,738	1,535,465	932,052		932,052
	[a]14,766,543	19,554,382	36,867,721	44,204,996	23,701,325	5,011,786	28,713,111
Beehive ovens:							
Alabama	2,711,917	1,708,228	2,949,992	1,488,755	1,012	222,107	223,119
Colorado	1,473,112	1,026,019	1,216,154	422,244	10,502	113,326	123,828
Georgia	87,300	35,377	38,280	29,804		12,708	12,708
Kansas	(b)						
Kentucky	307,162	462,168	533,346	447,418	161,507		161,507
New Mexico	679,209	732,830	1,047,675	(b)	(b)	(b)	(b)
Ohio	223,439	28,815	223,200	139,144	99,787		99,787
Oklahoma			(b)				
Pennsylvania	38,591,781	33,972,018	34,059,026	24,344,157	6,099,492	622,999	6,722,491
Tennessee	685,861	433,781	564,920	310,583		54,328	54,328
Utah	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Virginia	1,555,969	995,396	2,042,429	1,645,253	415,352	26,686	442,038
Washington	78,693	(b)	154,460	47,876		6,291	6,291
West Virginia	3,808,853	2,071,001	4,516,108	2,283,737	298,501	44,725	343,226
Combined States	608,023	812,883	814,707	826,865	261,451	24,672	286,123
	50,811,319	42,278,516	48,160,297	31,985,836	7,347,604	1,127,842	8,475,446

[a] Revised figures. [b] Included under "Combined States."

YIELD OF COKE FROM COAL.

The percentage yield of coke obtained from any coal is dependent primarily upon the quantity of volatile matter present in the coal. Almost without exception practically all the volatile matter is eliminated during coking, the fixed carbon and the ash with only a very low percentage of volatile matter being left to form the coke. The yield of coke from any particular coal is lower in beehive ovens than in by-product ovens, because in the beehive oven a small part of the coke is burned in order to produce the heat required for the coking operation itself.

The data in Table 23 show that the yields of by-product ovens in 1921, as in previous years, were several per cent higher than those of beehive ovens. The beehive yield, however, was slightly greater than in any other recent year. The by-product yield fell off slightly from the yield for 1920, as a natural consequence of the continued operation of many by-product plants that use high-volatile coal because of the demand for the gas which they make and the simultaneous decrease in activity of other by-product plants that are operated primarily for the manufacture of blast-furnace coke and therefore use large amounts of low-volatile coal. The decrease in percentage yield of coke from the coal employed in by-product ovens is therefore not an indication of decreased efficiency in operation during 1921.

TABLE 23.—*Percentage yield of coke from coal in beehive and by-product ovens in the United States, 1915, 1918, 1920, and 1921.*

State.	1915		1918		1920		1921	
	Beehive.	By-product.	Beehive.	By-product.	Beehive.	By-product.	Beehive.	By-product.
Alabama	58.6	69.3	58.2	67.9	59.8	68.8	59.6	69.1
Colorado	65.4		62.4	69.5	64.6	70.7	65.7	68.7
Georgia	56.6		57.6		55.4		54.6	
Illinois		72.2		71.4		69.1		67.7
Indiana		75.1		73.3		71.6		71.2
Kentucky	61.6	71.5	56.4	73.9	60.9	69.5	61.6	71.9
Maryland		66.7		74.8		71.5		73.9
Massachusetts		75.6		82.2		77.4		73.5
Michigan		72.0		75.9		73.2		70.4
Minnesota		70.7		73.3		71.6		69.2
Missouri		77.0		75.2		72.0		70.8
New Jersey		77.0		68.6		71.7		69.5
New Mexico	53.1		57.0		54.4		71.8	
New York		70.2		70.5		69.1		68.0
Ohio	66.3	69.6	62.2	67.2	62.5	68.9	62.3	67.8
Oklahoma			58.2					
Pennsylvania	66.3	71.9	65.0	70.4	65.3	68.3	66.4	67.4
Rhode Island						66.3		70.0
Tennessee	53.9	72.5	53.6	74.9	52.3	75.9	51.5	72.2
Utah	57.3		56.3		56.8		57.3	
Virginia	63.3		60.4		62.5		63.5	
Washington	65.4	70.0	60.6	74.8	69.2	58.9	55.6	54.5
West Virginia	60.4	69.6	60.2	70.7	60.4	71.4	61.0	67.9
Wisconsin		70.3		73.4		70.0		66.5
Average	65.1	72.0	63.3	70.5	64.1	69.9	65.3	68.8

The important trend in coke yields during recent years is made clear by the curves of figure 36. The curves for the years up to 1918, inclusive, are based upon reports by operators who did not specify whether breeze was included or not, but for 1920 and 1921 both the production of coke excluding breeze and the total production of coke and breeze are shown. The curves for years up to 1918 are therefore not exactly comparable with any of those for years after 1918, but they are approximately comparable with the curves showing yield of coke exclusive of breeze, for it is clear from the individual schedules that most reports prior to 1918 did not include breeze. Curve F, it should be noted, does not include breeze wasted.

COKE BREEZE.

It is inevitable that a considerable percentage of the coke made will be so fine as not to be suitable for blast-furnace or foundry use or for domestic fuel. This fine coke is separated by screening or forking, and some of it is sold as breeze or screenings. It commands a lower price than the larger coke, and of course the operators always aim to reduce their production of breeze to a minimum. In Table 24 are given data by States for the quantity and value of breeze and screenings recovered in by-product plants.

TABLE 24.—*Coke breeze recovered at by-product plants in the United States in 1921, by States.*

State.	Net tons.	Value.	State.	Net tons.	Value.
Alabama	155,568	$296,941	Ohio	327,672	$456,658
Colorado	23,492	(a)	Pennsylvania	587,287	872,386
Illinois	123,061	269,677	Tennessee	958	3,161
Indiana	254,056	407,063	Washington	6,594	3,956
Kentucky	10,066	7,046	West Virginia	15,578	7,318
Maryland	19,034	(a)	Missouri, Rhode Island, and Wisconsin	67,094	102,566
Massachusetts	23,984	(a)	Undistributed		382,668
Michigan	58,848	117,032			
Minnesota	42,329	86,675		1,831,110	3,160,887
New Jersey	60,621	(a)			
New York	54,868	147,740			

a Included under "Undistributed."

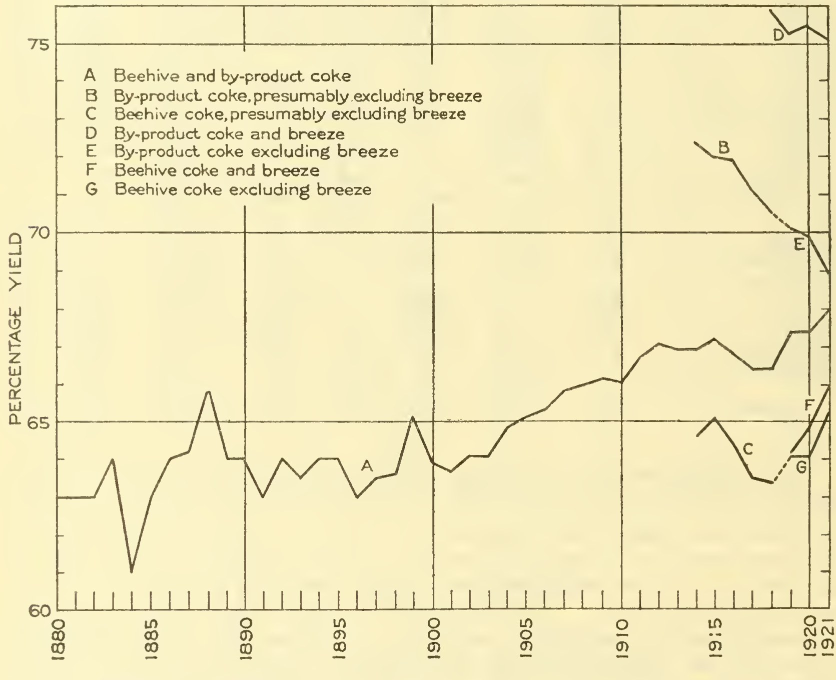


FIGURE 36.—Yield of coke from coal in by-product and beehive plants, 1880–1921.

There is marked difference in beehive and by-product practice with respect to treatment of breeze. At a beehive plant the opportunities for utilizing breeze on the premises are few, and as the outside market for breeze is limited it has been treated by most beehive operators as so much waste matter and allowed to accumulate in piles or dumps in the manner of anthracite culm banks. The total quantity of breeze formed each year in the manufacture of beehive coke is not known accurately. Fulton states that the fines produced in the Connellsville region amount to 2 or 3 per cent, and Eavenson reports that in the Pocahontas field 5 to 8 per cent is common.

Beehive operators were asked to report for 1921 the quantity of breeze produced and the quantity sold. The quantity reported as produced amounted to 58,267 tons of screenings and breeze, valued at $162,593 (Table 27), but as many beehive operators made no report on this subject it is clear that this total is far short of the breeze actually produced. Only 10 operators reported the quantity of breeze sold. The aggregate was 12,910 tons, which brought in $39,532. (See Table 27.)

Inquiry was also made as to the quantity of screenings and breeze used by the producer in affiliated steel works or at the coke plant. Only 6 out of the 303 operators reported using breeze in this way, and the quantity reported, 10,520 tons, was very small.

In order to find out what becomes of the fines produced, the beehive operators were asked, "What is done with coke breeze and screenings at this plant?" The replies of 59 operators who answered this question are summarized in the following statement:

Dumped or otherwise wasted	38
Used for railroad fills	2
Used for road material	3
Used under boilers	9
Used at brick plant	1
Used in sintering plant	2
Stocked at ovens, awaiting better market	4
	59

As stated above, 10 other operators reported sales, and the remainder, 234 in all, ignored the question, a fact which confirms the conclusion that beehive practice generally affords no use for the fines.

At by-product plants, on the contrary, practically none of the fine coke is wasted, because there is ready use for it under the boilers in making steam or for other heating operations. As most of the by-product plants are at industrial centers the fines not needed at the coke plant itself can frequently be sold to other industrial establishments in the neighborhood, without the expense of shipment by rail that is involved in selling breeze from most of the beehive plants.

TABLE 25.—*Yield and disposition of breeze produced at by-product ovens in the United States in 1921.*

State.	Yield.		Disposition (per cent).			
	Percentage of coal used.	Percentage of total coke and breeze.	Sold.	Used by producer.	Reported as wasted.	Added to or taken from stock.
Alabama	4.5	6.1	9.3	81.9	1.7	+7.1
Colorado	5.6	7.6		98.5	1.5	
Illinois	6.3	8.5	29.0	65.6		+5.4
Indiana	5.9	7.6	4.2	81.6		+14.2
Kentucky	3.9	5.2	101.1			−1.1
Maryland	4.8	6.1	3.9	112.1		−16.0
Massachusetts	6.0	7.5	98.2			+1.8
Michigan	5.3	7.0	59.2	78.8		−38.0
Minnesota	6.7	8.9	4.2	92.7	6.7	−3.6
New Jersey	5.7	7.6	25.1	75.5		−.6
New York	5.0	6.8	1.5	136.6		−38.1
Ohio	7.5	9.9	10.9	84.2		+4.9
Pennsylvania	7.5	10.0	1.2	77.2	2.4	+19.2
Tennessee	1.2	1.6	104.2			−4.2
Washington	15.1	21.7		100.0		
West Virginia	5.6	7.6	1.0	100.0		−1.0
Missouri, Rhode Island, and Wisconsin	7.2	9.5	20.8	82.2		−3.0
	6.4	8.5	11.2	80.4	1.1	+7.3

DISPOSAL.

The coke-producing industry is in large part operated as an adjunct to the metallurgical industry, and the blast furnaces are the principal users of both beehive and by-product coke. A considerable percentage of all the coke produced is used by the producers; the remainder is sold, but the sales are to a large extent only transfers from one branch of an establishment to another and represent book sales rather than changes of ownership. During 1921 approximately 9 per cent of the beehive coke and 68 per cent of the by-product coke was used in the plants of the producers, and about 80 per cent of the by-product coke breeze was used in the coke or affiliated plants of the producing companies.

SALES.

For convenience in the Geological Survey's canvass the larger sizes of coke are classified as "furnace," "foundry," and "domestic and other." Tables 26 and 27 summarize for each State the production, the sales according to these three grades, and the use by producers of coke and breeze in 1920 and 1921. During 1921 a great quantity of coke was put into stock, much more than was taken out of stock, and as a consequence the total of sales and use by the producer is considerably less than the total production.

TABLE 26.—*By-product coke produced and sold or used by the producer in the United States in 1920 and 1921.*

State.	Produced.				Sold.								Used by producer.	
	Coke.		Screenings and breeze.		Furnace.		Foundry.		Domestic and other.		Screenings and breeze.		Coke (net tons).	Screenings and breeze (net tons).
	Net tons.	Value.[a]	Net tons.	Value.[a]	Net tons.	Value.	Net tons.	Value.	Net tons.	Value.	Net tons.	Value.		
1920.														
Alabama	3,123,890	$25,959,526	206,847	$382,667	228,798	$1,890,345	27,514	$301,000	21,300	$115,428	40,053	$74,035	2,836,509	163,116
Illinois	2,136,793	25,791,092	197,746	405,379	387,790	5,008,243	216,537	3,040,733	267,755	2,479,078	103,208	211,686	1,259,168	118,186
Indiana	4,553,697	46,994,153	326,546	568,190	180,718	2,120,703	196,208	2,667,306	385,842	3,083,628	37,100	64,520	3,840,900	292,454
Kentucky	466,985	3,614,463	42,283	27,061	364,266	2,623,676	44,098	501,462	64,278	534,466	42,283	27,265		
Maryland	682,132	3,785,833	50,360	175,756	7,437	(b)					2,520	(b)	678,989	59,255
Massachusetts	488,089	(b)	33,150	(b)			355,365	(b)	132,410	(b)	50,629	(b)		
Michigan	1,393,445	15,731,994	92,388	185,700	291,793	3,227,253	400,696	5,553,922	448,752	4,107,026	20,524	41,168	282,799	17,902
Minnesota	674,801	10,675,352	45,504	118,310	106,085	1,127,699	57,229	744,511	163,765	1,719,202	8,884	23,077	360,806	42,730
New Jersey	725,571	(b)	72,330	(b)	453,831	(b)	95,164	(b)	221,837	(b)	23,841	(b)	10,683	49,213
New York	1,040,192	12,066,227	38,980	126,685	297,628	3,471,321	8,036	99,003	90,220	1,022,880	35,102	113,999	639,445	20,613
Ohio	5,614,877	52,555,249	423,887	623,114	651,654	6,547,341	632	4,418	169,216	1,135,150	142,586	209,542	4,783,002	268,285
Pennsylvania	7,730,256	77,843,678	777,027	924,662	544,152	6,291,166			173,763	941,251	32,743	38,935	7,100,823	492,586
Tennessee	139,121	1,367,559	5,141	2,108	98,677	900,300	39,702	460,490			3,126	1,274		
Washington	26,284	273,354	6,014	19,546	1,057	10,993					85	276	23,344	5,929
West Virginia	447,392	4,608,138	7,512	15,024	36,348	397,569			9,110	70,989	100	200	344,957	37,677
Colorado, Missouri, Rhode Island, and Wisconsin	1,590,426	17,509,451	135,120	439,060	404,730	4,838,372	274,801	3,544,082	213,489	2,276,375	20,235	45,993	687,036	124,240
Undistributed		14,252,663		421,556		4,386,241		6,761,298		3,594,956		397,034		
	30,833,951	313,028,732	2,460,835	4,434,818	4,054,964	42,841,222	1,715,982	23,678,225	2,361,737	21,080,429	563,019	1,249,004	22,848,461	1,692,186

[a] The value of the total product in 1920 was not reported by the operator but has been estimated by the Geological Survey for each State by assuming that the part of the product not sold (such as coke consumed by the producer in associated iron furnaces) had the same value per ton as the part reported as sold. The value given for 1921 includes the operators' statements of the value of the part of the product not sold.

[b] Included under "Undistributed."

TABLE 26.—*By-product coke produced and sold or used by the producer in the United States in 1920 and 1921*—Continued.

State.	Produced				Sold								Used by producer.	
	Coke.		Screenings and breeze.		Furnace.		Foundry.		Domestic and other.		Screenings and breeze.		Coke (net tons).	Screenings and breeze (net tons).
	Net tons.	Value.	Net tons.	Value.	Net tons.	Value.	Net tons.	Value.	Net tons.	Value.	Net tons.	Value.		
1921.														
Alabama	2,401,127	$11,461,771	155,568	$206,041	294,818	$1,613,161	12,954	$108,157	41,493	$182,413	14,440	$31,768	1,728,667	127,517
Colorado	286,755	(b)	23,492	(b)	18,137	(b)	....	....	....	....	....	....	258,719	23,140
Illinois	1,322,178	11,383,808	123,061	269,677	200,755	1,945,854	78,686	824,912	250,224	2,300,926	35,725	104,821	663,474	80,739
Indiana	3,091,263	19,007,519	254,056	407,063	4,180	35,890	80,110	759,481	134,082	1,051,777	10,578	18,177	2,684,908	207,208
Kentucky	185,383	1,097,467	10,066	7,046	113,942	600,095	40,000	308,836	29,889	180,133	10,179	7,128	....	....
Maryland	292,439	(b)	19,034	(b)	102,358	(b)	....	....	....	....	752	(b)	124,603	21,339
Massachusetts	294,059	(b)	23,984	(b)	5,684	(b)	191,306	(b)	83,878	(b)	23,546	(b)	....	....
Michigan	777,125	7,650,191	58,848	117,632	24,392	187,663	133,114	1,407,347	356,553	3,647,361	34,961	61,770	221,459	46,499
Minnesota	435,860	4,337,016	42,329	80,675	3,610	31,215	36,214	441,004	96,538	975,746	1,782	3,845	154,649	39,232
New Jersey	739,763	(b)	60,621	(b)	155,716	(b)	44,219	(b)	232,229	(b)	15,227	(b)	28,904	45,772
New York	746,916	5,451,805	54,868	147,740	311,063	2,403,499	9,313	70,629	64,285	628,419	785	5,845	336,280	74,924
Ohio	2,966,273	15,837,503	327,872	456,858	419,176	2,188,509	7,045	46,454	67,806	329,968	35,772	26,117	2,503,068	275,971
Pennsylvania	5,303,371	21,740,543	587,287	872,386	747,216	4,550,399	76	576	46,604	208,940	7,103	10,404	4,542,614	453,114
Tennessee	57,723	290,675	958	3,161	5,795	28,390	22,208	125,355	3,536	16,299	999	3,296	....	....
Washington	23,765	159,938	6,594	3,956	....	....	....	....	704	4,923	....	....	19,667	6,595
West Virginia	188,355	845,878	15,578	7,318	56,797	255,447	....	....	11,254	52,994	153	72	109,579	15,579
Missouri, Rhode Island, and Wisconsin	637,214	6,107,201	67,094	102,566	129,649	1,225,361	81,146	905,657	261,036	2,369,352	13,965	34,287	95,245	55,089
Undistributed	....	12,735,271	....	382,668	....	2,137,491	....	2,664,373	....	2,459,969	....	166,579	....	....
	19,749,580	117,506,646	1,831,110	3,160,887	2,593,318	17,202,994	736,391	7,662,781	1,679,911	13,809,165	205,997	474,109	13,470,396	1,472,619

b Included under "Undistributed."

TABLE 27.—*Beehive coke produced and sold or used by the producer in the United States, 1920 and 1921.*

State.	Produced.				Sold.								Used by producer.	
	Coke.		Screenings and breeze.[a]		Furnace.		Foundry.		Domestic and other.		Screenings and breeze.		Coke (net tons).	Screenings and breeze (net tons).
	Net tons.	Value.[b]	Net tons.	Value.[b]	Net tons.	Value.	Net tons.	Value.	Net tons.	Value.	Net tons.	Value.		
1920.														
Alabama	890,001	$9,300,510	689	$2,756			77,173	$806,265			11	$11	674,022	178
Colorado	272,826	2,673,478	1,523	4,219	175,405	$1,260,652	21,035	(c)	24,477	(c)	1,470	(c)	51,909	53
Georgia	16,523	197,285					16,489	196,881						
Kentucky	272,592	1,961,742			272,592	1,961,742								
Ohio	86,933	686,771	3,000	6,120					10	(c)	1,815	(c)	86,758	300
Pennsylvania	15,908,483	139,822,353	193,563	448,606	10,693,334	88,974,833	1,288,812	11,811,664	90,585	$737,418	17,670	35,906	1,778,009	56,500
Tennessee	162,587	1,560,998	2,536	11,919	3,719	27,893	21,162	213,099			350	(c)	135,115	2,140
Virginia	1,027,788	9,105,202	3,387	22,659	569,555	4,866,512	142,038	1,435,405			3,387	22,661	316,750	
Washington	33,111	354,097			32,230	341,132	881	(c)						
West Virginia	1,380,941	12,266,370	4,276	37,280	955,426	7,898,170	231,928	2,463,880	36,624	255,677	2,160	18,907	162,036	
New Mexico and Utah	459,304	3,887,716	37,003	170,337	425,976	3,603,707	4,408	36,977	40,446	344,169	17,168	81,103	165	
Undistributed								215,566		207,883		9,415		
	20,511,092	181,217,522	245,977	703,896	13,128,237	108,943,650	1,807,256	17,200,737	192,142	1,545,147	41,010	168,036	3,204,881	59,171
1921.														
Alabama	132,912	794,314	6,916	20,944			63,133	411,471					69,586	4,850
Colorado	81,376	(c)	1,137	(c)	669	(c)	24,078	(c)	953	(c)	519	(c)	56,358	149
Georgia	6,943	80,828	345	69			6,943	80,828			300	60		
Kentucky	99,442	753,240			100,509	753,621								
Ohio	62,150	434,950	2,200	(c)					24	(c)	1,320	(c)	62,126	880
Pennsylvania	4,466,105	22,371,288	41,152	117,177	3,362,526	16,526,871	758,341	4,093,408	49,455	214,152	3,842	7,755	275,831	4,641
Tennessee	28,005	168,794			10,406	72,738	11,060	63,306					6,403	
Virginia	280,476	2,029,652	2,138	11,821	191,363	1,407,391	77,161	527,150			2,138	11,821	13,034	
Washington	3,495	34,572			2,544	23,795	951	10,777						
West Virginia	203,537	1,407,166	104	455	127,624	701,441	68,104	504,614	2,481	16,705	104	455	12,116	
New Mexico and Utah	167,601	1,443,672	4,265		162,068	1,396,947	1,572	13,121	3,961	31,664	4,687	14,248	24	
Undistributed		634,973		12,127		6,580		227,024		7,801		5,103		
	5,538,042	30,166,449	58,257	162,593	3,957,709	20,979,386	1,011,343	5,932,599	56,874	272,412	12,910	39,532	495,481	10,520

[a] The figures here given are those reported by the operators, but they fall far short of showing the quantity of fines actually produced, for at many beehive plants the fines have no value.

[b] The value of the total product in 1920 was not reported by the operator, but has been estimated by the Geological Survey for each State by assuming that the part of the product not sold (such as coke consumed by the producer in associated iron furnaces) had the same value per ton as the part reported as sold. The value given for 1921 includes the operator's statement of the value of the part of the product not sold.

[c] Included under "Undistributed."

VALUE.

The term "value," as applied to coke in the reports of the Geological Survey, is the value at the ovens. For that part of the output that is sold the value is obviously the amount received for the coke f. o. b. ovens. But a considerable proportion of the coke produced in the United States is made in ovens operated by large corporations that not only mine the coal and make the coke but also operate blast furnaces and steel mills that consume the entire product of the ovens. Under such conditions the fixing of a value upon the coke and upon the coal consumed in making it is purely arbitrary. By some corporations the coke is charged to the furnace department at cost; by others a percentage of profit is added or the reported value is based on what the coke would cost if purchased.

In the statistics published by the Geological Survey the value assigned to that part of the output produced but not sold has not always been arrived at in the same way, and therefore the figures of total value of all coke produced are not strictly comparable from year to year. Prior to 1918 and in 1919 and 1921 each operator was asked to place his own value on the coke produced but not sold. In 1918 and again in 1920 the value of this part of the product was estimated by the Geological Survey by assigning to the coke produced but not sold in each State a value per ton equal to the average sum received for the coke sold in the same State. These changes in the form of inquiry must be borne in mind in considering Table 2.

A better measure of changes in the prices of coke and by-products is found not in the estimated value per unit produced but in the actual receipts per unit sold. Table 28 summarizes the average receipts for sales of each grade of coke in each producing State, and Table 29 gives the average values for the United States for 1908–1921.

TABLE 28.—*Average receipts per ton for coke sold in the United States in 1920 and 1921.*

State.	Beehive.				By-product.			
	Furnace.	Foundry.	Domestic.	Average all grades.	Furnace.	Foundry.	Domestic.	Average all grades.
1920.								
Alabama		$10.45		$10.45	$8.26	$10.94	$5.42	$8.31
Colorado	$7.23	9.63	$8.49	7.60			8.88	8.88
Georgia		11.94		11.94				
Illinois					12.91	14.04	9.26	12.07
Indiana					11.73	13.59	7.99	10.32
Kentucky	7.20			7.20	7.20	11.37	8.31	7.74
Maryland					5.55			5.55
Michigan					11.06	13.86	9.15	11.29
Minnesota					10.62	13.01	10.50	15.82
New Mexico	8.45	8.16		8.45				
New York					11.66	12.32	11.34	11.60
Ohio			7.90	7.90	10.05	6.99	6.71	9.36
Pennsylvania	8.32	9.16	8.14	8.79	11.56		5.42	10.07
Tennessee	7.50	9.93		9.60	9.12	11.60		9.83
Virginia	8.54	10.10		8.86				
Washington	10.58	14.72		10.69	10.40			10.40
West Virginia	8.27	10.62	6.98	8.88	10.94		7.79	10.30
	8.30	9.52	8.04	[a] 8.44	10.57	13.80	8.93	[a] 10.77

[a] Revised figures.

TABLE 28.—*Average receipts per ton for coke sold in the United States in 1920 and 1921*—Continued.

State.	Beehive.				By-product.			
	Furnace.	Foundry.	Domestic.	Average all grades.	Furnace.	Foundry.	Domestic.	Average all grades.
1921.								
Alabama	....	$6.52	....	$6.52	$5.47	$8.35	$4.40	$5.45
Colorado	$9.83	9.46	$7.92	9.42	(a)	....	....	(a)
Georgia	....	11.64	....	11.64	....	....	....	....
Illinois	....	....	....	....	9.69	10.48	9.20	9.56
Indiana	....	....	....	....	8.59	9.48	7.84	8.46
Kentucky	7.50	....	....	7.50	5.27	7.72	6.03	5.92
Maryland	....	....	....	....	(a)	....	....	(a)
Massachusetts	....	....	....	....	(a)	(a)	(a)	(a)
Michigan	....	....	....	....	7.69	10.56	8.55	9.03
Minnesota	....	....	....	....	8.65	12.18	10.11	10.61
Missouri	....	....	....	....	(a)	(a)	(a)	(a)
New Jersey	....	....	....	....	(a)	(a)	(a)	(a)
New Mexico	(a)	....	(a)	(a)	....	....	....	....
New York	....	....	....	....	7.73	7.58	9.78	8.07
Ohio	....	....	(a)	(a)	5.22	6.59	4.87	5.19
Pennsylvania	4.91	5.40	4.33	4.86	6.09	7.58	4.48	5.99
Rhode Island	....	....	....	....	....	....	(a)	(a)
Tennessee	6.99	5.72	....	6.34	4.90	5.64	4.61	5.39
Utah	(a)	(a)	(a)	(a)	....	....	....	....
Virginia	7.35	6.83	....	7.20	....	....	....	....
Washington	(a)	(a)	....	(a)	....	....	7.00	7.00
West Virginia	6.20	7.41	6.76	6.62	4.50	....	4.71	4.53
Wisconsin	....	....	....	....	(a)	(a)	(a)	(a)
Combined States	8.63	9.47	8.51	8.64	8.16	11.27	8.37	9.01
	5.30	5.87	4.79	5.41	6.63	10.41	8.22	7.72

[a] Included under "Combined States."

TABLE 29.—*Average value per net ton for beehive and by-product coke in the United States, 1908–1921.*[a]

Year.	Beehive.	By-product.	Average.	Year.	Beehive.	By-product.	Average.
1908	$2.20	$3.44	$2.40	1915	$2.07	$3.45	$2.54
1909	2.10	3.27	2.29	1916	2.69	3.95	3.13
1910	2.17	3.47	2.39	1917	4.81	6.18	5.36
1911	2.05	3.48	2.37	1918	6.08	7.88	6.52
1912	2.10	3.84	2.54	1919	5.05	6.58	5.60
1913	2.39	3.82	2.78	1920	8.44	10.77	9.26
1914	2.15	3.39	2.56	1921	5.41	7.72	6.56

[a] The averages here given are not strictly comparable for all the years shown. For the years prior to 1918 they are derived from the total value of all coke at the ovens (including the operators' statement of that part of the product consumed by them in associated enterprises but not sold), which has been divided by the total number of tons produced. For the years 1918 to 1921 they are obtained by dividing the total reported receipts for sales by the total number of tons sold. Up to and including 1919 the figures are affected by the inclusion of a small but unknown amount of breeze. Beginning with 1920, breeze was excluded.

In 1921, as before, there was a wide difference between the average receipts per ton in States close to the coal mine and those in States distant from the source of coal. The lowest average for by-product furnace coke was $4.50 in West Virginia, where the ovens are at the mines; the highest was $9.69 in Illinois, where the coal used in coking must bear freight charges from the Appalachian region to Chicago and where beehive coke, to compete, would have to bear like charges. The same explanation accounts in general for the fact that average receipts for beehive coke are generally lower than those for the corresponding grade of by-product coke. The typical beehive plant is at the mines and distant from the point of consumption. The typical by-product plant is at the point of consumption and distant from the mines. Accurate comparison of beehive and by-product prices would therefore require a consideration of the freight differential.

EFFECT OF INCREASING DOMESTIC DEMAND.

Although the demand for domestic (household) coke was dull in 1921, it is significant that in many States the average receipts on sales of domestic grades exceeded those on furnace grades, though less than on foundry grades.

As has already been pointed out, the coke industry will doubtless in the future find the demand for household coke as a substitute for anthracite to be a helpful factor in stabilizing production through years when other requirements are subnormal. It is now recognized by many that coke makes a domestic fuel as satisfactory in most respects as anthracite except in small furnaces, where inadequate size of the fire box prevents maximum convenience in its use. The output of anthracite has not increased materially for a number of years and is not likely to increase hereafter. In the meantime the population in the territory that is naturally dependent upon anthracite is steadily increasing. The price of anthracite has increased rather than decreased since the World War. Hence those who desire a smokeless fuel are inclined to try substitutes for anthracite, and householders who have been properly instructed in the use of coke are finding it an acceptable fuel. If the price of coke delivered to the householder can be made attractive to him, there is small doubt that coke will gain recognition very rapidly, especially in districts where transportation charges make the price of anthracite high.

One of the great advantages in making coke for household fuel rather than for furnace use is the fact that a high volatile, relatively fast-coking coal can be used. Such coal, rapidly coked, yields the small sizes used for household heating, allows high by-product yields, and is otherwise often desirable from the standpoint of the coke-oven operator. If dealers and householders could be persuaded to store in summer for the subsequent winter's use anything like as great a percentage of the winter's requirement of coke as they have learned they must store if they use anthracite, by-product coke plants could be operated regularly throughout the year under conditions that would be most favorable for good quality of household coke, high yields of by-products, and low cost of operation. Apparently those engaged in the coke industry are beginning to have a great deal of confidence in developing such markets as will be most favorable to this household supply of by-product coke. But even the most optimistic operators realize that there is still a great deal of educational work and some engineering investigation required to determine the most favorable choice of coal and most desirable methods of oven operation in order to supply the household market at reasonable prices. In the past the demand for household coke has not been sufficient to establish any regular market habits, and the price charged for it has in general been based upon the price of anthracite rather than on factors relating to the production and marketing of the coke.

PRICES IN CONNELLSVILLE REGION.

The prices of Connellsville coke are more or less basic reference prices for both furnace and foundry sizes. The market quotations for this coke are summarized in Table 30 and shown graphically in figures 37 and 38. The data are those published regularly by the Iron Age. They indicate clearly the wide fluctuations that often occur within a single year. These fluctuations were particularly striking in 1920, when the maximum price was more than three times the minimum price on the spot market and two and one-half times that on the contract market. As might be expected, there were no such great fluctuations during 1921, because then practically all requirements could be readily met and the conditions of a "buyers' market" were distinctly favorable to the maintenance of low and steady prices.

TABLE 30.—*Prices of Connellsville furnace and foundry coke per net ton at the ovens, 1919–1921.*[a]

Month.	1919		1920		1921	
	Spot.	Contract.	Spot.	Contract.	Spot.	Contract.
Furnace:						
January	$5.00–$6.00	$6.00	$6.00	$6.00	$5.00–$5.25	$6.00
February	4.25– 5.00	6.00	6.00	. 6.00	4.50	$5.75– 6.00
March	4.00– 4.25	$4.75– 5.00	6.00	6.00	4.00– 4.50	5.25– 5.75
April	3.50– 4.00	4.00– 5.00	$10.00–11.00	$10.00–11.00	3.25– 3.75	3.75– 4.00
May	3.50– 4.00	4.00– 4.50	11.00–14.00	11.00–14.00	3.25	3.40
June	4.00	4.50– 4.75	14.00–17.00	11.50–15.00	2.75– 3.00	3.25
July	3.85– 4.25	5.00	17.00–18.00	11.50	2.75– 3.00	3.25
August	3.90– 4.85	5.00– 5.50	17.00–18.00	11.50–14.00	2.75	3.75
September	4.00– 4.85	5.50– 6.00	16.50–17.00	14.00	3.00– 3.25	4.00– 4.25
October	4.00– 5.50	6.00– 7.00	11.00–17.00	12.00–14.00	3.25– 3.35	4.25– 4.50
November	5.50– 6.00	7.00	7.50– 9.00	9.00–12.00	2.75– 3.10	4.00– 4.25
December	6.00– 6.50	7.00	5.50– 6.50	6.60	2.75	3.75– 4.00
Foundry:						
January	6.00	7.00	7.00	7.00	6.00– 6.50	7.00– 8.00
February	6.00	7.00	7.00	7.00	5.50– 6.00	6.50
March	4.25– 6.00	5.50– 7.00	7.00	7.00	5.50	6.00
April	4.00– 4.50	4.50– 5.50	11.00	11.00	4.50– 5.00	5.00–10.00
May	4.00	4.50– 5.00	12.00–15.00	12.00–15.00	4.50	5.00
June	4.00	5.00	15.00–17.00	15.00–16.00	4.25– 4.50	4.75– 5.00
July	4.12	5.00	17.00–19.00	14.00	4.00– 4.25	4.75
August	4.12	5.00– 5.50	18.00–19.00	14.00	3.75	(b)
September	4.12– 4.75	5.50– 5.75	17.50–18.00	14.00	4.00– 4.25	(b)
October	4.75– 6.00	5.75– 6.50	13.00–18.00	13.00–14.00	4.25– 4.50	(b)
November	6.00	6.50– 7.00	8.50–11.00	10.00–13.00	4.00– 4.25	(b)
December	6.00	7.00	6.50– 7.50	8.50	3.75– 4.00	(b)

[a] Iron Age. [b] No quotations.

The past trend of coke prices is indicated by Table 2, which shows the average value at the ovens of all coke produced from 1880 to 1921. The same data are shown graphically in figure 39.

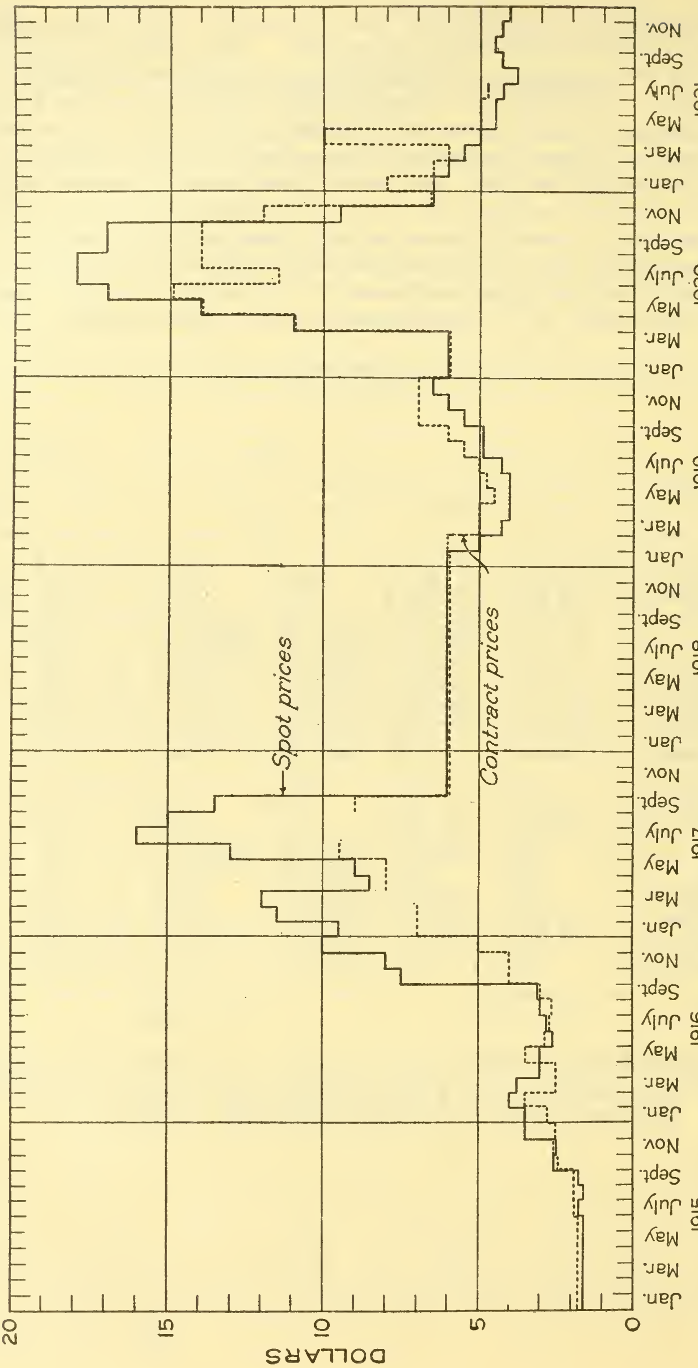


FIGURE 37.—Maximum prices of Connellsville foundry coke, 1915-1921, by months.

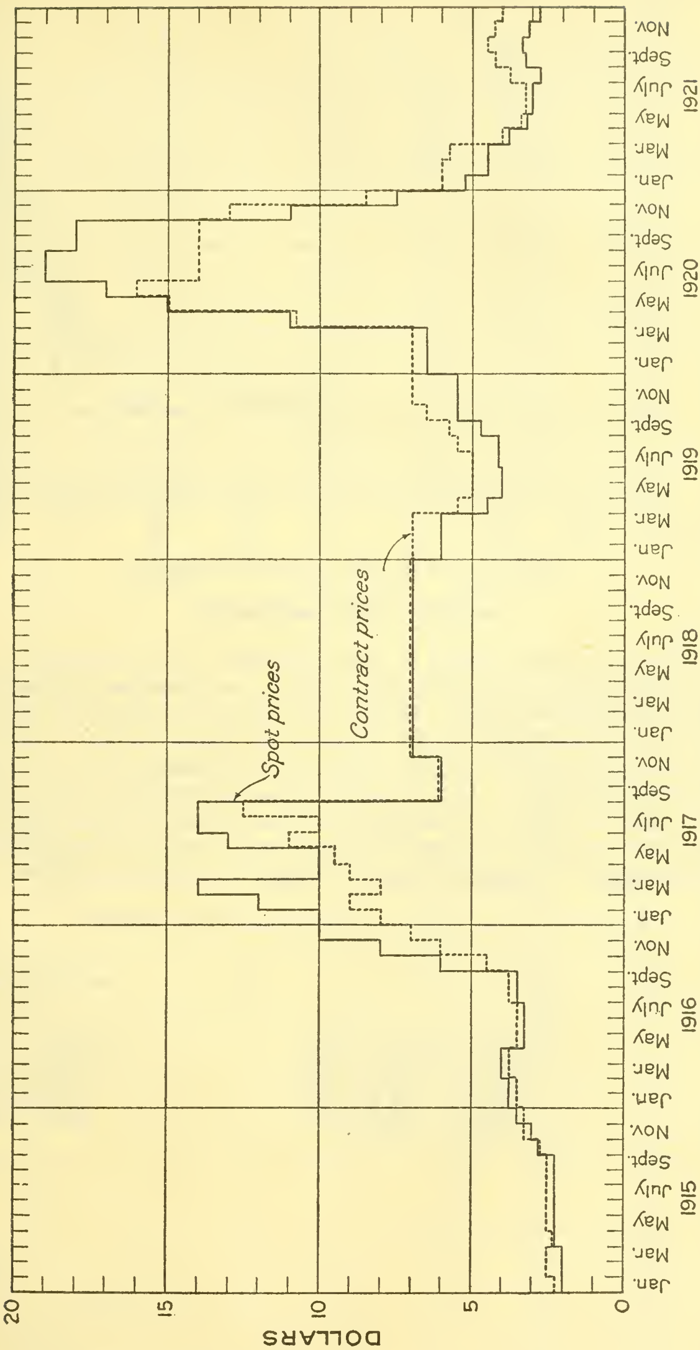


FIGURE 38.—Maximum prices of Connellsville furnace coke, 1915-1921, by months.

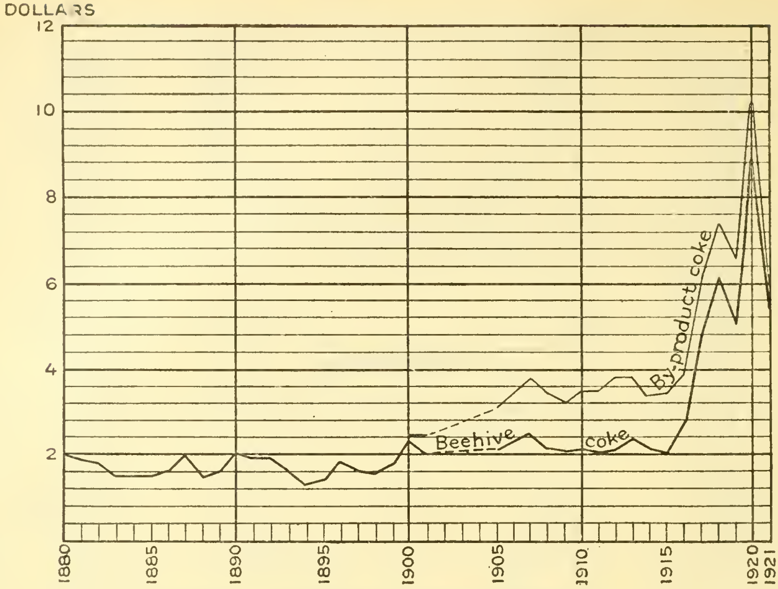


FIGURE 39.—Average value of coke at ovens, 1880-1921.

IMPORTS AND EXPORTS.

Our foreign trade in coke is not large, but it is of interest to note some of the details regarding shipments to or from the United States during the last few years. The recent exports of coke are shown in Tables 31–34, and the recent imports in Tables 35–37. All these tables are compiled from the records of the Bureau of Foreign and Domestic Commerce. It is evident that during 1921 this international trade in coke was negligible so far as the United States was concerned except for the normal movement of coke to and from Canada, following very natural lines of supply to near-by markets.

TABLE 31.—*Coke exported from the United States, 1909–1921.*

Year.	Net tons.	Value.	Year.	Net tons.	Value.
1909	1,002,916	$3,232,673	1916	1,174,645	$4,202,236
1910	984,618	3,053,293	1917	1,409,320	8,543,746
1911	1,023,727	3,215,990	1918	1,687,824	11,861,408
1912	912,576	3,002,742	1919	716,956	5,128,119
1913	987,395	3,309,930	1920	919,802	9,993,665
1914	663,585	2,233,686	1921	306,755	2,760,939
1915	895,509	3,092,498			

TABLE 32.—*Coke exported from the United States in 1920 and 1921, by customs districts.*

District.	1920		1921	
	Net tons.	Value.	Net tons.	Value.
Arizona	95,991	$765,120	186	$2,571
Buffalo	312,359	3,080,027	105,378	940,539
Dakota	4,726	63,140	8,072	70,560
Duluth-Superior	4,980	56,638	1,455	14,945
El Paso	68,496	403,950	6,067	43,781
Florida	4,501	79,942	5,226	89,260
Galveston			46	581
Georgia			225	3,492
Maine and New Hampshire	1,602	24,737	345	2,282
Maryland	78,889	842,558	20,315	127,050
Michigan	224,623	2,801,026	86,905	757,439
Mobile	239	5,538	151	2,397
New Orleans	786	19,278	1,755	33,762
New York	38,884	702,379	7,710	124,288
Ohio	18,450	178,178	6,140	37,280
Philadelphia	28,139	522,312	13,321	128,354
Porto Rico	66	1,294	4	94
Rochester	3,603	45,605	998	9,988
Sabine	381	5,602	246	1,845
St. Lawrence	19,573	166,994	16,570	120,100
San Antonio	4,294	75,677	19,204	159,585
San Diego	4	70	3	63
San Francisco	1,562	22,958	391	9,456
South Carolina	38	348		
Vermont	2,691	33,353	1,734	13,596
Virginia	3,386	78,732	4,181	66,463
Washington	1,539	18,209	127	1,168
	919,802	9,993,665	306,755	2,760,939

TABLE 33.—*Coke exported from the United States in 1920 and 1921, by countries of destination.*

Country.	1920		1921	
	Net tons.	Value.	Net tons.	Value.
Argentina	4,943	$110,935	2,219	$43,123
Barbados			17	185
Belgium	16,323	307,826	2,256	24,648
Bermuda	9	153	3	70
Brazil	2,479	48,363	833	11,731
British Honduras	6	137	8	138
British West Africa	134	4,240	22	426
Bulgaria	622	18,315		
Canada	594,143	6,467,875	227,641	1,967,108
Chile	56,785	574,234	5,572	34,601
Colombia	133	3,386	157	3,402
Costa Rica	91	2,316	67	1,278
Cuba	6,880	132,232	7,026	110,736
Denmark	7,820	141,670		
Dominican Republic	276	6,623	99	1,995
Dutch East Indies	473	10,003		
Ecuador	108	2,737	71	1,309
Egypt	56	1,250		
England	312	5,700	99	920
Finland	5,659	107,393		
France	15,346	252,608	2,880	40,100
French Oceania			2	49
French West Indies	32	866	7	136
Germany			3,333	30,874
Greece	392	7,450		
Guatemala	56	1,401	84	1,538
Haiti			2	40
Honduras	43	798	38	620
Italy	840	14,400	560	4,000
Jamaica			36	614
Mexico	171,161	1,281,857	31,232	262,167
Netherlands	2,635	65,770	4,496	72,643
Nicaragua	12	300	6	123
Norway	1,988	31,870	1,165	12,785
Other British West Indies	3	70		
Panama	249	4,653	250	8,368
Peru	15,303	164,665	15,028	101,974
Philippine Islands			450	8,309
Poland and Danzig	560	15,000		
Portugal	200	5,728	299	2,139
Portuguese Africa	12	245		
Rumania	6,535	53,869		

TABLE 33.—*Coke exported from the United States in 1920 and 1931, by countries of destination*—Continued.

Country.	1920		1921	
	Net tons.	Value.	Net tons.	Value.
Russia in Europe	560	$14,000		
Salvador	30	835	36	$997
Scotland	376	5,800	280	3,728
Spain	515	10,481	11	175
Sweden	3,743	68,500	11	400
Switzerland	1,250	29,735		
Trinidad and Tobago	28	560	11	200
Turkey in Europe	459	10,429	224	4,000
Uruguay	71	1,890	121	1,296
Venezuela	130	3,986	101	1,945
Virgin Islands of the United States	21	511	2	49
	919,802	9,993,665	306,755	2,760,939

TABLE 34.—*Coke exported from the United States in 1920 and 1921, by months.*

Month.	1920		1921	
	Net tons.	Value.	Net tons.	Value.
January	64,989	$513,240	41,154	$465,321
February	67,050	518,432	30,507	340,555
March	62,087	510,577	28,068	287,881
April	59,027	551,983	21,127	177,960
May	47,126	472,009	17,518	151,840
June	62,071	637,217	22,300	210,796
July	89,726	937,896	21,425	173,687
August	79,891	944,941	20,192	157,765
September	90,022	1,133,930	19,750	149,352
October	115,755	1,552,158	24,927	193,598
November	95,696	1,215,444	33,989	254,484
December	86,362	1,005,838	25,798	197,700
	919,802	9,993,665	306,755	2,760,939

TABLE 35.—*Coke imported and entered for consumption in the United States, 1908–1921.*

Year.	Net tons.	Value.	Year.	Net tons.	Value.
1908	147,427	$606,294	1915	53,222	$222,382
1909	191,253	736,120	1916	54,955	249,514
1910	172,716	625,130	1917	24,872	146,451
1911	77,923	254,455	1918	30,168	221,880
1912	123,614	488,398	1919	16,486	140,653
1913	101,212	435,157	1920	41,143	403,175
1914	133,226	551,104	1921	30,990	336,394

TABLE 36.—*Coke imported into the United States in 1920 and 1921, by customs districts.*

District.	1920		1921	
	Net tons.	Value.	Net tons	Value.
Alaska	86	$1,301		
Buffalo	1,713	23,355	1,077	$14,156
Chicago		5		
Hawaii	268	3,908	449	9,582
Los Angeles			222	1,690
Maine and New Hampshire	280	2,125	350	3,041
Michigan	1,893	18,799		
Montana and Idaho	36,636	352,056	20,476	237,410
Oregon			588	6,037
San Francisco			7,671	63,255
Vermont	142	739	80	530
Washington	125	887	77	693
	41,143	403,175	30,990	336,394

TABLE 37.—*Coke imported into the United States in 1920 and 1921, by countries of origin.*

Country.	1920		1921	
	Net tons.	Value.	Net tons.	Value.
Canada	40,874	$399,256	22,060	$255,830
England		2	5,835	54,879
Australia	268	3,911	3,095	25,685
Japan	1	6		
	41,143	403,175	30,990	336,394

TRANSPORTATION.

Tables 38 and 39 show the quantities of beehive coke loaded for shipment in 1920 and 1921 on the coke-originating railroads and waterways of the United States. The tables are based not upon the records of the carriers but upon reports from the coke producers. Coke transported in railroad cars over private railroads that are not common carriers is not included. Coke transported by waterways such as Monongahela River is included, regardless of the ownership of the barges in which the shipment is made, but shipments first loaded in railroad cars and later transferred to barges are not included.

TABLE 38.—*Beehive coke loaded for shipment on originating railroads and waterways in the United States, 1920 and 1921, by States, in net tons.*

State.	Railroad.	Shipments.	Production.	Percentage of production shipped.[a]
1920.				
Alabama	Louisville & Nashville	244,095		
	St. Louis-San Francisco	16,880		
	Southern	103,405		
		364,380	890,001	40.9
Colorado	Colorado & Wyoming; Denver & Rio Grande	274,349	272,826	100.6
Georgia	Central of Georgia	16,489	16,523	99.9
Kentucky	Chesapeake & Ohio	122,829		
	Louisville & Nashville	149,763		
		272,592	272,592	100.0
New Mexico and Utah.	Atchison, Topeka & Santa Fe; Denver & Rio Grande; El Paso & Southwestern.	487,998	459,304	106.2
Ohio			86,933	
Pennsylvania	Baltimore & Ohio	1,607,235		
	Buffalo, Rochester & Pittsburgh	127,091		
	Ligonier Valley	278,126		
	Monongahela	3,291,857		
	Pennsylvania	8,133,935		
	Pittsburgh & Lake Erie; Buffalo & Susquehanna.	609,677		
	Huntingdon & Broad Top Mountain; Reynoldsville & Falls Creek; Washington Run.	764,305		
		14,812,226	15,908,483	93.1
Tennessee	Southern	23,810		
	Louisville & Nashville; Nashville, Chattanooga & St. Louis.	28,181		
		51,991	162,587	32.0
Virginia	Chesapeake & Ohio	13,798		
	Interstate	559,210		
	Louisville & Nashville	92,239		
	Norfolk & Western	280,123		
	Southern	86,280		
		1,031,650	1,027,788	100.4

[a] Excess of shipments over production represents inclusion of screenings or withdrawal from stock.

TABLE 38.—*Beehive coke loaded for shipment on originating railroads and waterways in the United States, 1920 and 1921, by States, in net tons*—Continued.

State.	Railroad.	Shipments.	Production.	Percentage of production shipped.[a]
1920—Continued.				
Washington	Northern Pacific	33,111	33,111	100.0
West Virginia	Baltimore & Ohio	320,623		
	Chesapeake & Ohio	190,836		
	Norfolk & Western	548,699		
	Western Maryland	52,991		
	Kanawha & Michigan; Morgantown & Kingwood.	269,053		
		1,382,202	1,380,944	100.1
	Total railroad shipments	18,726,988		
	Total waterway shipments (Monongahela River, Pa.).	[b]297,057		
	Grand total	[b]19,024,045	20,511,092	[b]92.8
1921.				
Alabama	Louisville & Nashville	63,133		
	Southern	22,761		
		85,894	132,912	64.6
Colorado	Colorado & Wyoming; Denver& Rio Grande	82,577	81,376	101.5
Georgia	Central of Georgia	7,243	6,943	104.3
Kentucky	Chesapeake & Ohio	71,491		
	Louisville & Nashville	29,018		
		100,509	99,442	101.1
New Mexico and Utah.	Atchison, Topeka & Santa Fe; Denver & Rio Grande; El Paso & Southwestern.	172,288	167,601	102.7
Ohio			62,150	
Pennsylvania	Baltimore & Ohio	541,202		
	Buffalo, Rochester & Pittsburgh	84,617		
	Ligonier Valley	6,307		
	Monongahela	995,557		
	Pennsylvania	2,187,355		
	Pittsburgh & Lake Erie; Buffalo & Susquehanna.	273,080		
	Huntingdon & Broad Top Mountain; Washington Run.	115,563		
		4,203,681	4,466,105	94.1
Tennessee	Nashville, Chattanooga & St. Louis	11,060		
	Southern	10,406		
		21,466	28,005	76.6
Virginia	Interstate	220,065		
	Louisville & Nashville	317		
	Norfolk & Western	49,963		
	Southern	317		
		270,662	280,476	96.5
Washington	Northern Pacific	3,495	3,495	100.0
West Virginia	Baltimore & Ohio	24,673		
	Chesapeake & Ohio	51,664		
	Norfolk & Western	93,761		
	Western Maryland	3,888		
	Kanawha & Michigan; Morgantown & Kingwood.	24,327		
		198,313	209,537	94.6
	Total railroad shipments	5,146,128		
	Total waterway shipments (Monongahela River, Pa.).	185,000		
	Grand total	5,331,128	5,538,042	92.9

[a]Excess of shipments over production represents inclusion of screenings or withdrawal from stock.
[b]Revised figures.

TABLE 39.—*Beehive coke loaded for shipment on originating railroads and waterways in the United States in 1920 and 1921, by routes, in net tons.*

Route.	State.	Quantity. By States.	Quantity. Total.	Percentage of total.
1920.				
Railroads:				
Atchison, Topeka & Santa Fe; El Paso & Southwestern.	New Mexico	253,245	253,245	1.3
Baltimore & Ohio	Pennsylvania	1,607,235	1,927,858	10.1
	West Virginia	320,623		
Buffalo & Susquehanna; Huntingdon & Broad Top Mountain; Reynoldsville & Falls Creek; Washington Run.	Pennsylvania	764,305	764,305	4.0
Buffalo, Rochester & Pittsburgh	do	127,091	127,091	.7
Central of Georgia	Georgia	16,489	16,489	.1
Chesapeake & Ohio	Kentucky	122,829	327,463	1.7
	Virginia	13,798		
	West Virginia	190,836		
Colorado & Wyoming; Denver & Rio Grande.	Colorado and Utah	509,102	509,102	2.7
Interstate	Virginia	559,210	559,210	2.9
Kanawha & Michigan; Morgantown & Kingwood.	West Virginia	269,053	269,053	1.4
Ligonier Valley	Pennsylvania	278,126	278,126	1.4
Louisville & Nashville	Alabama	244,095	486,627	2.6
	Virginia	92,239		
	Kentucky and Tennessee.	150,293		
Monongahela	Pennsylvania	3,291,857	3,291,857	17.3
Nashville, Chattanooga & St. Louis	Tennessee	27,651	27,651	.1
Norfolk & Western	Virginia	280,123	828,822	4.4
	West Virginia	548,699		
Northern Pacific	Washington	33,111	33,111	.2
Pennsylvania	Pennsylvania	8,133,935	8,133,935	42.8
Pittsburgh & Lake Erie	do	609,677	609,677	3.2
St. Louis-San Francisco	Alabama	16,880	16,880	.1
Southern	do	103,405	213,495	1.1
	Tennessee	23,810		
	Virginia	86,280		
Western Maryland	West Virginia	52,991	52,991	.3
Total railroad shipments		18,726,988	18,726,988	98.4
Waterways: Monongahela River	Pennsylvania	[a] 297,057	[a] 297,057	1.6
Grand total		[a] 19,024,045	[a] 19,024,045	100.0
1921.				
Railroads:				
Atchison, Topeka & Santa Fe; El Paso & Southwestern.	New Mexico	18,169	18,169	.4
Baltimore & Ohio	Pennsylvania	541,202	565,875	10.6
	West Virginia	24,673		
Buffalo & Susquehanna; Huntingdon & Broad Top Mountain; Washington Run.	Pennsylvania	241,949	241,949	4.5
Buffalo, Rochester & Pittsburgh	do	84,617	84,617	1.6
Central of Georgia	Georgia	7,243	7,243	.1
Chesapeake & Ohio	Kentucky	71,491	123,155	2.3
	West Virginia	51,664		
Colorado & Wyoming; Denver & Rio Grande.	Colorado and Utah	236,696	236,696	4.4
Interstate	Virginia	220,065	220,065	4.1
Kanawha & Michigan; Morgantown & Kingwood.	West Virginia	24,327	24,327	.5
Ligonier Valley	Pennsylvania	6,307	6,307	.1
Louisville & Nashville	Alabama	63,133	92,468	1.7
	Kentucky	29,018		
	Virginia	317		
Monongahela	Pennsylvania	995,557	995,557	18.7
Nashville, Chattanooga & St. Louis	Tennessee	11,060	11,060	.2
Norfolk & Western	Virginia	49,963	143,724	2.7
	West Virginia	93,761		
Northern Pacific	Washington	3,495	3,495	.1
Pennsylvania	Pennsylvania	2,187,355	2,187,355	41.0
Pittsburgh & Lake Erie	do	146,694	146,694	2.8
Southern	Alabama	22,761	33,484	.6
	Tennessee	10,406		
	Virginia	317		
Western Maryland	West Virginia	3,888	3,888	.1
Total railroad shipments		5,146,128	5,146,128	96.5
Waterways: Monongahela River	Pennsylvania	185,000	185,000	3.5
Grand total		5,331,128	5,331,128	100.0

[a] Revised figures.

The relative freight rates on coke and on coal have received considerable attention lately. The rate per ton is higher for coke than for coal, partly because coke is bulkier per unit of weight. The average carload of bituminous coal weighs close to 50 tons; the average carload of coke, about 35 tons. It is being argued that the principle termed "coking in transit" should be adopted for coke, just as the principle termed "milling in transit" has been adopted for grain and cereal products. At present the transportation of raw coal from the mine to the by-product coke plant and the transportation of the finished coke from the plant to the point of consumption are viewed as separate hauls or movements. The principle of "coking in transit" would regard them as two phases of a single movement, and the transportation charge would be the through rate on raw coal from the mine to the ultimate destination of the coke, with due adjustment for that part of the haul in which the shipment moved as coke between the coke plant and the ultimate destination. If adopted, it is argued, "coking in transit" would permit the establishment of ovens at points favorable for regular labor supply and for maximum demand for by-products, instead of at points near the market for coke, the location encouraged by the present freight-rate structure. The question of relative advantage in freight rates, it should be noted, lies quite as much between beehive and by-product coke as between bituminous coal and coke.

WORLD'S PRODUCTION.

In other countries as well as in the United States the coke industry is closely related to the manufacture of pig iron, and hence coke is made in most countries that produce iron. Table 40, prepared by Miss W. I. Whiteside, of the Geological Survey, presents the available statistics of production for each of the principal producing countries of the world for the two years 1920 and 1921. In the preparation of this table trade sources of information have been consulted only where official publications are not to be had. It is evident that in a few other countries there was a marked decline of coke production from 1920 to 1921, but none of the world's principal producers except the United Kingdom have shown as great a decline as the United States. In fact, in 1921 the United States for the first time in more than 10 years ranked second as a producer, Germany taking first place. The United Kingdom and Belgium retained third and fourth places, respectively.

TABLE 40.—*Coke produced in the principal countries of the world, 1920–1921, in metric tons.*

[Gas-house coke not included.]

Country.	1920	1921	Country.	1920	1921
Australia (New South Wales)	576,678	601,600	Italy	95,727	50,000
Belgium	1,835,400	1,402,540	Japan [c]	67,106	(a)
British India	365,465	(a)	Netherlands	138,987	228,605
Canada	1,203,991	(a)	Rhodesia (southern)	94,526	116,316
China	(a)	(a)	Russia (Donetz basin)	10,000	104,016
Czechoslovakia	1,431,267	(a)	Spain	280,717	446,087
France	782,334	744,756	Union of South Africa	20,813	22,638
Germany [b]	25,416,676	28,098,386	United Kingdom [d]	12,813,845	4,649,057
Hungary	(a)	(a)	United States	46,579,196	22,940,425

[a] Data not available. [b] Includes Saar district. [c] Natural coke.
[d] In Great Britain the production of gas-house coke, not included above, is especially important, and was as follows: 1920, 8,440,471 metric tons; 1921, 6,907,608 tons.

BY-PRODUCTS.

GENERAL FEATURES.

Although the total output of coke in 1921 was less than 50 per cent of that in 1920, the decrease was mainly in beehive coke and therefore was not reflected in the output of by-products. The output of by-product coke and hence that of by-products was approximately two-thirds that of 1920.

The by-products obtained in the manufacture of coke in by-product ovens have represented constantly increasing percentages of the total value of the products from these ovens. In 1921 the sum realized from the sale of such by-products was about $60,000,000, twice the estimated value of the beehive coke produced during that year and more than half of the value of the by-product coke. Thus approximately one-third of the total income of the by-product coke companies came from the sale of the by-products.

The total receipts from the sale of by-products in 1921 were about two-thirds as much as in 1920, but this decrease was due to the decrease in quantity produced and sold, for the average income from the sale of by-products per ton of coke produced was exactly the same in 1921 as in 1920. Table 41 gives the principal data on the output and sales of by-products in the two years.

TABLE 41.—*By-products obtained from coke-oven operations in the United States in 1920 and 1921.*

Product.	Production.	Sales.		
		Quantity.	Value.	
			Total.	Average.
1920.				
Tar..........gallons..	360,664,124	174,363,696	$6,378,040	$0.037
Ammonia:				
Sulphate..........pounds..	675,816,486	626,013,975	27,110,260	.043
Ammonia liquor (NH_3 content)..........do....	65,777,259	62,076,772	8,585,173	.138
Other forms (NH_3 content)..........do....	....	....	....	....
Sulphate equivalent of all forms..........do....	(938,925,522)	(874,321,063)	35,695,433	.041
Gas:				
Distributed through city mains..M cubic feet..	a476,485,744	53,220,824	15,716,888	.295
Used in steel or affiliated plants..........do....		151,764,807	14,301,095	.094
Used under boilers, etc..........do....		25,430,288	2,216,335	.087
	a476,485,744	230,415,919	32,234,318	.140
Light oil and derivatives:				
Crude light oil..........gallons..	b109,709,915	1,067,045	126,158	.118
Benzol, crude..........do....	8,747,572	1,510,420	401,296	.266
refined..........do....	16,977,556	15,720,356	4,096,527	.260
Motor fuel c..........do....	57,645,462	55,764,265	12,644,931	.227
Toluol, crude..........do....	287,142	....	....	....
refined..........do....	2,710,649	2,470,364	740,722	.300
Solvent naphtha..........do....	5,678,525	4,695,464	851,048	.181
	92,046,906	81,227,914	18,860,682	.232
Naphthalene:				
Crude..........pounds..	11,246,807	11,507,703	307,999	.027
Refined..........do....	2,921,282	2,941,059	179,975	.061
	14,168,089	14,448,762	487,974	.034
Other products d..........	....	....	36,317	....
Value of all by-products sold..........	....	....	93,692,764	....

a Includes gas wasted and gas used for heating retorts.
b Of this quantity, crude light oil refined on the premises amounted to 106,564,417 gallons.
c The benzol content of motor fuel ranged from 50 to 100 per cent.
d Includes coal-tar oil, crude heavy solvent, carbon, and pyridin oil.

TABLE 41.—*By-products obtained from coke-oven operations in the United States in 1920 and 1921*—Continued.

Product.	Production.	Sales. Quantity.	Sales. Value. Total.	Sales. Value. Average.
1921.				
Tar .... gallons..	253,051,649	135,293,047	$5,645,309	$0.042
Ammonia:				
Sulphate .... pounds..	528,638,763	530,041,716	13,100,703	.025
Ammonia liquor (NH_3 content) .... do....	31,899,398	35,102,561	3,515,416	.100
Other forms (NH_3 content) .... do....	191,162	53,993	10,135	.188
Sulphate equivalent of all forms .... do....	(657,001,003)	(670,667,932)	16,626,254	....
Gas:				
Used under boilers, etc .... M cubic feet..	a310,188,713	12,122,777	1,120,087	.092
Used in steel or affiliated plants .... do....		98,352,049	10,593,204	.108
Distributed through city mains .... do....		43,826,172	14,249,961	.325
	a310,188,713	154,300,998	25,963,252	.168
Light oil and derivatives:				
Crude light oil .... gallons..	e76,917,269	2,433,078	240,111	.099
Benzol, crude .... do....	1,494,329	1,536,312	343,463	.224
refined .... do....	4,912,131	5,302,709	1,268,258	.239
Motor benzol .... do....	48,052,882	50,022,573	8,966,686	.179
Toluol, crude .... do....	26,529	26,529	4,410	.166
refined .... do....	942,982	808,964	228,968	.283
Solvent naphtha .... do....	3,822,776	2,881,656	510,509	.177
Other miscellaneous products .... do....	590,173	291,635	12,310	.042
	59,841,802	63,303,456	11,574,715	.183
Naphthalene:				
Crude .... pounds..	2,827,756	1,652,466	40,659	.025
Refined .... do....	115,229	331,057	18,676	.056
	2,942,985	1,983,523	59,335	.030
Other products	....	....	121,813	....
Value of all by-products sold	....	....	59,990,678	....

a Includes gas wasted and gas used for heating retorts.
e Of this amount 75,760,334 gallons were refined on the premises to make the derived products listed.

In 1921, as in preceding years, the output of by-products, except gas, from coke plants was much greater than the output of the corresponding products in manufactured-gas works making coal gas, water gas, and oil gas. Of course much more gas is sold for public-utility distribution from gas works than from coke-oven plants. The Geological Survey has no data on the operations of gas works in 1921, but the Bureau of the Census made a canvass of the industry and will probably issue a report on it.

The output of by-products has increased more rapidly than that of by-product coke, because improved oven construction, improved operating methods, and greater market demands have led to a marked increase in the yield of by-products per ton of coal carbonized, especially during the last 10 years, though since 1917 the yield of by-products per ton of coal charged has not changed greatly.

The yield of coke per ton of coal fluctuates appreciably with changing market conditions, which make it desirable to use coal containing greater or lesser percentages of volatile matter. The production and recovery of tar has increased slightly each year, probably in the main because of its greater market value, which has made care in its recovery more worth while. Increasing attention to proper distribution of heat in coke ovens has also improved the yield of tar, ammonium sulphate, and light oil, and in 1921 slightly higher yields of each of these products were recorded than in any previous year. The yield of gas per ton of coal carbonized was the same as in 1920, but the quantity available as surplus was slightly greater, probably because of slack metallurgical demand quite as much as because of improved operating practice. The quantity of gas used in heating the ovens decreased from 5.4 to 5.1 M cubic feet per ton of coal charged, but this decrease probably resulted from continued operation of the more efficient ovens and lessened operation of the older and less efficient plants rather than from any marked change in the practice at individual plants. Data for several recent years given in Table 42 show the average yields of the several by-products in all the by-products ovens in the United States.

TABLE 42.—*Average yield of coke and by-products per net ton of coal charged in by-product ovens in the United States, 1915, 1918, 1920, and 1921.*

Product.	1915	1918	1920	1921
Coke ... pounds..	1,440	1,410	1,395	1,376
Tar ... gallons..	7.1	7.1	8.2	8.8
Ammonium sulphate (or equivalent) ... pounds..	20.1	18.9	21.4	22.8
Light oil ... gallons..	1.54	2.4	2.7	2.8
Gas:				
Total ... M cubic feet..	11.0	10.4	10.8	10.8
Surplus sold or used ... do....	4.3	4.3	5.2	5.4
Burned in coking process ... do....	6.3	5.7	5.4	5.1
Wasted ... do....	.4	.4	.2	.3

All available data for the principal by-products are plotted in the curves of figure 40. These show the gradual increase in output of the principal products, in striking contrast with the sudden increase in output of light oil that resulted from the war-time demands for toluol, benzol, and other derivatives. The number of plants indicated in the chart is the total number in existence in the United States, whether they recover all by-products or not.

The receipts from sales of by-products can best be measured in terms of the income per ton of coke produced or per ton of coal charged. The former unit has been used in Table 43, which shows some very marked differences between 1920 and 1921. The income from the sale of ammonia compounds decreased by 32 cents per ton of coke produced, largely because of the great reduction in the market value of ammonium sulphate. The prices of this fertilizer constituent reached lower levels in 1921 than at any previous time in the recent history of the by-product business. Some so-called "distress sales" were made at prices between one-half and two-thirds those which had generally prevailed. Some sales were reported at about \$35 to \$40 per ton of ammonium sulphate, figures which are comparable with \$25 to \$30 per ton of Chilean nitrate when the two products are considered on the nitrogen-equivalent basis. The average price of Chilean nitrate in 1921 was about \$50 a ton at New York.

The income from light oil and its derivatives was 2 cents less per ton of coke produced in 1921 than in 1920, but it was higher than in any pre-war year. A slight increase was recorded in the income from tar, though because of the shortage of coal in 1920 more tar was used about the works than usual, and therefore less was sold, so that the receipts for the two years are not strictly comparable. The greatest increase in receipts from sales of by-products came through a gain in the value of gas sold, which was due in part to increasing unit value per M cubic feet, but more particularly to the

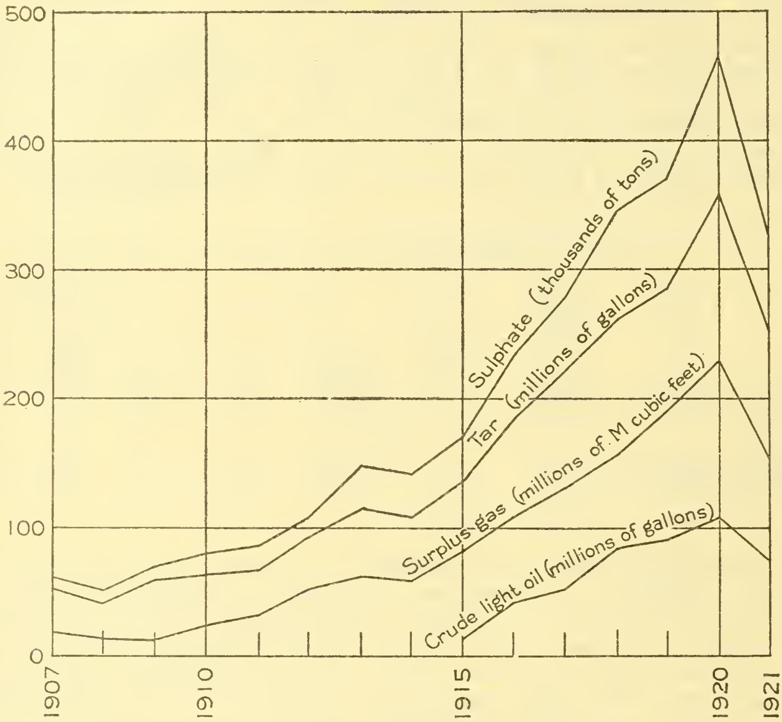


FIGURE 40.—By-products produced at coke plants, 1907–1921.

fact that during 1921 the coke plants connected with steel works were more seriously affected by the business depression than the plants that supply gas in greater ratio for municipal distribution.

TABLE 43.—*Receipts from sales of by-products per ton of coke produced in the United States, 1915, 1918, 1920, and 1921.*

Product.	1915	1918	1920	1921
Ammonia or its compounds	$0.70	$1.02	$1.16	$0.84
Light oil and its derivatives	.52	.99	.61	.59
Surplus gas sold or used	.61	.53	1.05	1.31
Tar	.25	.24	.21	.29
Miscellaneous products	.03	.09	.01	.01
	2.11	2.87	3.04	3.04

The by-product coke industry is intimately related with a number of other industries. Its relations with the anthracite and domestic fuel industry, the metallurgical industry, and the gas industry have already been pointed out. Similar relations exist between the by-product part of the industry and a number of chemical industries. The ammonia compounds produced in coke ovens represent one of the important sources of nitrogen-bearing fertilizer materials and supply ammonia for the refrigeration industry and for the manufacture of numerous chemical compounds of commercial importance. The products made by refining light oil are coming to have increasing importance in making "blended" motor fuels, and they will continue to have a very large place in the field of "intermediates" for the manufacture of dyestuffs and other organic chemicals. Tar has in the past represented a raw material for many refined products and organic chemicals, but the quantities of tar produced during recent years have been so great that only a small part of it has been refined, and it has become more and more a factor in the fuel market, being used both as a liquid fuel and as a binder in briquets. The quantities refined continue to be large, although they are smaller percentages of the total produced, as the quantities produced have increased also.

Very frequently optimistic persons have undertaken to estimate the tremendous advantage to the country if all the bituminous coal produced could be carbonized in by-product ovens and all the possible by-products saved. These estimates have contributed largely to a recognition of the wastefulness in burning the raw coal and have made clear the economic importance of further development of by-product coke ovens, but they have also encouraged rather extravagant ideas as to the rate at which this development can go on. If all the bituminous coal ordinarily produced in the United States were carbonized and the by-products recovered, ten or twelve times as much coke-oven tar, ammonium sulphate, and other derived products as were produced in 1921 would be poured into the markets, which could not absorb so great a quantity unless the change were made gradually over a long period of years.

Obviously the happy medium between wasteful coal utilization and too rapid development of the coke industry is at the point of maximum yield of coke and by-products that the markets can readily absorb at prices that permit a profit. If a price for coke comparable with its value as a substitute for anthracite were assured, and if approximately $3 could be realized from the sale of by-products for each ton of coke produced, then the construction of many more by-product ovens might safely go forward. Expectation of success in such an advance must be based on the further development of the demand for household coke and the substitution of coke by-products for other more expensive commodities. Tar can be used as a liquid fuel, gas for public-utility supply, light oil as a motor fuel, and ammonium sulphate in place of Chilean nitrate for fertilizers. But any development of this sort must and will be made gradually.

TAR.

In the carbonization of coal in a by-product oven much of the volatile matter driven off from the coal leaves the oven in the form of condensable vapor. Most of this vapor condenses very quickly after it leaves the heated oven space, dropping to form tar, of which it constitutes the heavier part. The remainder of the vapor gradually condenses and drops out of the crude gas as it is cooled down in the condensers and washing apparatus, and this forms the lighter portions of the tar. All the tar thus collected in the different parts of the works runs to sumps, from which it is pumped into storage tanks.

The tar formed in a coke oven is very similar to coal tar made in a coal-gas works. It lends itself to all the refining operations and to the production of many organic derivatives for which coal tar has become famous. One of the principal sources of these derivatives is now coke-oven tar, though formerly coal-gas tar was the sole source.

Tables 44 to 47 give data showing the production and sales of coke-oven tar during 1920 and 1921, the yield of tar per ton of coal carbonized, the average value of the tar sold, and the unit value of the sales in various plants.

TABLE 44.—*Coke-oven tar produced and sold in the United States in 1920 and 1921.*

State.	Produced (gallons).		Sold.		
	Total.	Per ton of coal coked.[a]	Gallons.	Value.	
				Total.	Average.
1920.					
Alabama	35,583,000		24,079,479	$649,989	$0.027
Colorado	7,256,000		103,984	(b)	(b)
Illinois	19,238,065		15,258,992	561,721	.037
Indiana	41,631,320		6,558,123	268,395	.041
Kentucky	4,924,439		5,554,819	(b)	(b)
Maryland	7,225,191				
Massachusetts	5,184,164		4,894,946	(b)	(b)
Michigan	15,161,169		11,141,320	543,652	.049
Minnesota	7,204,182		4,949,945	176,973	.036
New Jersey	10,642,804		10,595,050	(b)	(b)
New York	11,872,911		12,017,344	504,258	.042
Ohio	67,881,776		41,620,072	1,456,296	.035
Pennsylvania	106,862,576		17,693,346	726,441	.041
Tennessee	1,329,798		1,297,794	(b)	(b)
Washington	310,655		309,965	15,498	.050
West Virginia	6,147,946		5,941,230	190,163	.032
Missouri, Rhode Island, and Wisconsin	12,208,128		12,347,287	441,053	.036
Undistributed				843,601	.038
	360,664,124	8.2	174,363,696	6,378,040	.037
1921.					
Alabama	31,676,344	9.1	17,433,692	519,668	.030
Colorado	4,242,625	11.7	420	(b)	(b)
Illinois	15,207,037	7.8	11,712,806	529,923	.045
Indiana	25,181,776	5.8	7,112,033	261,505	.037
Kentucky	1,838,747	7.1	1,963,831	84,583	.043
Maryland	3,222,805	8.1	222,493	(b)	(b)
Massachusetts	3,163,615	8.0	2,668,748	(b)	(b)
Michigan	8,627,470	7.2	4,159,301	232,526	.056
Minnesota	5,402,735	8.6	4,234,807	204,679	.048
New Jersey	11,484,716	10.8	11,453,017	(b)	(b)
New York	10,359,063	9.4	9,388,966	362,197	.039
Ohio	40,338,633	9.2	24,769,152	1,165,425	.047
Pennsylvania	80,595,363	10.2	28,270,055	1,100,130	.039
Tennessee	692,282	8.7	817,984	16,937	.021
Washington	308,094	7.1	297,705	21,018	.071
West Virginia	2,981,118	10.7	3,055,810	126,678	.041
Missouri, Rhode Island, and Wisconsin	7,729,226	8.3	7,732,227	344,826	.045
Undistributed				675,214	.047
	253,051,649	8.8	135,293,047	5,645,309	.042

[a] 1920, figures by States not available.
[b] Included under "Undistributed."

The average yield of tar per ton of coal carbonized in 1921 was 8.8 gallons, the highest yet recorded. However, the yield varies greatly from plant to plant, depending upon the kind of coal, temperature of oven operation, completeness of tar recovery, and other factors. In general it is about 9 or 10 gallons of tar per ton of coal carbonized in modern plants using the average grades of coal that are selected for by-product coke manufacture. However, in a few plants very much higher yields are obtained, and in the older ovens that are operated with higher temperature in the upper section of the oven the yield is commonly not as great.

For convenience of consideration of by-product data the by-product coke-oven plants have been divided into two groups—those that make furnace coke or are affiliated with iron or steel plants, and those that sell less than half of the coke they produce for blast-furnace use. These groups are designated respectively furnace plants and merchant plants. The number within each group producing various yields of tar is shown in Table 45, which indicates that there is no striking difference in tar yield between plants of the two groups. The average yield of tar is slightly greater in furnace plants, but this is probably accidental. The large yield of more than 11 gallons of tar per ton of coal coked in eight plants in this group is probably due to the fact that a number of such plants are using coal unusually high in volatile matter in ovens of the most modern type.

TABLE 45.—*Yield of tar from coke-oven plants in 1921.*

	Furnace plants.	Merchant plants.	Total.
Total production of tar.....gallons..	214,943,192	38,108,457	253,051,649
Yield obtained per ton of coal coked:			
At plant reporting minimum average yield.....do....	5.1	5.7	5.1
At plant reporting maximum average yield.....do....	17.0	10.9	17.0
At average plant [a].....do....	8.9	8.5	8.8
Average yield for all coal coked [b].....do....	.....	.....	8.8
Total number of plants producing tar.....	48	19	67
Number producing—			
Less than 7 gallons of tar per ton of coal.....	8	3	11
7–7.99 gallons.....	9	3	12
8–8.99 gallons.....	5	6	11
9–9,99 gallons.....	11	5	16
10–10.99 gallons.....	7	2	9
11–11.99 gallons.....	4	.....	4
12 gallons or more.....	4	.....	4

[a] Sum of averages for all plants divided by number of plants.
[b] Total tar recovered at all plants divided by number of tons of coal coked.

A little more than half of the 253,000,000 gallons of tar produced in the United States during 1921 was sold; practically all of the remainder was used in making steam or in open-hearth or other metallurgical heating operations at affiliated steel or furnace plants. Table 46 shows that very little of the tar produced in merchant plants was employed as fuel, most of it being sold or put in stock. The difference between the total tar sold and used and the total production shown by Table 46 represents the net quantity that was thus put in stock or removed from stock during the year. More than 1,000,000 gallons went into stock at merchant plants, but nearly 7,000,000 gallons of tar was taken out of stock at furnace plants.

TABLE 46.—*Disposal of coke-oven tar produced in the United States in 1921.*

	Furnace plants.	Merchant plants.	Total.
Sold	102,339,450	32,953,597	135,293,047
Used:			
As fuel under boilers	23,088,924	1,519,428	24,608,352
In open-hearth or other metallurgical plants	96,428,775	2,518,302	98,947,077

The average value of all tar sold during 1921 was 4.2 cents a gallon, a gain of 0.5 cent as compared with 1920 and of 1.0 cent as compared with 1918 and 1919. The number of plants in each of the two groups obtaining various prices for tar is shown by Table 47. The maximum price for tar sold was more than 10 times the minimum, but most companies obtain between 3 and 5 cents a gallon on the average throughout the year. Only two plants obtained more than 7 cents a gallon. The data showing the average value of tar sold do not all relate to money transactions, for a number of coke plants affiliated with metallurgical works simply pump their tar into storage tanks from which it is drawn for open-hearth furnaces or other metallurgical heating operations. Under such conditions the value credited to the coke plant is simply a cost-keeping value between two subsidiaries of the same parent corporation, and is usually determined on the basis of the cost of coal of equivalent fuel value delivered at the metallurgical plant. Thus, if a gallon of tar is equal to 1.5 pounds of coal the coke plant gets credit for the cost of only this much coal in the bunkers of the metallurgical plant. At such plants coal is usually very cheap, and hence the tar credits are really far below what would be the market value of the tar in most industrial districts if it were actually sold for refining or for firing boilers. This system of cost-keeping accounts for the fact that much of the tar is credited at less than 5 cents a gallon, although in most localities it is worth at least that much for the replacement of coal. The average value of the tar at merchant plants is distinctly higher than the average at furnace plants, probably because a larger proportion of the tar produced at merchant plants is sold and not credited according to this system of cost keeping.

Further development of coke-oven tar markets and a corresponding increase in the utilization of tar as fuel is expected through the substitution of coke-oven tar for other liquid fuels, such as petroleum products, which are now increasing in price. The development of the Diesel type of engine promises to make some of the products of crude tar more valuable, thereby resulting in a greater use of tar for refining. If the use of tar oil in Diesel engines is extended then a greater recovery of light oil from crude tar may also be expected.

TABLE 47.—*Unit value of tar sold in 1921.*

	Furnace plants.	Merchant plants.	Total.
Total receipts from sales of tar	$4,083,219	$1,562,090	$5,645,309
Average receipts per gallon:			
At plant reporting maximum average realization	$0.150	$0.071	$0.150
At plant reporting minimum average realization	.013	.028	.013
At average plant [a]	.043	.049	.045
Average for all tar sold [b]	.040	.047	.042
Number of plants reporting sales of tar	44	18	62
Number of plants receiving—			
Less than 2 cents a gallon	1		1
2–2.99 cents	3	1	4
3–3.99 cents	14	3	17
4–4.99 cents	15	4	19
5–5.99 cents	8	7	15
6–6.99 cents	2	2	4
7 cents or more	1	1	2

[a] Sum of averages for all plants divided by number of plants.
[b] Total value of sales divided by number of gallons sold.

AMMONIA AND ITS COMPOUNDS.

During the coking process much of the nitrogen in the coal is converted into ammonia, which is present in the crude gas as it leaves the ovens and is removed either by washing the gas thoroughly with water or by bubbling the gas through diluted solutions of sulphuric acid. The latter process is known as the "direct-recovery process," for it yields ammonium sulphate directly. The ammonia that is removed from the gas by washing with water forms an ammonia liquor, which is then concentrated and subsequently distilled with lime for the recovery of the ammonia. The production of ammonia as ammonium sulphate or as ammonia liquor is separately reported.

Table 48 gives by States the quantities of ammonia produced as sulphate and as ammonia liquor, together with the sulphate equivalent of these two and of the small quantity of ammonia recovered as ammonium chloride, also the average yield in pounds of sulphate equivalent per ton of coal coked.

TABLE 48.—*Ammonia produced at coke-oven plants in the United States in 1921, in pounds.*

State.	Sulphate.	Liquor (NH_3 content).	Sulphate equivalent of all forms.	
			Total.	Per ton of coal coked.
Alabama	69,523,655	2,979,586	81,441,999	23.4
Colorado	9,562,365		9,562,365	22.9
Illinois	36,238,895	1,483,161	42,171,539	21.6
Indiana	53,864,918	7,297,078	83,053,230	19.1
Kentucky	636,018	1,212,113	5,484,470	21.3
Maryland	9,236,317		9,236,317	23.4
Massachusetts	8,593,000		8,593,000	21.5
Michigan	15,987,579	2,936,520	27,733,659	23.0
Minnesota	10,155,195	754,762	13,174,243	20.9
New Jersey	19,516,224	1,722,763	26,407,276	24.8
New York	16,047,030	1,968,102	23,919,438	21.8
Ohio	99,416,675	2,312,736	108,667,619	24.8
Pennsylvania	172,495,704	[a] 3,440,243	186,256,676	23.7
Tennessee	1,962,568		1,962,568	24.6
Washington		287,436	1,149,744	26.4
West Virginia	5,402,620	343,281	6,775,744	24.4
Missouri, Rhode Island, and Wisconsin		5,352,779	21,411,116	22.3
	528,638,763	[a] 32,090,560	657,001,003	22.8

[a] Includes a small quantity of "other forms" of ammonia.

The disposition of the ammonia from by-product coke-oven plants is shown in Table 49. The difference between the sales there recorded and the production represents the net changes in stock during the year. That table also includes, for each of the States reporting sales, the average value per pound of sulphate or per pound of NH_3 content of the liquor. Corresponding data in so far as they are available for 1920 are given in Table 50.

TABLE 49.—*Ammonia sold by coke-oven plants in the United States in 1921.*

State.	Sulphate.			Liquor (NH_3 content).			Total (sulphate equivalent of all forms).	
	Pounds.	Value.		Pounds.	Value.		Pounds.	Value.
		Total.	Average.		Total.	Average.		
Alabama	70,469,331	$1,882,122	$0.027	3,456,815	$316,778	$0.092	84,296,591	$2,198,900
Colorado	12,331,806	(a)	(a)				12,331,806	(a)
Illinois	30,646,742	814,846	.027	1,576,010	142,662	.090	36,950,782	957,508
Indiana	55,638,401	1,129,351	.020	7,848,972	725,844	.092	87,034,289	1,855,195
Kentucky				1,560,020	187,119	.120	6,240,080	187,119
Maryland	11,881,184	(a)	(a)				11,881,184	(a)
Massachusetts	10,068,800	(a)	(a)				10,068,800	(a)
Michigan	15,844,037	356,444	.022	3,504,735	491,613	.140	29,862,977	848,057
Minnesota	9,878,100	179,729	.018	782,076	72,954	.093	13,006,404	252,683
New Jersey	17,448,263	(a)	(a)	1,740,122	(a)	(a)	24,408,751	(a)
New York	13,997,015	359,599	.026	1,947,668	212,678	.109	21,787,687	572,277
Ohio	93,937,871	2,381,644	.025	2,969,873	268,142	.090	105,817,363	2,649,786
Pennsylvania	181,084,347	4,481,799	.025	[b] 3,540,666	[b] 311,224	.088	195,247,011	4,793,023
Tennessee	1,751,200	51,389	.029				1,751,200	51,389
Washington				291,483	28,335	.097	1,165,932	28,335
West Virginia	5,064,619	140,299	.028	362,561	(a)	(a)	6,514,863	196,935
Missouri, Rhode Island, and Wisconsin				5,575,553	541,639	.097	22,302,212	541,639
Undistributed		1,323,481	.026		226,563	.108		1,493,408
	530,041,716	13,100,703	.025	[b] 35,156,554	3,525,551	.100	670,667,932	16,626,254

[a] Included under "Undistributed." [b] Includes a small quantity of "other forms" of ammonia.

TABLE 50.—*Ammonium sulphate (equivalent) produced and sold at coke-oven plants in the United States in 1920.*

State.	Produced (pounds).	Sold.	
		Pounds.	Value.
Alabama	94,420,775	89,739,872	$3,858,414
Colorado	15,909,157	13,149,074	(a)
Illinois	58,617,540	55,156,896	2,094,393
Indiana	123,474,952	117,624,629	4,164,654
Kentucky	13,488,420	12,179,868	(a)
Maryland	19,226,789	16,323,821	(a)
Massachusetts	11,705,800	10,502,400	(a)
Michigan	43,207,928	37,397,141	1,654,056
Minnesota	18,753,550	17,286,929	740,032
New Jersey	27,775,469	26,706,133	(a)
New York	25,746,016	25,947,796	1,128,658
Ohio	191,678,808	176,949,169	7,216,295
Pennsylvania	242,308,762	225,692,473	9,782,184
Tennessee	3,486,408	2,705,025	(a)
Washington	1,490,788	1,473,988	36,739
West Virginia	14,628,452	11,992,745	529,411
Missouri, Rhode Island, and Wisconsin	33,005,908	33,493,104	1,012,416
Undistributed			3,478,181
	938,925,522	874,321,063	35,695,433

[a] Included under "Undistributed."

The average yield of ammonia figured as equivalent ammonium sulphate was 22.8 pounds per ton of coal carbonized during 1921, an average 1.4 pounds greater than in 1920 and by far the highest average yield ever attained in recent years. The fact that coke ovens were operating under conditions favorable for the maintenance of low temperature probably accounts in part for the increased output of ammonia, but it is due also to the facts that coal of good quality was generally available and that the older, less efficient plants were generally running at low percentages of their capacity. The range in the yield of ammonia per ton of coal carbonized is shown in Table 51. Plants reporting less than 15 pounds of sulphate per ton of coal carbonized are very few and are chiefly older plants that are not well designed for the most efficient recovery of by-products. In general the yield of ammonia at a modern, well-operated plant with normal coal supply will be from 22 to 28 pounds of sulphate or its equivalent per ton of coal carbonized.

TABLE 51.—*Yield of ammonium sulphate equivalent reported by coke-oven plants in 1921.*

Total ammonium sulphate or equivalent recovered .... pounds..	657,001,003
Yield of sulphate per ton of coal coked:	
At plant reporting minimum average yield ...... do....	3.6
At plant reporting maximum average yield ..... do....	30.3
At average plant [a] .... do....	21.9
Average yield for all coal coked [b] .... do....	22.8
Total number of plants reporting recovery of ammonia.....	67
Number of plants recovering—	
Less than 10 pounds per ton of coal........	2
10–14.9 pounds........	2
15–19.9 pounds........	14
20–21.9 pounds........	11
22–23.9 pounds........	13
24–25.9 pounds........	15
26–27.9 pounds........	3
28–29.9 pounds........	6
30 pounds or more........	1

[a] Sum of averages for all plants divided by number of plants.
[b] Total yield in sulphate equivalent divided by number of tons of coal carbonized.

The number of plants reporting the production of sulphate during 1921 was 52; the number producing and selling ammonia liquor was 34; these counts include 19 plants that produced both sulphate and liquor. The only plant reporting the production of ammonia in any other form than ammonium sulphate or ammonia liquor in 1921 was the Carnegie Steel Co., of Clairton, Pa., which reported the production of some ammonium chloride. No plants reported either production or sale of anhydrous ammonia in 1921.

The average sum received for by-product ammonia sold in the United States in 1921 was less than two-thirds the average in 1920, being only 2.5 cents per pound of ammonium sulphate equivalent. Of the 51 plants reporting sales of sulphate a number received less than 2 cents a pound, which is far below normal market prices. This condition resulted from the great depression in the agricultural industries, which made the demand for fertilizer materials much less than at any time for several years preceding. As a consequence many stocks of sulphate were sold at extremely low figures.

TABLE 52.—*Unit value of ammonium sulphate sold in 1921.*

Total sales of sulphate .... pounds..	530,041,716
Total value of sales	$13,100,703
Average receipts per pound:	
At plant reporting minimum average receipts	$0.015
At plant reporting maximum average receipts	.036
At average plant [a]	.029
Average for all sulphate sold [b]	.025
Total number of plants reporting sales of sulphate	51
Number of plants receiving:	
Less than 2 cents a pound	4
2–2.19 cents	2
2.2–2.39 cents	4
2.4–2.59 cents	11
2.6–2.79 cents	14
2.8–2.99 cents	12
3.0 cents or more	4

[a] Sum of averages for all plants divided by number of plants.
[b] Total value of sales divided by number of pounds sold.

LIGHT OIL AND ITS DERIVATIVES.

The decrease in the production and sale of light oil and its derivatives from coke-oven plants in 1921 was less than might have been expected from the decrease in the quantity of coke produced, owing to the fact that the average yield of crude light oil per ton of coal carbonized was slightly greater than in any preceding year, being 2.8 gallons.

Table 53 presents data of production, refining, and sales of the crude light oil recovered at coke-oven plants during 1921. The data are presented by States (or groups of States) for the first time in Geological Survey reports.

Of the total crude light oil produced practically all was refined on the premises of the producers in affiliated coke-oven plants, only about 3 per cent of it being sold in the form of crude light oil. It should be stated that Table 53 shows the production according to the State in which the crude light oil was recovered, and the quantity refined according to the State in which the refining was done. Thus the quantity refined in New York was greater than the quantity produced because a considerable quantity was shipped from other States to Syracuse for refining.

TABLE 53.—*Crude light oil produced and sold at coke-oven plants in the United States in 1921.*

State.	Produced (gallons).	Refined on the premises (gallons).	Sold.		
			Gallons.	Value.	
				Total.	Average.
Alabama	9,858,691	9,317,698			
Illinois	4,351,134	3,132,681	1,235,242	$108,009	$0.087
Indiana	11,863,773	11,783,965			
Kentucky	770,996		802,009	82,878	.103
Minnesota	602,769	610,142			
New York	3,405,339	[a] 6,854,435	171,641	26,539	.155
Ohio	14,308,564	14,068,018	201,177	20,118	.100
Pennsylvania	23,868,704	23,356,665	22,090	2,430	.110
Tennessee	305,590	305,590			
West Virginia	956,881	804,170			
Colorado, Missouri, and Wisconsin	3,499,652	3,456,525	719	97	.135
Maryland, Michigan, and New Jersey	3,125,176	2,070,445	200	40	.200
	76,917,269	75,760,334	2,433,078	240,111	.099

[a] Includes crude oil shipped by Solvay plants to the Syracuse refinery.

The principal constituent of crude light oil is benzol, and in general the refining of the light oil is feasible only when the market for crude or refined benzol is favorable. This compound is now being extensively used as a constituent of "blended motor fuel." The data in Table 54 show the extent to which motor benzol and other forms of crude or refined benzol were made and sold during 1921. About two-thirds of the entire output of crude light oil was sold in the form of motor benzol. Much of the crude benzol and some of the refined benzol not reported as motor benzol may also have been used in motor fuel, but the returns to the Geological Survey do not show how much.

TABLE 54.—*Benzol produced and sold in the United States in 1921, by States.*

State.	Produced (gallons).	Sold.		
		Gallons.	Value.	
			Total.	Average.
Crude benzol:				
Alabama	624,677	700,739	$126,218	$0.180
Illinois				
Indiana				
Kentucky				
Minnesota	14,831	100	30	.30
New York	670,974	657,366	170,690	.260
Ohio	162,346	157,017	41,656	.265
Pennsylvania	18,102	18,102	4,412	.244
Tennessee				
West Virginia				
Colorado, Missouri, and Wisconsin	3,399	2,988	457	.153
Maryland, Michigan, and New Jersey				
	1,494,329	1,536,312	343,463	.224
Refined benzol:				
Alabama	112,475	103,499	21,666	.209
Illinois	297,214	297,214	58,174	.196
Indiana	107,075	208,511	44,003	.211
Kentucky				
Minnesota	28,394	29,589	7,879	.266
New York	1,338,239	1,257,906	333,304	.265
Ohio	2,222,954	2,415,874	543,297	.225
Pennsylvania	326,922	324,319	87,455	.270
Tennessee	104,877	108,025	21,605	.199
West Virginia				
Colorado, Missouri, and Wisconsin	313,095	489,411	131,938	.270
Maryland, Michigan, and New Jersey	60,886	68,361	18,937	.277
	4,912,131	5,302,709	1,268,258	.239
Motor benzol:				
Alabama	6,483,083	6,755,209	1,107,415	.164
Illinois	2,021,130	2,092,697	351,176	.168
Indiana	8,826,489	9,136,960	1,443,904	.158
Kentucky				
Minnesota	431,793	536,343	80,863	.151
New York	2,685,388	3,194,071	714,259	.224
Ohio	8,028,381	8,287,784	1,555,523	.188
Pennsylvania	16,077,221	16,617,906	3,071,462	.185
Tennessee				
West Virginia	517,857	516,605	123,435	.239
Colorado and Wisconsin	1,534,525	1,656,977	261,203	.158
Maryland, Michigan, and New Jersey	1,447,015	1,228,021	257,446	.210
	48,052,882	50,022,573	8,966,686	.179

Toluol and solvent naphtha are the other two principal refined products made from crude light oil. The output and sales of these products in 1921 are shown in Table 55.

TABLE 55.—*Toluol and solvent naphtha produced and sold in the United States in 1921, by States.*

State.	Toluol (refined).				Solvent naphtha.			
	Produced (gallons).	Sold.			Produced (gallons).	Sold.		
		Gallons.	Value.			Gallons.	Value.	
			Total.	Average.			Total.	Average.
Alabama	18,838	4,829	$1,435	$0.297	174,977	143,034	$21,682	$0.152
Illinois	5,818	5,818	1,629	.280	62,614	58,370	7,561	.129
Indiana	4,952	14,554	4,101	.282	132,079	180,397	33,276	.184
Kentucky								
Minnesota					23,313	10,141	1,496	.147
New York	370,269	372,840	108,686	.292	235,281	206,178	53,360	.259
Ohio	187,398	152,936	42,390	.277	505,936	361,710	63,002	.174
Pennsylvania	90,270	71,826	19,915	.277	2,282,558	1,700,633	293,023	.172
Tennessee								
West Virginia					35,587	29,055	7,145	.246
Colorado, Missouri, and Wisconsin	[a] 264,986	[a] 175,134	[a] 43,667	[a] .249	297,479	88,743	19,632	.221
Maryland, Michigan, and New Jersey	26,980	37,556	11,555	.308	72,952	103,395	10,332	.100
	[a] 969,511	[a] 835,493	[a] 233,378	[a] .279	3,822,776	2,881,656	510,509	.177

[a] Includes a small quantity of crude toluol.

All companies making crude light oil or any of the products derived from it are classified by groups in Tables 56 and 57. The yield of crude light oil per ton of coal coked, like that of other by-products, is not dependent alone upon the efficiency of the oven or the skill of the oven operator. It depends also upon the kind of coke it is desired to make.

Table 57 shows into what derivative products the crude light oil is refined by the several plants that treat the oil on the premises. The data are not at all significant as to the efficiency of the plants; they simply represent operating practices as determined by the judgment of the plant operators. Thus a plant recovering less than 1 per cent of any constituent might, if the operator so desired, make 10, 20, or even 75 or 80 per cent of that constituent. Table 57 is therefore solely a record of present operating practices and not a guide to operating possibilities or efficiency.

TABLE 56.—*Crude light oil yields reported by coke-oven plants in 1921.*

Total recovery of crude light oil .... gallons..	76,917,269
Recovery per ton of coal coked:	
At plant reporting minimum average yield .... do....	.09
At plant reporting maximum average yield .... do....	4.0
At average plant [a] .... do....	2.7
Average recovery for all coal coked [b] .... do....	2.8
Total number of plants reporting recovery of light oil	57
Number of plants recovering—	
Less than 2 gallons per ton of coal	9
2–2.49 gallons	8
2.5–2.99 gallons	16
3–3.49 gallons	10
3.5–3.99 gallons	12
4 gallons or more	2

[a] Sum of averages for each plant divided by number of plants.
[b] Total crude oil recovered divided by number of tons of coal coked.

TABLE 57.—*Relative percentages of crude light oil refined by coke-oven plants in 1921 recovered in the form of benzol, motor benzol, toluol, and solvent naphtha.*

	Benzol.			Toluol (crude and refined).	Solvent naphtha.
	Crude.	Refined.	Motor benzol.		
Total recovery........................gallons..	1,494,329	4,912,131	48,052,882	969,511	3,822,776
Percentage of light oil refined at plant that was recovered in form of product specified:					
At plant reporting minimum percentage...	0.05	0.01	7.60	0.10	0.40
At plant reporting maximum percentage...	53.4	55.3	94.2	15.0	26.6
At average plant [a]........................	0.9	1.62	61.3	4.1	6.0
Average percentage of all light oil refined [b].	2.0	6.5	63.4	1.3	5.0
Number of plants recovering the product specified..........	9	26	38	18	34
Number of plants recovering following percentages of light oil refined in form of product specified:					
Less than 1 per cent.........................	5	4	....	6	2
1-9.9 per cent..............................	2	7	1	11	24
10-19.9 per cent............................	1	6	....	1	7
20-29.9 per cent............................	....	4	2	....	1
30-39.9 per cent............................	....	4	3	....	....
40-49.9 per cent............................	....	....	3	....	....
50-59.9 per cent............................	1	1	5	....	....
60-69.9 per cent............................	....	....	10	....	....
70-79.9 per cent............................	....	....	11	....	....
80-89.9 per cent............................	....	....	2	....	....
90 per cent or more..........................	....	....	1	....	....

[a] Sum of percentages for all plants divided by number of plants.
[b] Total product recovered divided by number of gallons of crude oil treated.

The price obtained per gallon for light-oil derivatives varies widely from time to time. However, at present the price for the principal derivatives, motor benzol and other benzol of commercial grades, is dependent largely upon the market price for gasoline. Motor benzol is worth slightly more per gallon for blending than gasoline, for the blended fuels made from it command slightly higher retail prices. The range of prices and the number of companies obtaining various rates of income from the light-oil derivatives are shown in Table 58, grouped by unit values for each of the principal products. In that table, as in Table 57, there is probably some overlapping between crude benzol, refined benzol, and motor benzol, because the Geological Survey has not undertaken to establish any definite standard for the guidance of operators in making their returns on these commodities. Each operator has in consequence reported his results in accordance with the local interpretation of these terms, and it is undoubtedly true that this interpretation varies to a considerable extent throughout the country. However, any discrepancies in the returns resulting from this variation are not of great consequence, for these compounds are largely interchangeable in use, and hence for most purposes no distinction is needed.

TABLE 58.—*Average receipts for light-oil derivatives sold during 1921.*

	Benzol.			Toluol (crude and refined).	Solvent naphtha.
	Crude.	Refined.	Motor benzol.		
Total sales........gallons..	1,536,312	5,302,709	50,022,573	835,493	2,881,656
Average receipts per gallon:					
At plant reporting minimum receipts..	$0.150	$0.159	$0.135	$0.166	$0.080
At plant reporting maximum receipts..	.300	.324	.251	.315	.293
At average plant [a]........	.226	.248	.193	.266	.190
Average for all sales[b]........	.224	.239	.179	.279	.177
Total number of plants reporting sales.....	8	28	37	21	30
Number of plants reporting receipts of—					
Less than 10 cents a gallon........	....	....	....	....	2
10–14.9 cents........	....	....	4	....	7
15–19.9 cents........	3	4	17	3	9
20–24.9 cents........	2	6	14	1	5
25–29.9 cents........	2	15	2	14	7
30–34.9 cents........	1	3	....	3	....

[a] Sum of averages for all plants divided by number of plants.
[b] Total value of sales of each product divided by number of gallons sold.

Table 59 shows the number of plants making light oil or its derivatives in each of the States where such plants operated during 1921.

TABLE 59.—*Number of plants making light oil or derivatives in 1921.*

State.	Total making coke.	Making crude light oil.	Making any refined product.	Making motor benzol.
Alabama........	7	7	4	4
Colorado........	1	1	1	1
Illinois........	7	4	2	2
Indiana........	6	5	5	5
Kentucky........	1	1	....	....
Maryland........	1	1	1	1
Massachusetts........	1	....	....	....
Michigan........	3	2	1	1
Minnesota........	3	3	3	3
Missouri........	1	1	1	....
New Jersey........	2	1	1	1
New York........	5	4	3	3
Ohio........	12	10	7	7
Pennsylvania........	13	11	6	6
Rhode Island........	1	....	....	....
Tennessee........	1	1	1	....
Washington........	1	....	....	....
West Virginia........	3	3	2	2
Wisconsin........	2	2	2	2
	71	57	40	38

GAS.

The gas produced during the carbonization of coal in a by-product plant is used in part for heating the ovens, but except in some old ovens the larger part of the total production is available as surplus for use elsewhere in the works or for sale. This surplus gas is commonly the most valuable by-product of the plants, returning to the operator a third or a half of the total income from the sales of all by-products. In Table 60 are given data by States for coke-oven gas produced, used, and sold in 1920 and 1921. The small quantities reported to the Geological Survey as wasted are also recorded.

TABLE 60.—*Coke-oven gas produced and sold in the United States in 1920 and 1921, by States.*

State.	Number of plants.	Produced (M cubic feet).	Used in process (M cubic feet).	Sold or used.			Wasted (M cubic feet).
				M cubic feet.	Value.		
					Total.	Average.	
1920.							
Alabama	7	51,752,917	27,422,049	21,331,670	$1,565,603	$0.07	2,999,198
Colorado	1	8,122,365	3,513,151	4,470,986	(a)	(a)	138,228
Illinois	5	32,692,774	18,064,052	13,783,152	2,162,467	.16	845,570
Indiana	6	69,368,533	32,218,849	35,137,150	4,898,865	.14	2,012,534
Kentucky	1	7,365,332	4,171,288	3,194,044	124,762	.04	....
Maryland	1	9,647,393	3,145,023	6,502,370	(a)	(a)	....
Massachusetts	1	6,310,113	3,546,297	2,763,816	(a)	(a)	....
Michigan	3	19,657,878	10,277,573	9,189,942	1,179,993	.13	190,363
Minnesota	3	9,117,677	4,631,619	4,429,535	755,637	.17	56,523
New Jersey	2	10,505,589	1,020,829	9,484,760	(a)	(a)	....
New York	4	18,784,074	14,684,388	4,099,686	585,884	.14	....
Ohio	12	85,893,628	38,773,882	44,470,762	4,035,070	.09	2,648,984
Pennsylvania	13	122,840,496	60,967,169	60,541,987	6,282,329	.10	1,331,340
Tennessee	1	1,769,527	834,400	935,127	70,670	.08	....
Washington	1	415,556	....	392,866	506,890	1.29	22,690
West Virginia	3	6,501,268	2,954,583	3,438,965	239,766	.07	107,720
Missouri, Rhode Island, and Wisconsin	4	15,740,624	9,476,707	6,249,101	3,696,156	.59	14,816
Undistributed	......	....	....	....	6,130,226	.26	....
	68	476,485,744	235,701,859	230,415,919	32,234,318	.14	10,367,966
1921.							
Alabama	7	39,434,983	20,979,283	16,100,355	1,258,685	0.078	2,355,345
Colorado	1	4,717,236	1,913,898	2,688,952	(a)	(a)	114,386
Illinois	7	22,065,991	12,237,933	8,762,579	1,448,604	.165	1,065,479
Indiana	6	46,721,258	23,450,250	22,060,962	4,086,142	.185	1,210,046
Kentucky	1	2,652,511	1,785,214	762,309	2,977	.004	104,988
Maryland	1	4,622,450	1,155,750	3,466,700	(a)	(a)	....
Massachusetts	1	3,999,352	2,030,720	1,968,632	(a)	(a)	....
Michigan	3	11,821,589	5,674,204	6,147,385	1,070,652	.174	....
Minnesota	3	6,136,893	2,789,214	3,199,091	894,529	.279	148,588
New Jersey	2	12,081,614	4,160,640	7,920,974	(a)	(a)	....
New York	5	11,080,665	4,489,037	6,591,628	1,180,222	.179	....
Ohio	10	46,884,297	21,799,673	23,593,670	2,886,700	.122	1,490,954
Pennsylvania	11	83,790,113	37,747,014	43,797,582	4,604,939	.105	2,245,517
Tennessee	1	882,129	441,000	441,129	41,635	.094	....
Washington	1	411,062	....	411,062	245,775	.557	....
West Virginia	3	2,862,280	1,556,598	1,190,682	136,470	.114	115,000
Missouri, Rhode Island, and Wisconsin	4	10,024,290	4,826,984	5,197,306	2,699,745	.519	....
Undistributed	......	....	....	....	5,406,177	.337	....
	67	310,188,713	147,037,412	154,300,998	25,963,252	.168	8,850,303

a Included under "Undistributed."

A more complete analysis of the disposition of the gas for the country as a whole is given in Table 61. From these data it is evident that almost exactly one-half of the total output was sold or used under such circumstances that a cost-keeping value could be assigned. In 1921, as in preceding years, the percentage wasted was almost negligible.

TABLE 61.—*Disposition of gas from by-product ovens in the United States in 1920–1921.*

	Millions of cubic feet.	Percentage of total production.	Value.	
			Total.	Cents per M.
1920.				
Used under boilers	25,430	5.3	$2,216,335	8.7
Used in steel or other related plants	151,765	31.8	14,301,095	9.4
Distributed through city mains (sold)	53,221	11.2	15,716,888	29.5
Total sold or used (not for ovens)	230,416	48.3	32,234,318	14.0
Used in heating ovens	235,701	49.5		
Wasted	10,368	2.2		
Total produced	476,485	100.0		
1921.				
Used under boilers	12,123	3.9	1,120,087	9.2
Used in steel or other related plants	98,352	31.7	10,593,204	10.8
Distributed through city mains (sold)	43,826	14.1	14,249,961	32.5
Total sold or used (not for ovens)	154,301	49.7	25,963,252	16.8
Used in heating ovens	147,038	47.4		
Wasted	8,850	2.9		
Total produced	310,189	100.0		

In by-product oven plants that are affiliated with metallurgical works there is generally available ample outlet for gas in the heating operations of the affiliated works. In most of the merchant plants this outlet is not available, but gas can generally be applied to advantage in firing boilers or in other industrial work in the vicinity. The bulk of the surplus from a number of plants located in or near large cities goes for use in city supply to public-utility distributing companies, which are in some cities the same companies that own the ovens. The quantity and value of the gas used in each of these three ways in each State are shown in Table 62. These data make clear the great differences in the average value of the gas in different localities for the same operation, and the considerable difference in the United States as a whole between the average value of the gas sold for distribution through city mains and that of the gas used in boilers or in affiliated metallurgical plants.

The price credited to a coke department for gas supplied to affiliated works, like that for tar, is usually determined by the cost of an equivalent quantity of the cheapest available substitute fuel. Thus in many plants gas is credited at less than 10 cents per M cubic feet, although in some places it is really worth several times this much, even for firing boilers or industrial heating, and certainly would sell for many times this much if distributed through city gas mains for use in households for cooking, heating water, and lighting.

Table 62.—*Use of by-product gas in the United States in 1921, by States.*

State.	Used under boilers.			Used in steel or other affiliated plants.			Distributed through city mains.		
	M cubic feet.	Value.		M cubic feet.	Value.		M cubic feet.	Value.	
		Total.	Average.		Total.	Average.		Total.	Average.
Alabama	4,791,460	$316,507	$0.07	9,935,297	$752,416	$0.08	1,373,598	$189,762	$0.14
Colorado				2,688,952	(a)	(a)			
Illinois	182,468	20,279	.11	2,112,104	234,564	.11	6,468,007	1,193,761	.18
Indiana	1,246,350	136,273	.11	16,905,706	1,922,201	.11	3,908,906	2,027,668	.52
Kentucky	762,309	2,977	.004						
Maryland				166,587	(a)	(a)	3,300,113		(a)
Massachusetts							1,968,632	(a)	(a)
Michigan	100	82	.82	1,600,418	317,523	.20	4,546,867	753,047	.17
Minnesota	319,798	40,493	.13	429,684	60,151	.14	2,449,609	793,885	.32
New Jersey							7,920,974	(a)	(a)
New York	477,461	51,230	.11	5,113,009	418,291	.08	1,001,158	710,701	.71
Ohio	2,523,335	430,506	.17	18,354,976	2,237,203	.12	2,715,359	218,991	.08
Pennsylvania	1,711,033	114,509	.07	40,168,607	4,244,291	.11	1,917,942	246,139	.13
Tennessee	91,839	3,214	.03				349,290	38,421	.11
Washington	5,406	3,232	.60				405,656	242,543	.60
West Virginia	11,218	785	.07	845,159	60,502	.07	334,305	75,183	.22
Missouri, Rhode Island, and Wisconsin				31,550	2,840	.09	5,165,756	2,696,905	.52
Undistributed					343,222	.12		5,062,955	.38
	12,122,777	1,120,087	.09	98,352,049	10,593,204	.11	43,826,172	14,249,961	.33

a Included under "Undistributed."

The yield of gas per ton of coal carbonized depends very largely upon the coal, to a less extent upon the method of oven operation chosen and the design of the oven itself, and still less upon the skill of the operator. The figures on yield of gas per ton of coal therefore should not be used as a measure of plant management or efficiency. They do, however, reflect operating practices and thus are of interest. They are given for 1921 by States in Table 63, and by groups of different yields in Table 64.

Table 63.—*Yield and disposal of gas and number of plants supplying gas for certain uses in 1921, by States.*

State.	Yield of gas (M cubic feet per ton of coal coked).	Disposal (per cent of total).					Number of plants.		
		In coke plants.		To steel or other affiliated plants.	For distribution through city mains.	Wasted.	Supplying gas for city distribution.	Supplying gas to steel or other affiliated plants.	Reporting waste.
		For use in heating coke ovens.	For use under boilers.						
Alabama	11.3	53.2	12.2	25.2	3.4	6.0	3	5	6
Colorado	11.3	40.6		57.0		2.4		1	1
Illinois	11.3	55.5	.8	9.6	29.3	4.8	6	2	2
Indiana	10.8	50.2	2.7	36.2	8.3	2.6	6	4	5
Kentucky	10.3	67.3	28.7			4.0			1
Maryland	11.7	25.0		3.6	71.4		1	1	
Massachusetts	10.0	50.8			49.2		1		
Michigan	10.7	48.0		13.5	38.5		3	2	
Minnesota	9.7	45.4	5.3	7.0	39.9	2.4	2	1	
New Jersey	11.3	34.4			65.6		2		
New York	10.1	40.5	4.3	46.2	9.0		2	3	
Ohio	10.7	46.5	5.4	39.1	5.8	3.2	4	7	
Pennsylvania	10.7	45.0	2.1	47.9	2.3	2.7	2	11	5
Tennessee	11.0	50.0	10.4		39.6		1		
Washington	9.4		1.3		98.7		1		
West Virginia	10.3	54.4	.4	29.5	11.7	4.0	1	2	1
Missouri, Rhode Island, and Wisconsin	10.8	48.2		.3	51.5		3	1	
Average or total	10.8	47.4	3.9	31.7	14.1	2.9	38	40	21

TABLE 64.—*Yield of gas per ton of coal coked reported by coke plants in 1921.*

Total production of gas .... M cubic feet..	310,188,713
Yield of gas per ton of coal coked:	
At plant reporting minimum average yield .... do....	5.0
At plant reporting maximum average yield .... do....	14.1
At average plant [a] .... do....	10.5
Average for all coal coked [b] .... do....	10.8
Total number of plants reporting recovery of gas	67
Number of plants reporting yields of—	
Less than 8 M cubic feet per ton of coal coked	2
8–8.99 M cubic feet	3
9–9.99 M cubic feet	12
10–10.49 M cubic feet	11
10.5–10.99 M cubic feet	21
11–11.99 M cubic feet	10
12 M cubic feet or more	8

[a] Sum of averages for all plants divided by number of plants.
[b] Total production of gas divided by number of tons of coal coked.

The percentage of gas used in heating the ovens is determined largely by the oven design, to a less extent by the skill of the oven operatives, and to some extent by the percentage of volatile matter in the coal that is being carbonized. Data for all the plants are shown by States in Table 63 and by efficiency groups in Table 65. It is evident that half or less of the gas is used for heating the ovens. The ovens of the most modern types require only 30 to 35 per cent of the gas when operating with high-volatile coal of good grades.

TABLE 65.—*Gas used in heating ovens in 1921.*

Total quantity of gas reported as used in heating ovens .... M cubic feet..	147,037,412
Percentage of total production used:	
At plant reporting minimum percentage	[a] 14.5
At plant reporting maximum percentage	93.6
At average plant [b]	53.7
Average for all gas produced [c]	47.4
Total number of plants reporting	63
Number of plants reporting—	
Less than 20 per cent used	[a] 1
20–29.9 per cent	2
30–39.9 per cent	8
40–44.9 per cent	13
45–49.9 per cent	11
50–59.9 per cent	9
60–69.9 per cent	9
70–79.9 per cent	2
80–89.9 per cent	2
90 per cent or more	6

[a] This plant used also some other gas for heating ovens.
[b] Sum of averages for all plants divided by number of plants.
[c] Total gas used in heating all ovens divided by total gas produced.

The percentage of gas wasted is negligible in nearly all the States. However, at a few plants no application for all the gas is available, and hence a small part of the surplus is simply burned from the vent pipe in order to get rid of it. Table 63 shows by States the percentage of gas that was thus disposed of in 1921 and the number of plants reporting such waste.

As pointed out above, the price obtained for gas depends largely upon local conditions, mainly the use to which the gas is put. The number of plants selling part of their surplus for city-gas supply and the number selling to steel plants either affiliated with or located near the coke plants are shown in Table 63. The average prices obtained are shown in Table 62, and the number of plants by price groups is shown for each class of sales in Table 66.

TABLE 66.—*Average receipts per M cubic feet of gas sold for certain uses reported by coke plants in 1921.*

	City gas.	Boiler use.	Steel-plant use.
Total sales of gas ....M cubic feet..	43,826,172	12,122,777	98,352,049
Average receipts per M cubic feet of gas sold:			
At plant reporting minimum average receipts	$0.08	$0.004	$0.04
At plant reporting maximum average receipts	1.21	.82	.40
At average plant [a]	.343	.127	.112
Average receipts for all gas sold or used [b]	.325	.092	.108
Total number of plants reporting sales	38	31	40
Number of plants reporting—			
Less than 5 cents per M cubic feet sold	....	5	2
5–9 cents	4	12	11
10–19 cents	15	11	24
20–29 cents	5	....	2
30–39 cents	1	....	....
40–49 cents	3	1	1
50–59 cents	3	....	....
60–69 cents	1	1	....
70–99 cents	4	1	....
$1 or more	2	....	....

[a] Sum of averages for all plants divided by number of plants.
[b] Total value of sales divided by number of M cubic feet sold.

Because of the increasing income obtainable from surplus oven gas operators of by-product plants are more and more considering the use of cheaper gas from other sources to heat the ovens. In several places in the United States producer gas or blue water gas has been used very successfully for this purpose. The advantage of this substitution is particularly great in plants that supply gas for city distribution, where it is desirable to have the greatest possible yield of gas available for city supply per ton of coal handled. If all the gas produced in the ovens is used for city supply and the heating of the ovens provided for otherwise, the most favorable results are obtained. Some of the modern types of oven are so designed that the fuel used for firing can be quickly changed from oven gas to producer gas or blue water gas, and changed back again subsequently, as the seasonal demand for gas in city supply makes desirable. It is likely that most of the new plants installed in localities where the use of some of the surplus gas for city supply is feasible will be so designed as to permit this change. Such plants will doubtless from year to year send increasing percentages of their total gas output into city supply.

Plants that use gas made by some other process in heating the ovens generally produce this gas from some of the coke breeze made at the plants. Thus the heating of the ovens by other gas has the additional advantage of affording a good outlet right at the plant for a portion of this fine coke, which otherwise is often sold at a very low price in order to dispose of it promptly.

NAPHTHALENE.

In Table 41 are given figures showing the production and sales of crude and refined naphthalene made at the by-product coke plants during 1921. The production was approximately 20 per cent of that in 1920, and the average value per pound decreased slightly also.

MISCELLANEOUS BY-PRODUCTS.

A few of the reports made to the Geological Survey give data on minor by-products produced and sold. Three plants reported the sale of 16,062 gallons of pyridin oil, tar paint, and a few other liquid products made from tar or light oils at a total value of $6,084. Four other plants reported the sale of 851,258 pounds of sodium prussiate at a total value of $115,035, an average of 13.5 cents a pound. It is likely that numerous other minor products were made by some plants, but the Geological Survey has not made any special canvass of such production, and doubtless some has not been reported. However, the total value of such material is a very small percentage of the total value of the by-products produced and sold.

APPENDIX.

SCHEDULES USED IN CANVASS FOR 1921.

No.......... Confidential,

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PRODUCTION OF COKE AND BY-PRODUCTS IN BY-PRODUCT OVENS, 1921.

Please fill out replies to the following queries and return as promptly as possible in the inclosed envelope which requires no postage. All replies are held confidential, individual figures not being divulged except by express permission of the operator.

Name of operator..
Address..
Name of plant..
Location of plant: Town..
State........................ County..

1. OVENS:

In stating capacity of ovens, please give total quantity of coke of grades you aim to produce, that can be obtained with all conditions favorable and all ovens active.

New ovens completed in 1921:
Number..
Type..
Capacity..tons coke per day.
Date first coke pushed..
Ovens dismantled or otherwise permanently abandoned in 1921:
Number..
Ovens in existence Dec. 31, 1921:
Number..
Capacity..tons coke per day.
Ovens in course of construction Dec. 31, 1921:
Number..
Type..
Capacity..tons coke per day.
Probable date first coke will be pushed..

....

2. COAL CHARGED INTO OVENS:

	Net tons	Value at ovens
Unwashed........................	....	$............
Washed........................	....	....
Total charged........................	....	....

Does quantity of washed coal represent weight before or after washing?..........
If before, what is the average percentage of loss in washing..........

....

3. PRODUCTION OF COKE:

	Net tons
All coke except screenings and breeze............	....
Screenings and breeze (include all fines obtained, whether used or wasted)............	....
Total produced............	....

4. SALES OF COKE:

	Net tons	Value at ovens
Furnace........................	....	$............
Foundry........................	....	....
Domestic and other........................	....	....
Screenings and breeze........................	....	....
Total sales........................	....	....

5. COKE USED BY PRODUCER (in affiliated steel works or at coke plant):

	Net tons
Coke (all other than breeze)............	....
Screenings and breeze............	....

Was any breeze wasted?..
If, so, how much?..

6. SOURCE AND KIND OF COAL COKED:

Name of field.	Approximate percentage volatile matter in coal charged.	Net tons from each field.
....	....	....
....	....	....

By-products obtained and sold, 1921.

7. TAR:

Quantity produced..........gals.. ....
Quantity sold..........do.. ....
Value of sales.......... $..........
Used as fuel under boilers..........gals.. ....
Used in open-hearth or other affiliated plant...do.. ....
Change in stock {Increase..........do.. .... / Decrease..........do.. ....}

8. AMMONIA:

Produced as—
Sulphate..........lbs.. ....
Liquor.......... ....
(lbs. NH_3 content.)
Other forms.......... ....
(lbs. NH_3 content.)
(Specify form..........)

Sold as—

	Quantity.	Value of sales.
Sulphate..........lbs..	....	$..........
Liquor.......... (lbs NH_3 content.)	....	....
Other forms.......... (lbs NH_3 content.)	....	....

(Specify form..........)

If pounds of NH_3 in ammonia liquor is not known, state gallons of liquor and approximate strength:

	Produced.	Sold.	Value of sales.
Gallons	....	....	$..........
Strength	....	....	

9. GAS:

	M.	Value at plant.
Produced..........	....	
Used in heating ovens..........	....	
Used* under boilers or other coke-plant equipment..........	....	$..........
Used* in steel or other affiliated plant.	....	....
Distributed through city mains..........	....	....
Wasted..........	....	

*Assign a "cost-keeping" value for that used.

10. CRUDE LIGHT OIL:

Produced..........gals.. ....
Sold as crude light oil..........do.. ....
Value of sales.......... $..........
Refined on premises..........gals.. ....
Change in stock {Increase..........do.. .... / Decrease..........do.. ....}

What percentage of the crude light oil refined is "lost" in process of refining?..........

11. LIGHT OIL DERIVATIVES:

Benzol—
Crude—
Produced..........gals.. ....
Sold..........do.. ....
Value of sales.......... $..........
Refined—
Produced..........gals.. ....
Sold..........do.. ....
Value of sales.......... $..........

11. LIGHT OIL DERIVATIVES—Continued.

Benzol—Continued.

Motor fuel—

Produced..........gals.. ....

Sold..........do.. ....

Value of sales.......... $..........

Give below approximate analysis of motor fuel—

"Benzol" in motor fuel.......... ....%

Petroleum derivatives in motor fuel.......... ....%

Other constituents in motor fuel.......... ....%

(Specify..........)

Toluol—

Crude—

Produced..........gals.. ....

Sold..........do.. ....

Value of sales.......... $..........

Refined—

Produced..........gals.. ....

Sold..........do.. ....

Value of sales.......... $..........

Solvent naphtha—

Crude and refined including xylol—

Produced..........gals.. ....

Sold..........do.. ....

Value of sales.......... $..........

12. NAPHTHALENE:

Crude (melting point below 79° C.)—

Produced..........lbs.. ....

Sold..........do.. ....

Value of sales.......... $..........

Refined (melting point 79° C. or over)—

Produced..........lbs.. ....

Sold..........do.. ....

Value of sales.......... $..........

13. OTHER PRODUCTS (specify character and unit of measure):

Produced.......... ....

Sold.......... ....

Value of sales.......... $..........

....

(Sign here with title.)

No.......... Confidential.

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PRODUCTION OF BEEHIVE COKE IN 1921.

Please fill out replies to the following queries and return as promptly as possible in the inclosed envelope, which requires no postage. All replies are held confidential, individual figures not being divulged except by express permission of the operator.

Name of operator ....

Address ....

Name of plant ....

Location of plant: Town ....

State.......... County..........

1. OVENS:

In stating capacity of ovens, please give total quantity of coke, of grades you aim to produce, that can be obtained with all conditions favorable and all ovens active.

New ovens completed in 1921:

Number ....

Type ....

Capacity .... tons coke per day.

Date first coke pushed ....

Ovens dismantled or otherwise permanently abandoned in 1921:

Number ....

Ovens in existence Dec. 31, 1921:
- Number ....
- Type ....
- Capacity .... tons coke per day.

Ovens in course of construction Dec. 31, 1921:
- Number ....
- Type ....
- Capacity .... tons coke per day.
- Probable date first coke will be pushed ....

2. Coal Charged into Ovens:

	Net tons.	Value at ovens.
Unwashed	....	$........
Washed	....	....
Total charged	....	....

Does quantity of washed coal represent weight before or after washing? ....
If before, what is the average percentage of loss in washing? ....
Is coal crushed before charging into ovens? ....

3. Production of Coke:

	Net tons.
All coke except screenings and breeze	....
Screenings and breeze (include all fines obtained, whether used or wasted)	....
Total produced	....

4. Sales of Coke:

	Net tons.	Value at ovens.
Furnace	....	$........
Foundry	....	....
Domestic and other	....	....
Screenings and breeze	....	....
Total sales	....	....

5. Coke Used by Producer (in affiliated steel works or at coke plant):

	Net tons.
Coke (all other than breeze)	....
Screenings and breeze	....
Total used	....

What is done with coke breeze and screenings at this plant? ....

6. If coal charged into these beehive ovens is shipped in over a railroad, from what mines did it come? ....

....

7. On what railroads is coke loaded for shipment?

Roads.	Tons.
....	....
....	....
....	....

8. Please note the names and addresses of any new coke plants in your vicinity.

....

....

9. If you have recently acquired this plant, please give the name and address of the former owner or operator and the date on which you took possession.

....

....

10. If you have sold or leased this plant, or surrendered your lease, please give the name and address of your successor and the date on which you gave possession.

....

....

COAL IN 1919, 1920, AND 1921.

By F. G. Tryon and Sydney A. Hale.

INTRODUCTION.

SPECIAL STATISTICAL REPORTS ON COAL IN 1919-1921.

With the publication of this report the statistical record of the coal industry issued by the United States Geological Survey completes its fortieth year. From 1882 to 1918 the Survey issued from year to year an unbroken series of annual reports on the industry. The publication of separate reports for 1919 and 1920 was not attempted for several reasons, especially as the mimeographed weekly coal reports established by C. E. Lesher in June, 1917, gave statistical information to the public with a promptness more in keeping with the pace of modern business. By means of that report the fundamental statistics for each State have commonly been placed in the hands of the trade within ten days or two weeks after they were compiled in the Survey, whereas by the printed volume the figures for no single State could be made public until those for the entire country were complete and the matter had been edited and printed.

The generous reception given to the weekly coal report by producers and consumers of coal in itself tended to divert the energies of the Survey's statistical staff from the work of preparing printed annual reports to that of improving the current statistical service on coal supply and demand. The statistics of weekly production were expanded, and a series of reports on stocks in the hands of consumers was begun. The war had increased the demand upon the Survey without increasing correspondingly the funds available to supply the demand, and the staff received calls in rapid succession to assist other Government agencies that dealt with coal. The assistance given lay not in framing policies but in answering questions concerning facts, and each answer given was conditioned on the strict observance of the requirement that returns made by individual producers to the Survey must be held confidential and that only totals for the locality or the State should be disclosed. Special studies of this kind were made for the Central Coal Committee set up by the Director General of Railroads to distribute coal during the strike of 1919; the Bituminous Coal Commission of 1920; the Interstate Commerce Commission; the Senatorial investigating committees, presided over by Senators Frelinghuysen, Calder, and LaFollette; the Coal Committee of the President's Conference on Unemployment; the Department of Commerce; the Fuel Distribution Committee of August, 1922; the Federal Fuel Distributor; and, as this is written, the United States Coal Commission. Only a small part of the results of these special inquiries are recorded in this report; the rest will be found in the publications of the agencies for which the work was done or will be summarized in later publications of the Geological Survey.

The present report is therefore confined to the presentation of the annual statistics of production collected from the producers of anthracite and bituminous coal for the calendar years 1919, 1920, and 1921.

ACKNOWLEDGMENTS.

These reports can be prepared only by the generous cooperation of the coal producers, railroad officials, and consumers, whose responses to requests for information have been most hearty and encouraging. Special thanks are due to the secretaries of local coal operators' associations, who have not only assisted in collecting facts but have contributed much essential information through their familiarity with local conditions. The State geologists of Alabama, Illinois, Iowa, Georgia, Maryland, Michigan, North Carolina, Oregon, Pennsylvania, Virginia, and Washington; the State mine inspectors of Alabama, Indiana, Kentucky, and Pennsylvania; the Pennsylvania Department of Internal Affairs; the Department of Industrial Relations of Ohio; and the Industrial Commission of Utah have cooperated in the collection of reports.

Special credit is due to Miss Lida Mann, of the United States Geological Survey, under whose supervision the annual statistics of bituminous coal were compiled, and to her assistant, Miss J. M. Corse. The annual statistics of anthracite were compiled by Mrs. H. L. Bennit, and the weekly and monthly estimates of production by Miss R. M. McKinney. The canvass of wagon mines in 1920 was made by W. F. McKenney. F. G. Tryon was in charge of the work, and Sydney A. Hale wrote most of the text of this report.

UNITS OF MEASUREMENT.

The standard unit of measurement adopted for this report is the net or short ton of 2,000 pounds, but as Pennsylvania anthracite is mined and sold by the gross or long ton (2,240 pounds), that unit is used in the part of the report dealing with anthracite. Unless the unit is otherwise expressly stated the word "ton" as here used means the net ton of 2,000 pounds, to which all other figures, however reported, have been reduced.

There is a steadily growing sentiment in favor of the general use of the net ton of 2,000 pounds as the standard unit of the coal trade, particularly for bituminous coal in the Eastern States, where both gross and net tons are now used. The use of both units is, of course, undesirable, but as many State and municipal laws require the use of the gross ton, and as freight rates throughout a part of the Eastern States are now fixed accordingly, it is difficult to make an immediate change to a standard unit. In reports on foreign trade and shipping rates quantities are expressed in either gross or metric tons, and in these, too, the use of two units is undesirable. The general use of the net ton in the United States, even in the anthracite region, is here recommended.

METHOD OF COLLECTING THE STATISTICS.

The statistics here published are obtained from the producers' written reports, most of them signed by officers of the companies furnishing the figures. These reports are collected by correspondence, which is supplemented by visits of field agents if correspondence has failed The Geological Survey has no power to subpoena records, or to compel the filing of reports, or to punish producers for rendering false reports.

Under this system accurate results can be obtained only by the generous cooperation of the producers in furnishing returns voluntarily. The operators generally make cordial responses to the Survey's questionnaires, with which they have become familiar through 40 years of contact and cooperation, so that a very large percentage of the returns are obtained by mail, leaving relatively few to be obtained by personal visits.

Accurate statistics might not be obtained under a system of voluntary reporting if the questionnaires asked for information which the operators might be reluctant to furnish or concerning which they had a motive to misrepresent the facts. Questions of this nature are not asked by the Survey, except, possibly, inquiries concerning the value of the product and the occurrence of strikes. In 1920, when coal reached its highest recorded price, a number of operators declined to state the value of the coal they sold. The number and the importance of these failures to make returns and the method used by the Survey in estimating the values not reported are explained on page 532. The possible errors in the returns dealing with strikes are discussed on page 502.

The other questions asked by the Geological Survey deal with the physical operation of the mine. They include such matters as tons produced, disposition of the product, numbers of men employed, time worked, method of mining, and railroad over which shipments are made. The operators can obtain no advantage by concealing or misstating these facts, for they can be definitely ascertained from other sources. They are constantly being checked by the departments of mines in States that commonly publish them, and they can be checked against the records of coal shipped kept by the railroads, which must agree in the aggregate with the reports made by the operators of coal tendered for shipment. These checks are sufficient to warrant public confidence in the substantial accuracy of the returns, which are, however, subject to qualifications as to interpretation made in publishing them. Whether the voluntary system of reporting may be safely used as to inquiries concerning costs, prices, profits, and other financial matters is a different question.

COMPLETENESS OF THE RETURNS.

A complete count of the thousands of wagon mines and country banks from which bituminous coal is dug in this country could be made only by sending agents up every creek and along every hillside in the coal-bearing regions of the country. The cost of such a count would prohibit it, and in practice a limit must be set to the size of the mines to be considered. The Federal Census Bureau sets this limit at mines making an output of approximately 1,000 tons a year. By many of the States the limit is set higher. The Pennsylvania Department of Mines, for example, covers only enterprises employing as many as 10 men.

The Geological Survey seeks to get the total output of coal from all sources in order to find the rate at which the country's coal resources are being drawn upon. In practice, however, it has been found advisable to employ different methods for the commercial mines on the one hand and the country banks and wagon mines on the other.

For the commercial mines satisfactory mailing lists have been built up by which the statistics can be obtained largely by correspondence. The lists now contain the names of many thousand operators, past and present. The canvass of 1920 showed that 6,277 commercial producers were operating 8,921 mines. To these lists new names are constantly being added from the trade journals, from reports of field agents, and from reports by the producers themselves. At regular intervals the list is checked against lists kept by associations of operators or State officials, and against lists of shippers kept by railroad car distributors. Every tenth year the list is further checked by the enumerators of the Federal Census Bureau, who canvass the entire country. Even after all this checking the list is not absolutely complete, but it is very nearly so.

Schedules of inquiry are sent by the Geological Survey to all producing companies listed, and no company is dropped from the list until it has been definitely accounted for. To follow up companies from which no reply is received by correspondence, cooperative arrangements have been made with State geologists and coal-mine inspectors, secretaries of operators' associations, and other local agents, who make inquiry in person and report to Washington. In the Rocky Mountain States the work of following up delayed returns is now done by the branch offices maintained by the Geological Survey at Denver, Salt Lake, and San Francisco. Areas to which no permanent local representative of the Survey has been assigned can be covered only by sending out a field agent from Washington, and the present plans include regular work by such an agent every year.

Many of the smaller mines are operated so intermittently that the owners can not be found at the end of the year, and recourse must be had to railroads to find the number of tons of coal shipped, from which estimates of the number of men employed and the value of the product can be made. Such estimates are made in order to round out totals, but only when the evidence shows that a mine was in operation during the year and when all other means of getting the exact figures have failed. Wherever in this report the inclusion of estimates introduces the probability of significant error, that fact is indicated.

The method just described is used in the canvass of commercial producers, including all mines that make an output of about 1,000 tons and that are operated rather steadily year after year. To handle the numerous sporadic wagon mines and country banks is a different problem and requires a different method. For several years the Geological Survey attempted to canvass these "small mines" by mail. Information received from time to time indicated that there were some 18,000 banks, and that even this number was too small to cover all of them. The largest number of these small mines from which reports were received by mail in one year was 3,695, the number reporting in 1917, and they produced only 1,625,000 tons out of the total of 552,000,000 tons of bituminous coal mined in that year. The inquiry was continued long enough to show that the annual production of these little mines in the years before the war could hardly have exceeded one or two million tons.

The attempt to canvass the small mines by mail broke down entirely, however, in 1920, when the unprecedented increase in spot prices stimulated the opening of thousands of new wagon mines. By the spring of 1921, while the canvass of production was under way, the market had collapsed, the wagon mines had closed, and many of the owners could not be found. The Geological Survey therefore turned to the railroads and asked for lists of all wagon mines that shipped in 1920, the date that each opened and closed, and the number of carloads shipped by each. The response of the railroads was instant and generous. Most of them were able to furnish the information required, which showed that a total of 4,405 "wagon mines" had shipped 4,513,800 tons of bituminous coal in 1920. The number and the output of these mines is given by States on page 524. In addition reports were obtained in 1920 from 1,440 banks without railroad connection that produced 420,500 tons.

The experiment showed that the only means of obtaining an adequate picture of the activity of wagon mines in a year of high prices is the records of the railroads. It was not considered worth while to ask the railroads for this information in 1921, however, because the profound depression in the coal market put the wagon mines temporarily out of business. For this reason the statistics of production in 1921, published in this report, do not include that of wagon mines and country banks. The omission will probably not prevent a just comparison of the statistics for 1921 with those for earlier years, for if the figures for small mines were available they could hardly raise the published totals by three-tenths of 1 per cent. No reports have ever been obtained from the wagon mines and country banks as to employees or time worked, and all the statistics of number of men employed, average days worked, and the like, in this and earlier reports, are calculated from the returns of the commercial mines alone.

REVIEW OF THE COAL INDUSTRY IN 1919, 1920, AND 1921.

RELATION OF PRODUCTION OF COAL TO PROSPERITY AND DEPRESSION IN OTHER INDUSTRIES.

The production of bituminous coal in the United States is a mirror of the industrial progress and retrogression of the country that is not considered by all students of business economics with the thoroughness warranted by the accuracy of its reflections. In the rise and fall of tonnage of coal produced from year to year may be seen the counterpart of the rise and fall of general commercial activity. For short periods the image may be blurred or distorted by internal difficulties, such as strikes, accidents, or local disabilities in transportation, or by external forces, such as unusual sectional demand, a windfall in export trade, or an abnormal increase in the use of bituminous coal for household use after a long suspension of mining in the anthracite region. The maximum productive capacity of the soft-coal mines of the United States, however, so far exceeds the maximum demand on them—when the demand is properly distributed—that the distortions mentioned are soon corrected and the broad outlines that remain give a true picture of the industrial history of the country.

As 65 to 75 per cent of the Pennsylvania anthracite shipped finds its way into the bins or cellars of individual householders or owners of apartments for domestic heating, the history of its production is not much more than a record of variations in the weather from year to year. The tonnage of anthracite steaming coal—that is, the quantity of smaller sizes of hard coal consumed by industrial plants and public utilities for generating power and by some of the larger

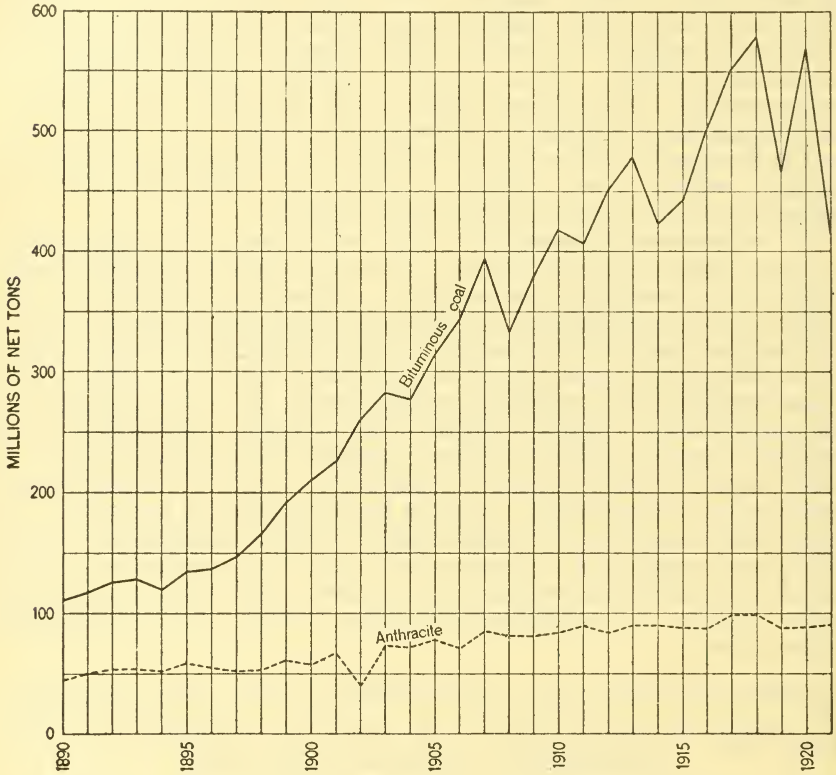


FIGURE 41.—Production of bituminous coal and anthracite in the United States, 1890–1921.

apartment houses, offices, and public buildings for heating—reflects to a less degree the changes in the rate of industrial activity. Outside of eastern communities, where the popular interpretation of antismoke ordinances creates the feeling that the use of anthracite is compulsory, the territory in which the steam sizes of hard coal may be distributed in competition with bituminous coal is decidedly small. The fluctuations in the rate of production of the steam sizes of anthracite therefore reflect directly contemporaneous conditions in the bituminous industry, and in so doing they reflect indirectly the state of general business activity.

BITUMINOUS TRADE IN 1919.

Effect of end of control by the Fuel Administration.—At the beginning of 1919 the coal trade was under the strict control as to price and distribution that had been established by the United States Fuel Administration during the World War. Both the maximum price schedules and the zoning system defining the territory of distribution for each producing field were abandoned on February 1. This return of freedom from restraint, however, if it had any effect, only augmented the difficulties of marketing for the bituminous shippers and distributors. During the preceding autumn industrial plants and retail coal merchants had been accumulating stocks in the expectation that the war would last another year, so that Armistice Day found consumers and retailers with about 63,000,000 tons of bituminous coal on hand. What quantity was in the hands of individual householders there is no means of knowing. The immediate let down in industrial activity and the mild winter cut down so greatly the consumption of fuel that, despite the inroads made upon the output by the epidemic of influenza late in the fall of 1918, the commercial stocks on hand January 1, 1919, had been reduced only to 57,900,000 tons.

A study of the normal distribution of bituminous coal shows that aside from New England and tidewater trade the predominating movement is westward. Coals mined in eastern fields travel westward through other producing areas and compete with coals mined nearer the source of consumption, but the shipment of coal eastward through a competitive field, unless it is one close by, is rather unusual. Thus Pennsylvania coals move eastward and southward until they meet in competition the West Virginia coals, and they must then be turned northward and westward for a market. On the other hand, West Virginia coals move westward through and beyond Ohio and into Illinois, and for certain purposes small amounts of Pennsylvania and West Virginia coals traverse not only the Middle Western but the Rocky Mountain producing fields and reach the Pacific coast. On the other hand, Illinois coals do not, under normal conditions, move east of Indiana and Michigan; their market is to the west, north, and south. Indiana coals also move in the same directions, although West Virginia, Ohio, and Kentucky coals enter Indiana as active competitors with the coals of that State.

What has been said applies particularly to coals used for domestic fuel. The ability of the eastern coals to penetrate western markets for industrial use, except in gas, by-product, and metallurgical plants, is circumscribed by the adjustment of freight rates, so that, with the exception of the coal shipped over the docks on the Great Lakes, little eastern coal can ordinarily find a market for industrial consumption in the territory in which the bulk of the Illinois and Indiana product is marketed. In the States of the Great Plains and other regions where no coal is produced or where that mined is of inferior quality or is produced at high cost, there is both an eastward and a westward movement, with the westward predominating.

The zoning system established by the Fuel Administration in cooperation with the Railroad Administration temporarily shifted the avenues of distribution from their normal course. It was held to be a waste of railroad equipment to permit cars to move from West Virginia to Illinois, for example, if consumers in Illinois could draw supplies from their own State. Moreover, as the production of war material was largely centered in the East the Government felt that every step possible must be taken to assure a full supply of fuel to plants having contracts for war material. Thus zones had to be defined for the distribution of coal and priority given for its transportation. These restrictions on distribution were removed at the same time that the war-time manufacturing activities that had maintained the high production in eastern fields were stopped, and naturally the eastern operators made a determined effort to recover their western coal markets.

When the price restrictions were lifted the bituminous market was glutted, but even in the early part of February, 1919, the general trend of the quotations, which continued until midsummer, was toward an increase in the price of coals of high quality and a decrease in the price of those that were less favored. This was a natural reaction from the Government's plan of price control. The Government maxima had necessarily been based upon costs of production, and thus high maxima had often been authorized for grades of coal that the consumers considered less desirable than other grades for which the Government maxima were lower. There were, of course, some deviations from this general trend, but they were evident only for short periods and were due principally to accumulations of spot coal.

The strike of 1919 and the revival of Government control.—Production dragged along at an indifferent rate until early summer, when the abnormal stocks had been reduced, and when under the influence of a national "buy early" advertising campaign the rate of monthly output shot ahead. The danger of a strike in the organized districts quickened the rate of production during September, so that in October, when a strike on November 1 became a practical certainty, the monthly total broke all previous records.

The strike, which lasted from November 1 to December 12, turned upon two subjects of dispute. The union miners demanded a 60 per cent increase in pay and a 30-hour five-day week, and they insisted that the existing contract terminated October 31. The operators promptly rejected the demand for an increase in pay and a shorter week, but the conferences between the contending parties really split on the question when the existing contract terminated. The agreement under which the men had been working provided that "subject to the next biennial convention of the United Mine Workers of America, the mine workers' representatives agree that the present contract be extended during the continuation of the war and not to exceed two years from April 1, 1918." The union maintained that the war had ended with the signing of peace by the Allied Powers and Germany and that the organization could not be held responsible for the failure of the United States to ratify the Versailles treaty "within a reasonable length of time," and that therefore the contract was at an end. The operators held that, in the absence of a declaration by the Government that the war was at an end, the contract held until March 31, 1920. After injunction proceedings, which were ineffective in forcing the strikers back to work, the strike was officially called off on December 11, on the understanding that the President of the United States would appoint an arbitration commission.

In numbers of men affected and percentage of mine capacity closed, the strike proved to be the greatest in the history of the soft-coal industry up to that time. At the period of maximum effectiveness 71 per cent of the capacity of the bituminous mines was shut down. The table (p. 506) and map (Pl. I, p. 504) show that practically all the organized mines were closed. Production in the four weeks immediately preceding the strike had averaged 12,281,000 tons. During the first week of the strike it dropped to 3,638,000 tons, or 29.6 per cent of the pre-strike average; in the second week it was 33.3 per cent; the third 44.3 per cent; the fourth 47.4 per cent; the fifth 43.5 per cent; the week the strike ended 48 per cent; and the following week 86.4 per cent. Throughout the strike the anthracite mines were producing at capacity, and the nonunion bituminous mines were shipping up to the limit of the available car supply.

The promulgation of the strike notice was followed by the reestablishment of Government control over the coal industry. The Fuel Administration maximum prices were reinstated. The powers of the Fuel Administration, under the Lever Act, to divert and distribute coal were exercised through a Central Coal Committee of the Railroad Administration under the chairmanship of Mr. H. B. Spencer. A few hours before the strike became effective a Government order vested in the Railroad Administration the control of all soft coal then on wheels, as well as that subsequently mined. Class priorities were hurriedly reestablished, and regional and district coal committees were set up to feed out the coal available in accordance with the general priorities and the judgment of committee members as to individual needs.

The Tidewater Coal Exchange, which since the war had continued to handle a part of the tidewater business, though without authority to compel shippers to consign their tidewater business to its pools, was again clothed with full powers over the tidewater movement. The permit system for exports was reestablished, and for a time overseas exports were greatly curtailed. Export dumpings at North Atlantic ports dropped from 1,819,000 net tons in October to 230,000 tons in November and 182,000 tons in December.

By the time the strike had reached its sixth week consumers' stocks in the territory north of the Ohio and Potomac and east of the Mississippi were dangerously low and industries were beginning to close for lack of fuel. In the effort to meet the deficit in production in the Mississippi Valley, where practically all the mines were closed by the strike, an abnormal number of coal cars from the nonunion fields was sent westward, and for months the normal balance of equipment was not restored. Both these facts influenced the market in the following year.

ANTHRACITE TRADE IN 1919.

The anthracite trade emerged from Government control at the same time as the bituminous trade, but it did not again become subject to regulation when the strike in the soft-coal regions started. When prices were released from Government supervision, however, the Fuel Administrator declared that examinations made in regard to cost of production subsequent to the wage increase in the winter of 1918 showed "that it would have been necessary, on the basis of the present wage scale, to raise these maximum prices possibly as much as 50 cents a ton above those last fixed by the Government in order to prevent financial embarrassment and perhaps the closing down of companies producing a substantial percentage of the necessary anthracite output." Although the working force at the mines was in general below the maximum, that fact does not explain the decreased production for the year. The decrease in the output of anthracite from 1917–18 to 1919 was due mainly to market conditions.

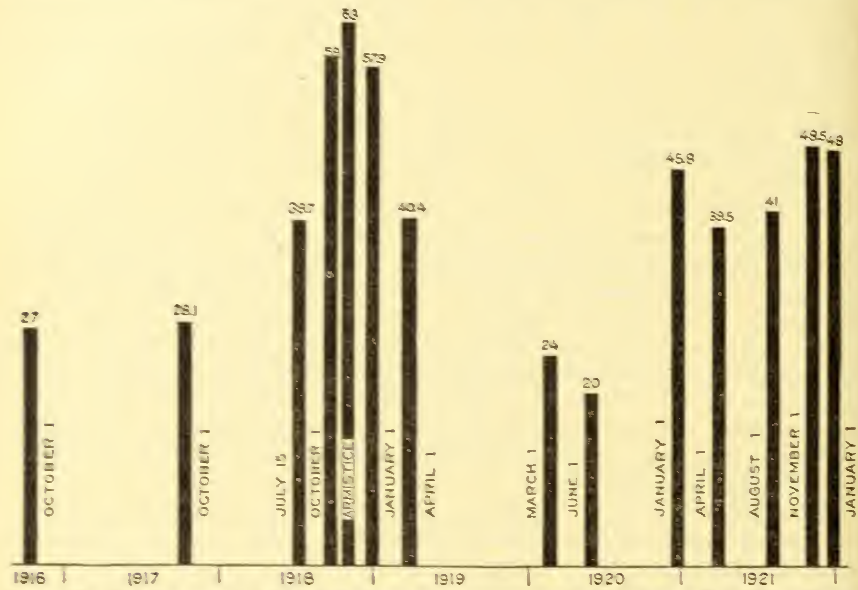


FIGURE 42.—Total commercial stocks of bituminous coal, October 1, 1916, to January 1, 1922. Figures represent millions of net tons and include coal in hands of railroads, industrial consumers, public utilities, and retailers. Coal for steamship fuel, on lake docks, and in transit is not included.

BITUMINOUS TRADE IN 1920.

Effect of the industrial boom on production.—Government control of the bituminous industry, which had been revived because of the general strike in the organized soft coal regions in 1919, was in process of abatement during the first quarter of 1920. Then began the post-war industrial boom that swept over the country during the first 10 months of 1920. During the first three months of that year about 138,653,000 tons of coal was produced, as compared with 108,589,000 tons during the first quarter of 1919 and 134,117,000 tons in the first quarter of 1918. Despite the increase, the stocks of coal in the hands of commercial consumers and retail dealers had dropped to 24,000,000 tons on March 1, as against 40,400,000 tons in hand 11 months before.

The switchmen's strike.—Although the conditions that controlled the distribution of coal during the strike of 1919 caused production to fluctuate, and the eastern and southern nonunion districts complained that the cars shipped into western territory during the strike were being diverted to the mines in that part of the country, the general trend was upward. The first check came in April, when the monthly output dropped from 47,850,000 tons to 38,764,000 tons.

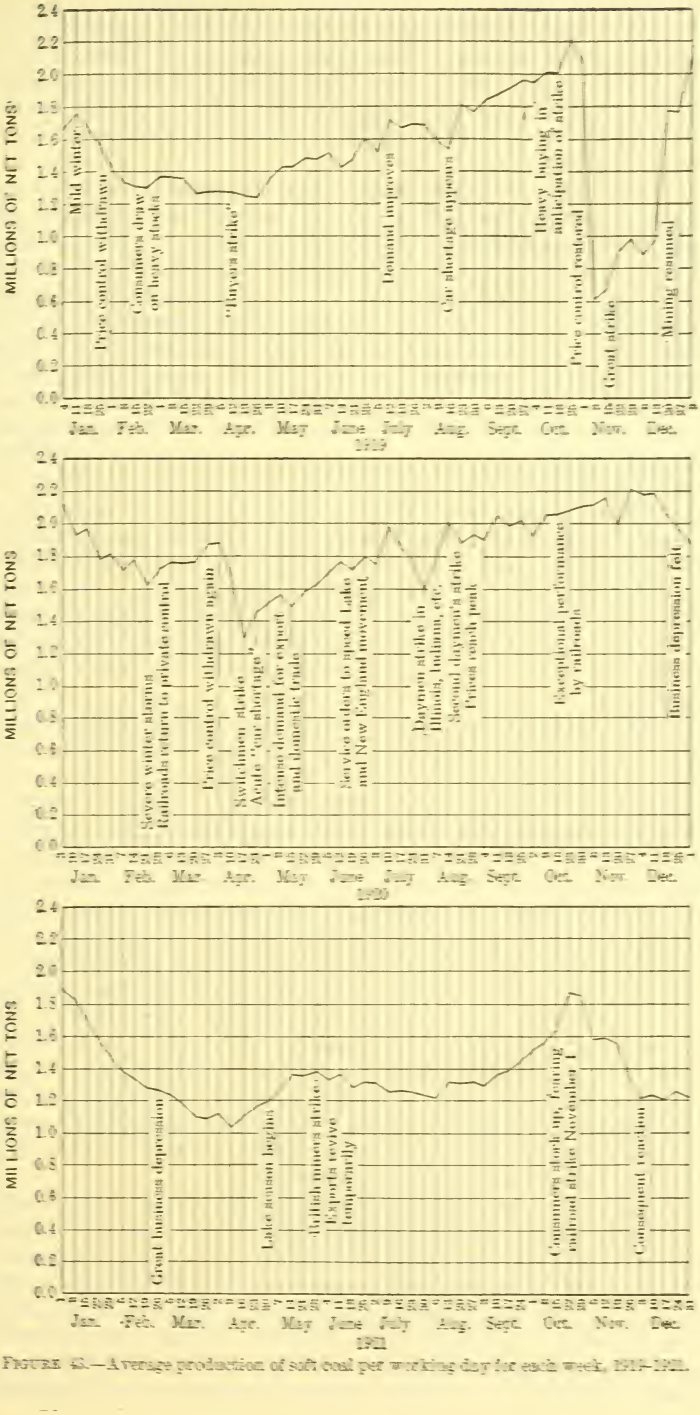


FIGURE 43.—Average production of soft coal per working day for each week, 1919–1921.

Responsibility for this decline was laid directly on the railroads and they, in turn, pointed to the "outlaw" switchmen's strike, which began April 1, in explanation of their inability to maintain their usual standards of service. This strike piled up freight of all kinds at the big railroad terminals, and the influence of the congestion was felt all along the lines. In spite of the efforts put forth by the railroads and the coal mines, production in May was barely 1,000,000 tons more than in April.

Sudden expansion of export trade.—With domestic industry moving at the highest speed permitted by the conditions of labor and the facilities for transportation and with consumers anxious to make up the deficit made in their coal reserves by the strike of the preceding winter, the situation was further complicated by the resumption of exports. By stopping exports from Germany and curtailing those from Great Britain the World War had given American producers of coals available for export an opportunity that they were not slow to grasp. From annual exports of 17,000,000 net tons (approximately 76 per cent to Canada) in 1913, the exports of coal had increased to 23,840,000 net tons (including 18,117,000 tons to Canada) in 1917. The total in 1919 had fallen to 20,114,000 net tons (11,950,000 tons to Canada). In that year exports were low in February, March, and April, and the increase that began in May was checked in November by the regulations for distribution issued by the Central Coal Committee. Restrictions were somewhat relaxed by the end of 1919, but the first quarter of 1920 showed little change from month to month. In April, however, exports jumped from 1,681,000 net tons to 2,723,000 tons. In May they were 2,689,000 tons.

Most of the bituminous coal exported from this country is mined in West Virginia and Pennsylvania. These two States are also the principal sources of supply for the coal consumed in the New England States, New York, and New Jersey. Together with Ohio, and to a less degree Kentucky, they supply the dock trade of the Northwest. The marked increase in exports began in the month when the Lake shipping season opened, at a time when the manufacturers of New England were considering their coal reserves in relation to the business that was being offered to them at home and abroad. Although, month by month, with the exception of April, New England was receiving more bituminous coal than in 1919 (though less than in 1918), it was no longer able to maintain the same percentage relation between all-rail and tidewater receipts that it had maintained in 1918 and earlier years, when water shipments constituted 54 to 59 per cent of the total. At the same time the dock interests in the Northwest complained that they were not receiving their normal tonnages, and these two sections of the country, New England especially, laid the blame on the export trade.

The situation in New England and on the Great Lakes.—By this time, however, there was no longer any Fuel Administration, and the Railroad Administration also had ceased to function. The complainants therefore sought relief from the Interstate Commerce Commission under the broadened powers conferred upon it by the transportation act of 1920. In response the commission issued two general preference orders in favor of New England and the Northwest. Neither of these orders seemed to accomplish fully the purpose intended, and they were therefore followed by further orders, which required the shipment of a stated number of cars each day to the New England and Great Lakes trade. About the same time orders were also issued by the Interstate Commerce Commission reserving the greater part of the open-top equipment of the carriers for the transportation of coal. Improved conditions on the railroads and augmented monthly output of coal enabled the producers to meet the requirements of the Northeast and the Northwest, and the monthly exports continued to climb, until in August, the last month in which the New England priority order was operative, the exports had risen to 4,602,000 net tons. The New England priority order was suspended at the end of August because coal was being moved to the piers at and north of Hampton Roads, Va., in greater volume than could be handled by New England receivers. The priority order for the Great Lakes was suspended late in October, and in that month the exports, which amounted to 5,130,000 net tons, broke all records.

These special service orders and a number of others issued by the Interstate Commerce Commission to care for special requirements, such as those of public utilities, the Navy, and the car supply at wagon mines, came no closer to receiving universal approbation than had the efforts of the United States Fuel Administration and the Central Coal Committee and its subordinate agencies. Illinois, Indiana, Michigan, and Ohio in particular objected to the orders affecting the Great Lakes and New England as depriving domestic consumers and Ohio and Michigan industrial plants of their usual sources of supply.

The Bituminous Coal Commission.—In March, 1920, the United States Bituminous Coal Commission, appointed to settle the question of wages, handed down its decision, which provided for an increase of 24 cents a ton in tonnage rates; an advance of $1 a day to day and monthly men (except trapper boys and others receiving less than a man's pay, whose pay was raised 53 cents); an increase of 20 per cent in the pay for yardage, dead work, room turning, and similar operations; a 48-hour week; and a biennial contract terminating March 31, 1922. As compared with the scales in effect on October 31, 1919, the increase in wages was about 27 per cent. A subsequent strike resulted in an increase in the compensation to day and monthly men, raising the day rate from $6, as fixed by the commission, to $7.50.

Prices.—The selling prices of coal reached in 1920 were the highest recorded in the history of the bituminous industry, and there was so much complaint from consumers that investigations were made by Congress and by several of the States. Spot prices of eastern coals in the territory affected by the export demand rose to levels two, three, or four times the maximum prices established by the Fuel Administration in 1918. The peak was reached in August, when the weighted average spot price was stated by the Coal Age at $9.51 per net ton, run of mine, f. o. b. mines. This average is based on quotations for 14 coals, representing 90 per cent of the output of the country, and is the best single measure of spot prices available. Spot prices of Somerset run of mine, as quoted by the Coal Age, averaged $11.97 in the month of highest prices; Pocahontas averaged $12.90; central Illinois $8.25; and western Kentucky $7.03. The market broke, however, in the last quarter of the year, and by December prices were nearing the normal levels.

Most of the coal continued to move on contract at rates far below these prices. The average price obtained by the miners for all bituminous coal produced in 1920 was $3.75. This was somewhat more than three times the average for 1913. In comparison with the price during the war year, 1918, it was an increase of 45 per cent.

ANTHRACITE TRADE IN 1920.

The outstanding feature of the anthracite trade in 1920 was the new wage agreement. After fruitless negotiations between operators and miners, the question of new rates was referred to a commission appointed by the President, which announced its decision late in August. The union had demanded an increase of 60 per cent in contract rates and of $2 a day in the pay of day men, a 30-hour week, and full recognition of the United Mine Workers' organization. The decision in the arbitration of the bituminous wage cut the ground from under the demand for an increase of 60 per cent in contract rates. The decision provided for an increase of 20 per cent in contract rates over those in effect prior to March 31, 1920, and an increase of 17 per cent to company and monthly men, consideration miners, and miners' laborers. The demand for recognition of the United Mine Workers as a party to the contract was granted, but those for the closed shop and the check-off were denied. The award was followed by the so-called "vacation" strike of September; but when that was over the output quickly recovered. The loss in output during that time, however, made a strong market during the last quarter of the year.

BITUMINOUS TRADE IN 1921.

Decrease in production.—The first indications of the collapse of the postwar boom appeared during the last quarter of 1920, but its full force was not felt until 1921. In fact, during the last four months of 1920 the output of bituminous coal averaged 52,338,000 net tons a month, as against 46,890,000 tons a month in 1918. Nobody wanted to believe that "the bloom was off the boom," so the industries continued to accumulate stocks of coal with the idea that any slump in prices in the winter of 1920 would be a short seasonal freak. This idea, however, soon had to be abandoned, for the output in January, 1921, was the lowest since 1915 and was about 8,600,000 tons less than that in January of the preceding year. The output in February and March declined still further, and that in April was only 28,154,000 tons.

Exports.—In May and June the output increased, but the totals for those months were not only below those for May and June, 1920, but below those for the same months in 1919. Even this increase was probably due more to the beginning of the Lake trade and to a welcome spurt in the movement of exports than to any recovery in general industrial demand. The strike in the collieries of Great Britain that began on April 1 and continued until July 4, 1921, afforded the United States an opportunity to reenter temporarily many of the foreign markets that it had lost with the tightening of competition that followed the decline of the feverish postwar European activity of 1920, and thus coals were actually shipped to Newcastle. The exports from the United States to the United Kingdom in 1921 amounted to about 1,676,000 net tons, as compared with 58,000 tons in 1920 and 7,400 tons in 1919. Export shipments, which had started the year at a monthly rate of about 2,500,000 net tons, dropped to 1,410,000 tons in February but rose from 1,616,000 in tons April to 2,800,000 tons in May, 3,712,000 tons in June, and 2,968,000 tons in July. The trend was then downward from 1,899,000 tons in August to 863,000 tons in December. The total exports for the year were 23,131,000 net tons, as compared with 38,517,000 tons in 1920.

Comparison of figures on foreign trade for 1920 and 1921 shows that the American coal exporter lost business in practically every direction in 1921. In the trans-Atlantic trade the only gains registered were in the movement to the Azores and Madeira Islands, the Canary Islands, Dutch East Indies, Gibraltar, Czechslovakia, Portuguese Africa, European Russia, and England, to none of which was the total movement of sufficient volume to cause rejoicing. In the southern trade slight increases in shipments to the French West Indies and Nicaragua were the only variations in an otherwise unbroken list of losses. Colombia was the only South American country to take more coal from the United States in 1921 than in 1920.

Limitations on production.—The demands for the Lake trade and the export trade were not sufficient to offset the losses in other directions, and in July production decreased nearly 3,600,000 tons. In August and September, however, apprehension among consumers over a possible railroad strike caused increases, and in October the production was larger than for any other month in the year—approximately 44,687,000 tons. There was a sharp drop in November, and in December the output fell to 31,650,000 tons. Although the losses for the year were unevenly distributed among the different States, the percentage of decreases from 1920 showed little variation sectionally except in the Western Interior States (Iowa, Kansas, Missouri, Oklahoma, Arkansas, and Texas), where the output in 1921 was only 61.7 per cent of that in 1920. The Northeastern group of coal-producing States, comprising Michigan, Pennsylvania, Ohio, West Virginia, Maryland, Virginia, and eastern Kentucky, produced about 73 per cent as much as they produced in 1920; the southern Appalachian group (Alabama, Georgia, and Tennessee), 74.2 per cent; the Eastern Interior States (Illinois, Indiana, and western Kentucky), 76.3 per cent; and the Mountain and Northwestern groups, 71 per cent. The greater decline in the Western Interior group is readily understandable. In general this group produces high-cost coal of less desirable grade than certain other groups. The changes in the other groups are discussed in greater detail in the statistics under "Production," which follow.

The limitation on production during the year as a whole was the weak demand, which is considered in the weekly reports of the Geological Survey under the heading "no market." For reasons discussed elsewhere (pp. 488–491) no period in the year was wholly free from complaints of shortages in labor and means of transportation, but so far as the market conditions for the country as a whole were concerned, these complaints may be dismissed as inconsequential. Although these drawbacks may have kept down the output at particular mines and in particular fields for short periods, the demand for coal was at no time in 1921 equal to the productive capacity as measured by the supply of labor and the means of transportation actually available. This same general statement applies with like force to conditions at the bituminous mines in 1919, except for the period during which the union districts were tied up by the general strike, when the production of the mines unaffected by the strike was largely increased. In 1920, on the other hand, because of the combination of circumstances set forth in detail above, the lack of transportation facilities limited production for a long time.

The unfavorable record for bituminous coal in 1921 as compared with that in 1920 and the war years reflected a general industrial depression, not only in this country but throughout the world. Although the production of coal in the United States in 1921 was equal to that in 1910, the production in the whole world was down to that in 1909.

ANTHRACITE TRADE IN 1921.

The anthracite trade in 1921 may be described as "normal." Although the demand for the smaller sizes of hard coal showed a decrease, that for the domestic sizes showed a slight increase.

STATISTICS OF PRODUCTION IN 1919, 1920, AND 1921.

SUMMARY.

The record for production established in 1918 was not equaled during the three years covered by the present report. In 1918 the combined output of bituminous coal and Pennsylvania anthracite, 678,211,904 net tons, and the bituminous output, 579,385,820 net tons, both made new high records, and the output of anthracite, 98,826,084 net tons, was only eight-tenths of 1 per cent behind that of 1917, the banner year for anthracite.

In 1919 the combined output was 18.3 per cent, or 124,259,645 tons, less than that in 1918, the heaviest decline being in bituminous coal, which was 113,525,762 tons less than that in the preceding year, or 19.6 per cent. Part of this loss, of course, was due to the strike in November and December in the organized bituminous fields of the country. The decrease in the production of anthracite was 10,733,883 tons, or 10.8 per cent.

The total bituminous output in 1920—568,666,683 tons—exceeded that in 1919 by 102,806,625 tons, or about 22 per cent, and came within 10,719,137 tons, or about 1.8 per cent, of equaling the record of 1918. The output of anthracite, which is less affected by the industrial and export demands that caused the rapid recovery in the output of bituminous coal in 1920, amounted to 89,598,249 net tons, or only 1,506,048 tons more than in 1919, an increase of about 1.7 per cent.

In 1921 the output of anthracite was 90,473,451 net tons, an increase of 875,202 tons, or 1 per cent, over that in 1920. Although still 9,138,360 tons behind the record year of 1917, the production of hard coal since the end of the war has not shown the violent fluctuations that have marked the recent course of the production of bituminous coal. Thus the bituminous output in 1921 dropped to

415,921,950 tons, a decline of 152,744,733 tons, or 26.9 per cent, from that in 1920. Prices showed a still greater decline. The value of the bituminous coal produced in 1921 decreased $929,949,400, a decline of 43.7 per cent, as compared with the value of that produced in 1920. The average value per ton dropped from $3.75 to $2.89.

Summary of statistics of coal produced in the United States, 1918–1921.

	1918		1919	
	Net tons.	Value.	Net tons.	Value.
Bituminous coal and lignite	579,385,820	$1,491,809,940	465,860,058	$1,160,616,013
Pennsylvania anthracite	98,826,084	336,480,347	88,092,201	364,926,950
	678,211,904	1,828,290,287	553,952,259	1,525,542,963

	1920		1921	
	Net tons.	Value.	Net tons.	Value.
Bituminous coal and lignite	a 568,666,683	a $2,129,933,000	415,921,950	$1,199,983,600
Pennsylvania anthracite	89,598,249	434,252,000	90,473,451	452,305,000
	658,264,932	2,564,185,000	506,395,401	1,652,288,600

	Increase or decrease, 1921.			
	Quantity.		Value.	
	Net tons.	Per cent.	Dollars.	Per cent.
Bituminous coal and lignite	−152,744,733	−26.9	−$929,949,400	−43.7
Pennsylvania anthracite	+875,202	+.9	+18,053,000	+4.2
	−151,869,531	−23.1	−911,896,400	−35.6

a Revised figures.

The Territory of Alaska was the only region that made a new high record of production of bituminous coal in 1921. Eight States made such a record in 1920—Kentucky, North Dakota, Ohio, Oklahoma, Utah, Virginia, West Virginia, and Wyoming. Seven States—Illinois, Indiana, Kansas, Montana, New Mexico, Pennsylvania, and Washington—made their highest recorded production in 1918, and one State—South Dakota—in 1919. Alabama, Colorado, Iowa, and Missouri reached their highest output in 1917. Texas made its highest record in 1913; Arkansas, Maryland, and Michigan in 1907; Tennessee in 1910. Production in California and Oregon was at its peak in 1880—the oldest year of record. The figures of the maximum production for all States are shown in the following table:

Coal produced in the United States in 1921, by States, and highest recorded production.

State.	Net tons.	Maximum production.	
		Year.	Net tons.
Alabama	12,568,899	1917	20,068,074
Alaska	76,817	1921	76,817
Arkansas	1,227,777	1907	2,670,438
California, Idaho, and Oregon	38,845	1880	[a] 280,155
Colorado	9,122,760	1917	12,483,336
Georgia	33,815	1903	416,951
Illinois	69,602,763	1918	89,291,105
Indiana	20,319,509	1918	30,678,634
Iowa	4,531,392	1917	8,965,830
Kansas	3,466,641	1918	7,561,947
Kentucky	31,588,270	1920	35,690,762
Maryland	1,827,740	1907	5,532,628
Michigan	1,141,715	1907	2,035,858
Missouri	3,551,621	1917	5,670,549
Montana	2,733,958	1918	4,532,505
New Mexico	2,453,482	1918	4,023,239
North Carolina	23,438	1899	26,896
North Dakota	864,903	1920	948,625
Ohio	31,942,776	1920	45,878,191
Oklahoma	3,362,623	1920	4,849,288
Pennsylvania (bituminous)	116,013,942	1918	178,550,741
South Dakota	7,553	1919	14,417
Tennessee	4,460,326	1910	7,121,380
Texas	972,839	1913	2,429,144
Utah	4,078,784	1920	6,005,199
Virginia	7,492,378	1920	11,378,606
Washington	2,428,722	1918	4,082,212
West Virginia	72,786,996	1920	89,970,707
Wyoming	7,200,666	1920	9,630,271
Pennsylvania (anthracite)	90,473,451	1917	99,611,811

[a] California and Oregon only.

MONTHLY AND WEEKLY PRODUCTION.

The following tables form a summary of the statistics of the monthly and weekly production of anthracite and bituminous coal that were first published in the Geological Survey's weekly coal reports. The figures given are estimates, based upon weekly and daily reports of cars of coal and beehive coke loaded by the principal coal-carrying roads. The method of calculation is described in detail elsewhere.[1] The estimates thus obtained are afterward revised to agree with the results of the annual statistical reports from the producers of coal, and some of them therefore differ slightly from the estimates originally issued in the weekly reports.

To check the estimates of monthly production of anthracite an additional source of information is available in the monthly reports of shipments made by the Anthracite Bureau of Information.

Monthly production.—Comparisons of total production in months of unequal length, such as February and March, are misleading. A better comparative measure is the average production by the working day.

The production of bituminous coal normally shows a distinct seasonal rhythm. In the pre-war years there was a marked decline in output in the spring and summer. During the war the seasonal decline was obscured by the abnormal demands of the munitions industries, but in the postwar years it reappeared. In 1920, however, largely because of the boom demand and the aftermath of the strike in 1919, which made the combined output for November and

[1] Tryon, F. G., Control statistics of coal production and distribution: Statistical Assoc. Quart. Pub., September, 1920, pp. 314–325.

December in 1919 less than the output for October alone, the seasonal drop in the output was less and its duration was shorter than that in either 1919 or 1921. Production in October, 1919, was of course augmented by heavy prestrike buying. The total, 57,200,000 tons, was the largest recorded in the history of the industry.

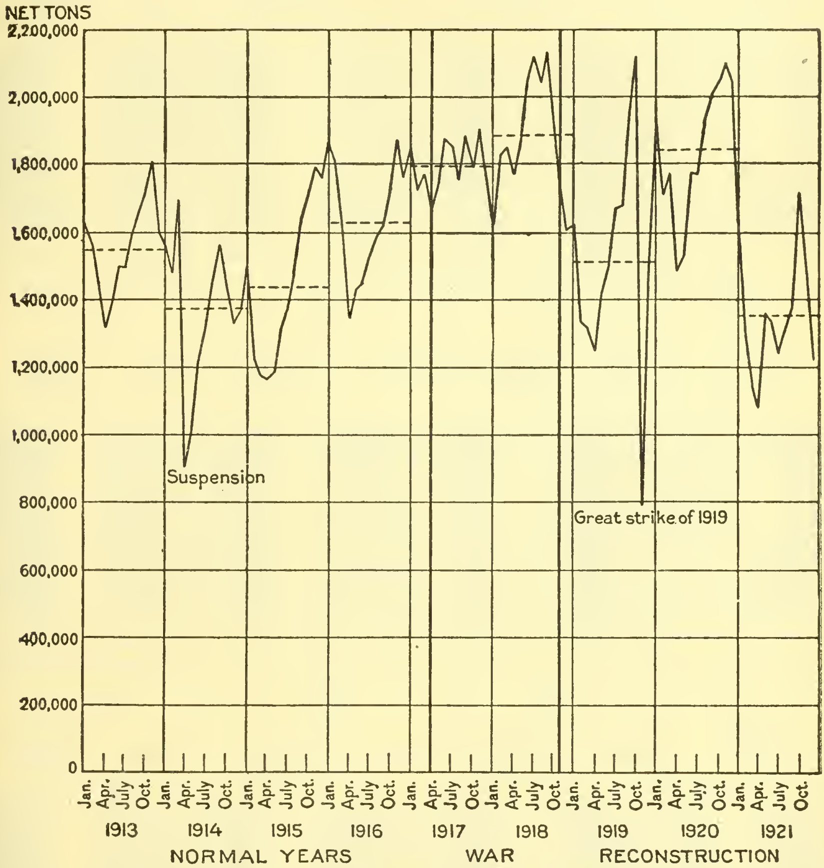


FIGURE 44.—Monthly fluctuations in bituminous coal production, 1913–1921. The curve represents the average production of bituminous coal per working day for each month. The broken horizontal line across each year represents the daily average for the year. The diagram illustrates a combination of two types of fluctuation, annual and seasonal. It also shows how the war demand buoyed up production during the summer of 1917 and 1918. Note the peaks just before the strikes of April, 1914, and November, 1919, and the profound depression of 1921.

Bituminous coal produced in the United States, by months, and average production per working day, 1913–1921, in net tons.

Month.	1913		1914		1915	
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.
January	42,274,000	1,626,000	40,191,000	1,546,000	37,194,000	1,488,000
February	37,057,000	1,544,000	35,472,000	1,478,000	29,321,000	1,222,000
March	37,536,000	1,444,000	45,455,000	1,684,000	31,801,000	1,178,000
April	34,169,000	1,314,000	23,609,000	908,000	29,968,000	1,153,000
May	37,205,000	1,378,000	28,551,000	1,098,000	30,938,000	1,190,000
June	37,405,000	1,496,000	31,412,000	1,208,000	33,957,000	1,306,000
July	38,858,000	1,495,000	34,305,000	1,319,000	35,573,000	1,368,000
August	41,590,000	1,600,000	37,751,000	1,452,000	38,161,000	1,468,000
September	41,424,000	1,657,000	39,019,000	1,561,000	40,964,000	1,639,000
October	46,164,000	1,710,000	37,685,000	1,449,000	44,198,000	1,700,000
November	43,233,000	1,801,000	33,392,000	1,336,000	44,737,000	1,789,000
December	41,519,000	1,597,000	35,862,000	1,379,000	45,814,000	1,762,000
	478,434,000	1,553,000	422,704,000	1,368,000	442,626,000	1,437,000

Month.	1916		1917		1918	
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.
January	46,593,000	1,864,000	47,969,000	1,845,000	42,227,000	1,624,000
February	45,187,000	1,807,000	41,353,000	1,723,000	43,777,000	1,824,000
March	43,828,000	1,623,000	47,869,000	1,773,000	48,113,000	1,851,000
April	33,628,000	1,345,000	41,854,000	1,674,000	46,041,000	1,771,000
May	38,804,000	1,437,000	47,086,000	1,744,000	50,443,000	1,868,000
June	37,742,000	1,452,000	46,824,000	1,873,000	51,138,000	2,046,000
July	38,113,000	1,525,000	46,292,000	1,852,000	54,971,000	2,114,000
August	42,696,000	1,581,000	47,372,000	1,755,000	55,114,000	2,041,000
September	42,098,000	1,619,000	45,108,000	1,880,000	51,183,000	2,133,000
October	44,807,000	1,723,000	48,337,000	1,790,000	52,300,000	1,937,000
November	44,927,000	1,872,000	47,690,000	1,908,000	43,895,000	1,756,000
December	44,097,000	1,764,000	44,037,000	1,761,000	40,184,000	1,607,000
	502,520,000	1,632,000	551,791,000	1,797,000	579,386,000	1,881,000

Month.	1919		1920		1921	
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.
January	42,193,000	1,623,000	49,748,000	1,913,000	41,148,000	1,646,000
February	32,103,000	1,338,000	41,055,000	1,711,000	31,524,000	1,314,000
March	34,293,000	1,319,000	47,850,000	1,772,000	31,054,000	1,150,000
April	32,712,000	1,258,000	38,764,000	1,491,000	28,154,000	1,083,000
May	38,186,000	1,414,000	39,841,000	1,532,000	34,057,000	1,362,000
June	37,685,000	1,507,000	46,095,000	1,773,000	34,635,000	1,332,000
July	43,425,000	1,670,000	45,988,000	1,769,000	31,047,000	1,242,000
August	43,613,000	1,677,000	49,974,000	1,922,000	35,291,000	1,307,000
September	48,209,000	1,928,000	50,241,000	2,010,000	35,870,000	1,380,000
October	57,200,000	2,119,000	53,278,000	2,049,000	44,687,000	1,719,000
November	19,006,000	792,000	52,576,000	2,103,000	36,805,000	1,472,000
December	37,235,000	1,432,000	53,257,000	2,048,000	31,650,000	1,217,000
	465,860,000	1,512,000	568,667,000	1,840,000	415,922,000	1,350,000

Anthracite produced in the United States, by months, and average production per working day, 1913–1921, in net tons.

Month.	1913		1914		1915	
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.
January	8,396,000	323,000	6,878,000	265,000	6,337,000	253,000
February	7,519,000	313,000	5,477,000	228,000	5,703,000	238,000
March	6,505,000	250,000	6,863,000	254,000	6,654,000	246,000
April	7,906,000	304,000	8,069,000	310,000	8,725,000	336,000
May	7,945,000	294,000	8,348,000	321,000	7,807,000	300,000
June	7,911,000	316,000	8,147,000	313,000	7,157,000	275,000
July	7,272,000	280,000	7,165,000	276,000	6,691,000	257,000
August	7,116,000	274,000	7,288,000	280,000	7,161,000	275,000
September	7,384,000	295,000	8,301,000	332,000	7,423,000	297,000
October	8,399,000	311,000	8,830,000	340,000	8,761,000	337,000
November	7,668,000	320,000	7,878,000	315,000	8,514,000	341,000
December	7,504,000	289,000	7,578,000	291,000	8,062,000	310,000
	91,525,000	297,000	90,822,000	294,000	88,995,000	289,000

Month.	1916		1917		1918	
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.
January	7,649,000	306,000	7,672,000	295,000	7,270,000	280,000
February	7,404,000	296,000	6,688,000	279,000	7,494,000	312,000
March	7,964,000	295,000	9,026,000	334,000	9,382,000	361,000
April	5,887,000	235,000	7,222,000	289,000	8,211,000	316,000
May	7,212,000	267,000	8,933,000	331,000	8,880,000	329,000
June	7,327,000	282,000	9,103,000	364,000	8,855,000	354,000
July	7,062,000	282,000	8,684,000	347,000	9,134,000	351,000
August	7,190,000	266,000	9,058,000	335,000	9,258,000	343,000
September	7,206,000	277,000	8,230,000	343,000	8,038,000	335,000
October	7,630,000	293,000	9,183,000	340,000	8,105,000	300,000
November	7,790,000	325,000	8,453,000	338,000	6,803,000	272,000
December	7,257,000	290,000	7,360,000	294,000	7,395,000	296,000
	87,578,000	284,000	99,612,000	324,000	98,826,000	321,000

Month.	1919		1920		1921	
	Total.	Daily average.	Total.	Daily average.	Total.	Daily average.
January	7,819,000	301,000	7,459,000	287,000	7,681,000	307,000
February	5,102,000	213,000	6,415,000	267,000	7,983,000	333,000
March	5,190,000	200,000	7,935,000	294,000	7,677,000	284,000
April	6,884,000	275,000	6,285,000	251,000	7,985,000	319,000
May	7,525,000	289,000	8,037,000	321,000	7,752,000	310,000
June	7,404,000	296,000	8,251,000	317,000	8,071,000	310,000
July	7,974,000	307,000	8,342,000	321,000	7,309,000	292,000
August	8,096,000	311,000	8,105,000	312,000	7,459,000	276,000
September	7,494,000	300,000	4,691,000	188,000	7,385,000	295,000
October	8,645,000	333,000	8,148,000	326,000	7,858,000	314,000
November	7,870,000	342,000	7,527,000	314,000	7,110,000	296,000
December	8,089,000	311,000	8,403,000	323,000	6,203,000	239,000
	88,092,000	290,000	89,598,000	295,000	90,473,000	298,000

Weekly production.—The extremes of the fluctuation in the output of bituminous coal are revealed even more sharply by the following table of weekly production. In the week ended October 25, 1919, the last full week before the great strike, the output was 13,344,000 net tons. In the first week of the strike it dropped to 3,638,000 tons. These figures are the highest and lowest, respectively, for the three years 1919 to 1921 and probably for other recent years.

For 1920 the lowest weekly output was 7,736,000 tons in mid-April, when the effect of the railroad switchmen's strike was most acute and the highest was 13,160,000 tons, reached late in December.

The lowest point touched in any full-time week during the depression in 1921 was 6,254,000 tons in the week of April 9. In the holiday week just preceding (May 28 to April 2) the total output was lower but the rate per working day was higher.

Bituminous coal produced in the United States, by weeks, 1919–1921.

1919		1920		1921	
Week ended—	Net tons.	Week ended—	Net tons.	Week ended—	Net tons.
Jan. 4[a]	5,369,000	Jan. 3[a]	4,243,000	Jan. 1[a]	282,000
11	10,522,000	10	11,583,000	8	11,000,000
18	10,036,000	17	11,771,000	15	10,154,000
25	9,379,000	24	10,704,000	22	9,386,000
Feb. 1	8,445,000	31	10,837,000	29	8,758,000
8	8,069,000	Feb. 7	10,239,000	Feb. 5	8,311,000
15	7,891,000	14	10,724,000	12	8,032,000
22	7,842,000	21	9,731,000	19	7,655,000
Mar. 1	8,216,000	28	10,352,000	26	7,595,000
8	8,206,000	Mar. 6	10,540,000	Mar. 5	7,438,000
15	8,175,000	13	10,512,000	12	7,052,000
22	7,601,000	20	10,585,000	19	6,655,000
29	7,710,000	27	11,267,000	26	6,599,000
Apr. 5	7,092,000	Apr. 3	9,938,000	Apr. 2	5,950,000
12	7,661,000	10	9,912,000	9	6,254,000
19	7,526,000	17	7,736,000	16	6,671,000
26	7,492,000	24	8,718,000	23	6,965,000
May 3	8,146,000	May 1	9,133,000	30	7,137,000
10	8,569,000	8	9,377,000	May 7	7,553,000
17	8,567,000	15	8,965,000	14	8,185,000
24	8,859,000	22	9,458,000	21	8,165,000
31	8,061,000	29	9,787,000	28	8,345,000
June 7	9,065,000	June 5	9,350,000	June 4	6,985,000
14	8,617,000	12	10,592,000	11	8,186,000
21	8,816,000	19	10,326,000	18	7,717,000
28	9,617,000	26	10,798,000	25	7,873,000
July 5	7,575,000	July 3	10,522,000	July 2	7,826,000
12	10,384,000	10	9,880,000	9	6,300,000
19	10,042,000	17	11,129,000	16	7,564,000
26	10,143,000	24	10,710,000	23	7,542,000
Aug. 2	10,097,000	31	9,586,000	30	7,480,000
9	9,504,000	Aug. 7	10,671,000	Aug. 6	7,344,000
16	9,233,000	14	12,084,000	13	7,942,000
23	10,841,000	21	11,292,000	20	7,877,000
30	10,605,000	28	11,644,000	27	7,923,000
Sept. 6	9,801,000	Sept. 4	11,423,000	Sept. 3	7,773,000
13	11,217,000	11	10,930,000	10	7,240,000
20	11,428,000	18	11,921,000	17	8,367,000
27	11,793,000	25	12,123,000	24	8,714,000
Oct. 4	11,697,000	Oct. 2	11,610,000	Oct. 1	9,085,000
11	12,072,000	9	12,380,000	8	9,335,000
18	12,012,000	16	12,387,000	15	9,924,000
25	13,344,000	23	12,512,000	22	11,292,000
Nov. 1	12,299,000	30	12,691,000	29	11,197,000
8	3,638,000	Nov. 6	11,691,000	Nov. 5	9,532,000
15	4,086,000	13	12,410,000	12	8,781,000
22	5,427,000	20	11,961,000	19	9,066,000
29	5,417,000	27	11,751,000	26	7,257,000
Dec. 6	5,326,000	Dec. 4	13,106,000	Dec. 3	7,261,000
13	5,890,000	11	13,160,000	10	7,473,000
20	10,664,000	18	12,435,000	17	7,218,000
27	8,755,000	25	9,908,000	24	7,614,000
Jan. 3[a]	7,021,000	Jan. 1[a]	9,572,000	31	6,092,000
	465,860,000		568,667,000		415,922,000

[a] Figures represent that part of the output in the week which is included in the calendar year shown. The figures of total production for these weeks are as follows: Jan. 4, 1919, 8,585,000 tons; Jan. 3, 1920, 11,264,000 tons; Jan. 1, 1921, 9,843,000.

To compare the trend of production in a week containing a holiday with that in a full week of six working days, recourse must be had to the average output per working day. In the accompanying table is given the number of working days in each week of the last three years and the average daily production. The figures, it should be noted, represent bituminous coal only. In the anthracite region certain other holidays are observed.

The number of days in the working year is not the same in all districts. All mines observe Sundays, Fourth of July, and Christmas, and practically all mines observe New Year's Day, although under exceptional circumstances, as in 1920, considerable coal may be loaded on New Year's Day. There are other holidays, such as Eight-Hour Day (April 1) and Labor Day, that are very generally observed in union districts but not in nonunion districts, and such days count over the country as a whole for about three-tenths of a full working day. Similar variations have been noted in the observance of Memorial Day and Thanksgiving Day. After allowance is made for these holidays the weighted average potential working year is 308 days for the country as a whole. Other special holidays, such as a presidential election day, or a draft registration day, may cut the working year still further. If Armistice Day is to be generally observed hereafter, the working year will average about 307 days. In 1920 the day counted for seven-tenths and in 1921 for five-tenths of a full day.

On other days, such as the birthdays of Lincoln and Washington and church holy days, the bituminous mines are not generally closed, and these days have therefore been counted in the table as working days.

These conclusions are based upon weekly reports of time worked and lost by the mines for the four years 1917–1921 and upon weekly and daily records of cars loaded by the railroads.

Number of working days and average production of bituminous coal per working day in each week, 1919–1921.

1919			1920			1921		
Week ended—	Number of working days.	Average production.	Week ended—	Number of working days.	Average production.	Week ended—	Number of working days.	Average production.
Jan. 4	[a] 3.3	[b] 1,660,000	Jan. 3	[a] 2.3	[b] 2,130,000	Jan. 1	[a] 0.2	[b] 1,898,000
11	6	1,754,000	10	6	1,931,000	8	6	1,834,000
18	6	1,673,000	17	6	1,962,000	15	6	1,693,000
25	6	1,564,000	24	6	1,784,000	22	6	1,565,000
			31	6	1,807,000	29	6	1,460,000
Feb. 1	6	1,408,000	Feb. 7	6	1,707,000	Feb. 5	6	1,385,000
8	6	1,345,000	14	6	1,788,000	12	6	1,339,000
15	6	1,315,000	21	6	1,622,000	19	6	1,276,000
22	6	1,307,000	28	6	1,726,000	26	6	1,266,000
Mar. 1	6	1,370,000	Mar. 6	6	1,757,000	Mar. 5	6	1,240,000
8	6	1,368,000	13	6	1,752,000	12	6	1,176,000
15	6	1,363,000	20	6	1,765,000	19	6	1,109,000
22	6	1,267,000	27	6	1,878,000	26	6	1,100,000
29	6	1,285,000						
Apr. 5	5.5	1,287,000	Apr. 3	5.3	1,880,000	Apr. 2	5.3	1,123,000
12	6	1,277,000	10	6	1,652,000	9	6	1,043,000
19	6	1,255,000	17	6	1,290,000	16	6	1,112,000
26	6	1,249,000	24	6	1,453,000	23	6	1,161,000
						30	6	1,190,000
May 3	6	1,358,000	May 1	6	1,522,000	May 7	6	1,259,000
10	6	1,428,000	8	6	1,563,000	14	6	1,364,000
17	6	1,428,000	15	6	1,494,000	21	6	1,361,000
24	6	1,477,000	22	6	1,578,000	28	6	1,391,000
31	5.5	1,470,000	29	6	1,631,000			

[a] Number of working days in this week that fell in the year considered.
[b] Average daily production for the entire week, not for the working days that fell in the year considered.

Number of working days and average production of bituminous coal per working day in each week, 1919–1921—Continued.

1919			1920			1921		
Week ended—	Number of working days.	Average production.	Week ended—	Number of working days.	Average production.	Week ended—	Number of working days.	Average production.
June 7	6	1,511,000	June 5	5.5	1,700,000	June 4	5.2	1,341,000
14	6	1,436,000	12	6	1,766,000	11	6	1,365,000
21	6	1,470,000	19	6	1,721,000	18	6	1,286,000
28	6	1,603,000	26	6	1,800,000	25	6	1,312,000
July 5	5	1,515,000	July 3	6	1,754,000	July 2	6	1,305,000
12	6	1,731,000	10	5	1,976,000	9	5	1,260,000
19	6	1,674,000	17	6	1,855,000	16	6	1,261,000
26	6	1,691,000	24	6	1,785,000	23	6	1,257,000
			31	6	1,598,000	30	6	1,247,000
Aug. 2	6	1,683,000	Aug. 7	6	1,779,000	Aug. 6	6	1,224,000
9	6	1,584,000	14	6	2,014,000	13	6	1,324,000
16	6	1,539,000	21	6	1,882,000	20	6	1,313,000
23	6	1,807,000	28	6	1,941,000	27	6	1,321,000
30	6	1,768,000						
Sept. 6	5.3	1,849,000	Sept. 4	6	1,904,000	Sept. 3	6	1,296,000
13	6	1,870,000	11	5.3	2,062,000	10	5.3	1,366,000
20	6	1,905,000	18	6	1,987,000	17	6	1,395,000
27	6	1,966,000	25	6	2,021,000	24	6	1,453,000
Oct. 4	6	1,950,000	Oct. 2	6	1,935,000	Oct. 1	6	1,514,000
11	6	2,012,000	9	6	2,064,000	8	6	1,556,000
18	6	2,002,000	16	6	2,065,000	15	6	1,654,000
25	6	2,224,000	23	6	2,086,000	22	6	1,882,000
			30	6	2,116,000	29	6	1,867,000
Nov. 1	6	2,050,000	Nov. 6	5.5	2,120,000	Nov. 5	6	1,589,000
8	6	606,000	13	5.7	2,170,000	12	5.5	1,597,000
15	6	681,000	20	6	1,994,000	19	6	1,511,000
22	6	905,000	27	5.3	2,214,000	26	5.3	1,372,000
29	5.5	983,000						
Dec. 4	6	888,000	Dec. 4	6	2,185,000	Dec. 3	6	1,210,000
13	6	982,000	11	6	2,194,000	10	6	1,246,000
20	6	1,772,000	18	6	2,073,000	17	6	1,263,000
27	5	1,771,000	25	5.0	1,982,000	24	6	1,269,000
Jan. 3	[a] 3.0	[b] 2,130,000	Jan. 1	[a] 5.0	[b] 1,898,000	31	[a] 5	[b] 1,218,000
	308.1	1,512,000	....	307.9	1,847,000	....	306.8	1,356,000

[a] Number of working days in this week that fell in the year considered.
[b] Average daily production for the entire week, not for the working days that fell in the year considered.

MONTHLY PRODUCTION BY STATES.

The following tables show the production of bituminous coal in each State for each month from January, 1917, to December, 1921. The figures represent estimates based upon weekly reports of cars of coal and of beehive coke loaded by all the large coal-carrying roads, which were obtained either through the American Railway Association or directly from the carriers, and also upon monthly reports of coal shipped by waterways, which were courteously furnished by the United States Engineer Office.

The method of calculation is explained elsewhere.[2] The monthly estimates for each State are later revised to agree with the final statistics of total ouput for the year, which are obtained direct from the producers of coal. The revised estimates are sufficiently accurate to show clearly the general trend of output in each State from season to season. For certain States, notably Illinois, Colorado, and Indiana, the records kept by State officials and local operators' associations have been utilized, wherever available, by adjusting them to agree with the final total production as ascertained by the Geological Survey.

[2] Tryon, F. G., op. cit.

Bituminous coal produced in the United States, by States and months, 1917–1921, in net tons.

State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1917.													
Alabama	1,866,000	1,694,000	1,802,000	1,570,000	1,732,000	1,685,000	1,602,000	1,521,000	1,486,000	1,676,000	1,758,000	1,676,000	20,068,000
Arkansas	214,000	184,000	185,000	147,000	179,000	176,000	170,000	172,000	165,000	180,000	191,000	181,000	2,144,000
Colorado	1,305,000	1,012,000	1,060,000	914,000	997,000	974,000	943,000	1,050,000	1,012,000	1,066,000	1,047,000	1,103,000	12,483,000
Illinois	7,493,000	6,460,000	7,478,000	6,538,000	7,355,000	7,315,000	7,232,000	7,400,000	7,047,000	7,551,000	7,450,000	6,880,000	86,199,000
Indiana	2,399,000	2,098,000	2,291,000	1,886,000	2,232,000	2,088,000	2,114,000	2,190,000	2,099,000	2,378,000	2,425,000	2,339,000	26,539,000
Iowa	871,000	759,000	754,000	581,000	746,000	740,000	730,000	688,000	706,000	792,000	813,000	786,000	8,966,000
Kansas	646,000	608,000	648,000	519,000	617,000	607,000	568,000	576,000	558,000	587,000	619,000	632,000	7,185,000
Kentucky	2,568,000	2,259,000	2,455,000	2,137,000	2,389,000	2,343,000	2,388,000	2,182,000	2,042,000	2,378,000	2,541,000	2,126,000	27,808,000
Maryland	323,000	356,000	419,000	387,000	425,000	404,000	379,000	429,000	385,000	440,000	437,000	362,000	4,746,000
Michigan	129,000	119,000	136,000	109,000	119,000	97,000	102,000	108,000	109,000	113,000	112,000	121,000	1,374,000
Missouri	568,000	491,000	496,000	377,000	478,000	453,000	447,000	452,000	438,000	471,000	499,000	501,000	5,671,000
Montana	348,000	354,000	377,000	286,000	333,000	286,000	341,000	358,000	342,000	368,000	406,000	428,000	4,227,000
New Mexico	347,000	341,000	344,000	305,000	323,000	322,000	296,000	322,000	328,000	343,000	334,000	396,000	4,001,000
North Dakota	86,000	70,000	77,000	51,000	53,000	45,000	55,000	61,000	60,000	67,000	80,000	86,000	791,000
Ohio	3,572,000	2,826,000	3,350,000	2,915,000	3,422,000	3,536,000	3,540,000	3,723,000	3,445,000	3,700,000	3,570,000	3,150,000	40,749,000
Oklahoma	448,000	348,000	317,000	257,000	365,000	363,000	342,000	363,000	344,000	382,000	399,000	459,000	4,387,000
Pennsylvania	14,529,000	12,485,000	15,479,000	13,699,000	14,806,000	14,885,000	14,576,000	14,938,000	14,315,000	15,053,000	14,324,000	13,359,000	172,448,000
Tennessee	535,000	456,000	498,000	443,000	524,000	525,000	503,000	527,000	494,000	555,000	578,000	556,000	6,194,000
Texas	231,000	190,000	189,000	175,000	206,000	195,000	186,000	212,000	183,000	199,000	196,000	194,000	2,356,000
Utah	391,000	297,000	322,000	295,000	316,000	294,000	237,000	295,000	339,000	439,000	410,000	490,000	4,125,000
Virginia	943,000	798,000	887,000	759,000	871,000	828,000	802,000	831,000	800,000	877,000	885,000	806,000	10,087,000
Washington	341,000	329,000	324,000	290,000	299,000	306,000	321,000	325,000	301,000	329,000	420,000	425,000	4,010,000
West Virginia	6,915,000	6,118,000	7,301,000	6,579,000	7,576,000	7,646,000	7,705,000	7,905,000	7,460,000	7,722,000	7,394,000	6,121,000	86,442,900
Wyoming	881,000	686,000	661,000	619,000	704,000	692,000	695,000	725,000	632,000	654,000	783,000	844,000	8,576,000
Other States [a]	20,000	15,000	19,000	16,000	19,000	19,000	18,000	19,000	18,000	17,000	19,000	16,000	215,000
	47,969,000	41,353,000	47,869,000	41,854,000	47,086,000	46,824,000	46,292,000	47,372,000	45,108,000	48,337,000	47,690,000	44,037,000	551,791,000

[a] Includes Alaska, California, Georgia, Idaho, North Carolina, Oregon, and South Dakota.

Bituminous coal produced in the United States, by States and months, 1917–1921, in net tons—Continued.

State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1918.													
Alabama	1,398,200	1,449,616	1,593,119	1,524,629	1,670,243	1,693,265	1,820,269	1,824,874	1,694,800	1,731,827	1,453,452	1,330,668	19,184,962
Arkansas	162,331	168,300	184,961	177,009	193,915	196,588	211,333	211,867	196,766	201,065	168,745	154,489	2,227,369
Colorado	904,264	937,516	1,030,325	985,030	1,080,203	1,095,092	1,177,230	1,180,208	1,096,085	1,120,031	939,998	860,589	12,407,571
Illinois	7,150,010	7,419,000	7,803,007	6,888,011	7,762,015	7,767,011	8,240,020	8,149,031	7,630,000	8,226,000	6,516,000	5,741,000	89,291,105
Indiana	2,184,570	2,264,192	2,516,556	2,454,444	2,671,947	2,716,914	2,929,249	2,945,925	2,730,790	2,756,012	2,344,164	2,163,871	30,678,634
Iowa	597,047	619,002	680,280	651,034	713,212	723,043	777,275	779,242	723,699	739,509	620,641	568,211	8,192,195
Kansas	551,115	571,381	627,944	600,948	658,343	667,417	717,478	719,292	668,022	682,617	572,893	524,497	7,561,947
Kentucky	2,252,639	2,334,763	2,594,114	2,528,668	2,753,259	2,799,348	3,017,865	3,034,765	2,813,298	2,840,324	2,414,924	2,228,650	31,612,617
Maryland	327,763	339,816	373 456	357,400	391,535	396,931	426,704	427,783	397,291	405,971	340,715	311,932	4,497,297
Michigan	106,756	110,682	121,638	116,409	127,527	129,285	138,982	139,333	129,402	132,229	110,975	101,600	1,464,818
Missouri	413,064	428,254	470,648	450,415	493,433	500,234	537,754	539,114	500,687	511,626	429,387	393,114	5,667,730
Montana	330,329	342,476	376,379	360,198	394,600	400,039	430,044	431,132	400,401	409,149	343,383	314,375	4,532,505
New Mexico	293,214	303,996	334,090	319,727	350,263	355,091	381,725	382,690	355,413	363,178	304,800	279,052	4,023,239
North Dakota	52,454	54,383	59,767	57,197	62,660	63,524	68,288	68,461	63,581	64,970	54,527	49,921	719,733
Ohio	3,261,913	3,380,797	3,757,810	3,665,374	3,990,073	4,057,278	4,374,422	4,399,386	4,078,073	4,115,512	3,500,717	3,231,588	45,812,943
Oklahoma	350,804	363,704	399,709	382,525	419,058	424,835	456,700	457,855	425,220	434,510	364,667	333,860	4,813,447
Pennsylvania	12,705,043	13,167,977	14,640,866	14,287,905	15,551,022	15,814,198	17,051,654	17,150,384	15,897,002	16,037,687	13,646,715	12,600,288	178,550,741
Tennessee	497,847	516,154	567,250	542,863	594,711	602,908	648,130	649,769	603,455	616,639	517,520	473,802	6,831,048
Texas	164,792	170,851	187,765	179,692	196,854	199,568	214,536	215,079	199,749	204,113	171,304	156,832	2,261,135
Utah	374,372	388,138	426,562	408,223	447,212	453,376	487,382	488,615	453,787	463,701	389,167	356,290	5,136,825
Virginia	749,921	777,498	854,466	817,731	895,831	908,178	976,296	978,767	909,002	928,861	779,556	713,701	10,289,808
Washington	297,512	308,452	338,987	324,413	355,398	360,296	387,320	388,300	360,623	368,501	309,268	283,142	4,082,212
West Virginia	6,400,656	6,633,893	7,375,278	7,196,440	7,833,011	7,965,393	8,588,493	8,638,015	8,006,848	8,078,465	6,873,395	6,345,952	89,935,839
Wyoming	687,892	713,187	783,789	750,093	821,732	833,059	895,543	897,808	833,813	852,030	715,075	654,667	9,438,688
Other States[a]	12,492	12,952	14,234	13,622	14,923	15,129	16,263	16,305	15,143	15,473	12,987	11,889	171,412
	42,227,000	43,776,980	48,113,000	46,041,000	50,442,980	51,138,000	54,970,955	55,114,000	51,182,950	52,300,000	43,894,975	40,183,980	579,385,820
1919.													
Alabama	1,768,000	1,298,000	1,304,000	1,192,000	1,216,000	1,175,000	1,343,000	1,214,000	1,379,000	1,688,000	850,000	1,110,000	15,537,000
Arkansas	145,000	106,000	110,000	109,000	102,000	112,000	143,000	141,000	164,000	192,000	1,000	104,000	1,429,000
Colorado	949,000	814,000	815,000	761,000	766,000	780,000	839,000	880,000	920,000	1,056,000	620,000	1,123,000	10,323,000
Illinois	5,917,000	5,022,000	5,256,000	4,485,000	4,676,000	4,395,000	5,271,000	5,517,000	6,833,000	8,515,000	13,000	4,963,000	60,863,000
Indiana	1,879,000	1,528,000	1,680,000	1,461,000	1,753,000	1,709,000	1,856,000	2,004,000	2,353,000	2,923,000	11,000	1,755,000	20,912,000
Iowa	596,000	442,000	511,000	414,000	438,000	405,000	491,000	497,000	670,000	809,000	0	352,000	5,625,000
Kansas	582,000	457,000	458,000	461,000	443,000	441,000	517,000	497,000	534,000	629,000	5,000	201,000	5,225,000
Kentucky	2,542,000	2,060,000	2,259,000	2,123,000	2,502,000	2,303,000	2,717,000	2,369,000	2,774,000	3,371,000	2,044,000	2,972,000	30,036,000
Maryland	275,000	188,000	197,000	213,000	258,000	264,000	294,000	307,000	334,000	382,000	139,000	171,000	3,022,000
Michigan	104,000	84,000	75,000	142,000	26,000	58,000	98,000	98,000	103,000	134,000	0	75,000	997,000
Missouri	444,000	356,000	329,000	317,000	301,000	288,000	369,000	352,000	420,000	536,000	1,000	267,000	3,980,000
Montana	352,000	205,000	280,000	220,000	231,000	241,000	256,000	292,000	350,000	440,000	92,000	277,000	3,236,000
New Mexico	299,000	243,000	219,000	213,000	246,000	242,000	252,000	268,000	273,000	327,000	192,000	365,000	3,139,000

[a] Includes Alaska, California, Georgia, Idaho, Nevada, North Carolina, Oregon, and South Dakota.

North Dakota	94,000	68,000	71,000	50,000	47,000	46,000	51,000	58,000	70,000	105,000	68,000	113,000	841,000
Ohio	2,596,000	1,975,000	2,208,000	2,309,000	3,454,000	3,705,000	3,862,000	3,964,000	4,310,000	5,264,000	178,000	2,052,000	35,877,000
Oklahoma	369,000	313,000	362,000	320,000	325,000	274,000	351,000	365,000	407,000	478,000	2,000	236,000	3,802,000
Pennsylvania	14,151,000	10,034,000	10,568,000	10,355,000	12,252,000	12,320,000	14,503,000	15,183,000	15,588,000	17,778,000	7,115,000	10,911,000	150,758,000
Tennessee	558,000	439,000	459,000	406,000	406,000	411,000	481,000	449,000	489,000	632,000	101,000	382,000	5,213,000
Texas	170,000	158,000	159,000	136,000	147,000	139,000	148,000	142,000	146,000	138,000	85,000	113,000	1,681,000
Utah	407,000	328,000	329,000	258,000	303,000	330,000	388,000	404,000	400,000	471,000	457,000	556,000	4,631,000
Virginia	822,000	677,000	683,000	649,000	722,000	681,000	801,000	703,000	806,000	948,000	796,000	1,039,000	9,327,000
Washington	382,000	296,000	289,000	262,000	220,000	235,000	255,000	275,000	276,000	348,000	1,000	151,000	2,990,000
West Virginia	6,010,000	4,398,000	4,994,000	5,437,000	6,921,000	6,709,000	7,540,000	6,920,000	7,862,000	9,083,000	5,937,000	7,225,000	79,036,000
Wyoming	765,000	601,000	666,000	406,000	418,000	410,000	586,000	702,000	736,000	939,000	285,000	706,000	7,220,000
Other States [a]	17,000	13,000	12,000	13,000	13,000	12,000	13,000	12,000	12,000	14,000	13,000	16,000	160,000
	42,193,000	32,103,000	34,293,000	32,712,000	38,186,000	37,685,000	43,425,000	43,613,000	48,209,000	57,200,000	19,006,000	37,235,000	465,860,000
1920.													
Alabama	1,412,000	1,152,000	1,344,000	1,124,000	1,147,000	1,331,000	1,371,000	1,451,000	1,450,000	1,525,000	1,488,000	1,499,000	16,294,000
Arkansas	182,000	149,000	174,000	145,000	148,000	172,000	177,000	187,000	187,000	197,000	192,000	194,000	2,104,000
Colorado	1,064,000	868,000	1,013,000	847,000	864,000	1,003,000	1,033,000	1,093,000	1,093,000	1,149,000	1,122,000	1,129,000	12,278,000
Illinois	8,155,000	7,118,000	8,257,000	5,668,000	6,061,000	6,887,000	5,600,000	7,237,000	7,539,000	8,363,000	8,729,000	9,111,000	88,725,000
Indiana	2,544,000	2,075,000	2,421,000	2,024,000	2,066,000	2,398,000	2,470,000	2,614,000	2,611,000	2,747,000	2,681,000	2,700,000	29,351,000
Iowa	677,000	552,000	645,000	539,000	550,000	638,000	658,000	696,000	695,000	731,000	714,000	719,000	7,814,000
Kansas	513,000	419,000	489,000	409,000	417,000	484,000	499,000	528,000	527,000	555,000	541,000	545,000	5,926,000
Kentucky	3,093,000	2,524,000	2,944,000	2,461,000	2,512,000	2,916,000	3,003,000	3,178,000	3,176,000	3,340,000	3,261,000	3,283,000	35,691,000
Maryland	352,000	288,000	335,000	280,000	286,000	332,000	342,000	362,000	362,000	381,000	371,000	374,000	4,065,000
Michigan	129,000	105,000	123,000	103,000	105,000	122,000	125,000	133,000	133,000	139,000	136,000	137,000	1,490,000
Missouri	465,000	380,000	443,000	370,000	378,000	439,000	452,000	478,000	478,000	502,000	490,000	494,000	5,369,000
Montana	383,000	312,000	364,000	304,000	311,000	361,000	371,000	393,000	393,000	413,000	403,000	406,000	4,414,000
New Mexico	319,000	260,000	304,000	254,000	259,000	301,000	310,000	328,000	328,000	345,000	336,000	339,000	3,683,000
North Dakota	82,000	67,000	78,000	65,000	67,000	78,000	80,000	85,000	84,000	89,000	87,000	87,000	949,000
Ohio	3,976,000	3,244,000	3,785,000	3,164,000	3,229,000	3,748,000	3,861,000	4,085,000	4,082,000	4,293,000	4,191,000	4,220,000	45,878,000
Oklahoma	420,000	343,000	400,000	334,000	341,000	396,000	408,000	432,000	432,000	454,000	443,000	446,000	4,849,000
Pennsylvania	14,788,000	12,062,000	14,075,000	11,765,000	12,008,000	13,935,000	14,359,000	15,192,000	15,179,000	15,966,000	15,588,000	15,691,000	170,608,000
Tennessee	577,000	472,000	550,000	459,000	469,000	544,000	561,000	593,000	593,000	623,000	609,000	612,000	6,662,000
Texas	140,000	114,000	133,000	111,000	113,000	132,000	136,000	144,000	144,000	151,000	148,000	149,000	1,615,000
Utah	520,000	425,000	495,000	414,000	423,000	491,000	505,000	535,000	534,000	562,000	549,000	552,000	6,005,000
Virginia	986,000	805,000	939,000	785,000	801,000	930,000	957,000	1,013,000	1,012,000	1,065,000	1,039,000	1,047,000	11,379,000
Washington	326,000	266,000	310,000	259,000	264,000	307,000	316,000	334,000	334,000	352,000	343,000	346,000	3,757,000
West Virginia	7,797,000	6,362,000	7,422,000	6,204,000	6,332,000	7,350,000	7,571,000	8,012,000	8,005,000	8,420,000	8,220,000	8,276,000	89,971,000
Wyoming	835,000	681,000	794,000	664,000	678,000	787,000	810,000	857,000	857,000	901,000	880,000	886,000	9,630,000
Other States [a]	13,000	12,000	13,000	12,000	12,000	13,000	13,000	14,000	13,000	15,000	15,000	15,000	160,000
	49,748,000	41,055,000	47,850,000	38,764,000	39,841,000	46,095,000	45,988,000	49,974,000	50,241,000	53,278,000	52,576,000	53,257,000	568,667,000

[a] Includes Alaska, California, Georgia, Idaho, North Carolina, Oregon, and South Dakota.

Bituminous coal produced in the United States, by States and months, 1917–1921, in net tons—Continued.

State.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1921.													
Alabama	1,360,000	1,086,000	1,011,000	915,000	925,000	966,000	884,000	1,022,000	1,062,000	1,255,000	1,138,000	945,000	12,569,000
Arkansas	116,000	88,000	89,000	82,000	95,000	106,000	109,000	116,000	112,000	140,000	91,000	84,000	1,228,000
Colorado	1,057,000	747,000	620,000	644,000	675,000	547,000	662,000	778,000	866,000	1,037,000	836,000	654,000	9,123,000
Illinois	7,264,000	5,661,000	5,293,000	4,625,000	4,781,000	4,569,000	4,794,000	6,135,000	6,263,000	8,022,000	6,056,000	6,140,000	69,603,000
Indiana	2,354,000	1,800,000	1,757,000	1,239,000	1,309,000	1,318,000	1,252,000	1,743,000	1,770,000	2,349,000	1,685,000	1,743,000	20,319,000
Iowa	477,000	396,000	382,000	326,000	303,000	290,000	277,000	357,000	378,000	504,000	434,000	407,000	4,531,000
Kansas	386,000	303,000	295,000	290,000	276,000	283,000	301,000	323,000	329,000	333,000	91,000	257,000	3,467,000
Kentucky	2,776,000	2,183,000	2,268,000	2,226,000	2,754,000	2,944,000	2,535,000	2,801,000	2,842,000	3,314,000	2,861,000	2,084,000	31,588,000
Maryland	196,000	194,000	176,000	161,000	160,000	153,000	134,000	138,000	134,000	157,000	105,000	120,000	1,828,000
Michigan	126,000	99,000	80,000	72,000	73,000	85,000	78,000	103,000	95,000	117,000	108,000	106,000	1,142,000
Missouri	378,000	270,000	279,000	250,000	272,000	283,000	278,000	290,000	305,000	373,000	297,000	276,000	3,551,000
Montana	225,000	228,000	220,000	170,000	162,000	156,000	182,000	247,000	282,000	325,000	305,000	232,000	2,734,000
New Mexico	280,000	217,000	218,000	211,000	187,000	185,000	205,000	202,000	201,000	197,000	181,000	169,000	2,453,000
North Dakota	75,000	72,000	71,000	47,000	42,000	44,000	46,000	67,000	84,000	102,000	122,000	93,000	865,000
Ohio	2,945,000	2,208,000	2,317,000	2,089,000	2,787,000	2,871,000	2,635,000	2,881,000	2,725,000	3,520,000	2,770,000	2,195,000	31,943,000
Oklahoma	322,000	242,000	235,000	254,000	248,000	263,000	277,000	329,000	309,000	366,000	287,000	231,000	3,363,000
Pennsylvania	11,731,000	9,100,000	8,802,000	7,294,000	10,016,000	10,049,000	8,466,000	9,463,000	9,460,000	12,106,000	10,633,000	8,894,000	116,014,000
Tennessee	443,000	362,000	348,000	320,000	354,000	369,000	322,000	377,000	385,000	470,000	393,000	317,000	4,460,000
Texas	101,000	80,000	82,000	75,000	94,000	88,000	95,000	83,000	74,000	79,000	65,000	57,000	973,000
Utah	370,000	336,000	296,000	298,000	269,000	230,000	289,000	450,000	478,000	439,000	330,000	294,000	4,079,000
Virginia	747,000	589,000	545,000	552,000	601,000	583,000	555,000	561,000	642,000	790,000	713,000	614,000	7,492,000
Washington	241,000	218,000	237,000	151,000	161,000	154,000	154,000	171,000	206,000	254,000	246,000	236,000	2,429,000
West Virginia	6,532,000	4,489,000	4,888,000	5,356,000	7,053,000	7,631,000	6,021,000	5,995,000	6,142,000	7,526,000	6,317,000	4,837,000	72,787,000
Wyoming	630,000	543,000	523,000	490,000	447,000	454,000	480,000	643,000	712,000	899,000	728,000	652,000	7,201,000
Other States[a]	16,000	13,000	22,000	17,000	13,000	14,000	16,000	16,000	14,000	13,000	13,000	13,000	180,000
	41,148,000	31,524,000	31,054,000	28,154,000	34,057,000	34,635,000	31,047,000	35,291,000	35,870,000	41,687,000	36,805,000	31,650,000	415,922,000

[a] Includes Alaska, California, Georgia, Idaho, North Carolina, Oregon, and South Dakota.

PRODUCTION BY GROUPS OF STATES.

The table below shows the production of bituminous coal and lignite in 1919–1921 by groups of States. In 1919, as compared with 1918, every group suffered a loss.[3] The biggest loss was in the first group—Pennsylvania, Maryland, West Virginia, and Virginia—where the output decreased 41,131,000 tons. This loss, however, amounted to only 14.5 per cent. The percentage of loss was greatest (30.8 per cent) in the group comprising Illinois, Indiana, and western Kentucky, although the actual loss, 40,356,000 tons, was slightly less than that in the first group. The Dakota-Southwestern group lost 28.2 per cent, or 8,855,000 tons. The large loss in percentage for the two groups last named is explained in part by the strike. In percentages Tennessee lost 23.7 per cent; Alabama, 19 per cent; the Colorado-Western group, 19.7 per cent; and the group comprising eastern Kentucky, Ohio, and Michigan, 14.4 per cent.

In 1920 the group comprising Illinois, Indiana and western Kentucky showed the largest gain over 1919, both in percentage and in tonnage. Tennessee came next in percentage, but neither of these areas made an output equal to that in 1918. The increase in output in the group comprising Pennsylvania, Maryland, and the Virginias came second. Alabama showed the least recovery from the slump in 1919, both in output and in percentage.

The loss of tonnage in 1921, as compared with 1920, was heaviest in the group of Eastern States and in the group comprising Illinois, Indiana, and western Kentucky, but the loss in percentage was greatest in the groups comprising the Western and Southwestern States and in Tennessee. Though the coals from Pennsylvania, Maryland, and the Virginias are more widely distributed within the United States than any others and though they practically monopolize the export trade through ports on the Atlantic seaboard, the output of that group in 1921 declined 77,901,000 tons, or 28.2 per cent. Part of this loss, of course, is due to the relative inactivity in the steel and coke industries in 1921. To this relative inactivity and that in other industries is due also the decline of 22.1 per cent in production in eastern Kentucky, Ohio, and Michigan. Tennessee, which increased its output 27.8 per cent in 1920, lost 33 per cent in 1921, and Alabama, which also felt the depression in the iron and steel trade, saw its modest gain of 4.9 per cent in 1920 changed to a loss of 22.9 per cent in 1921. Illinois, Indiana, and western Kentucky were able to maintain part of their increase of 42.8 per cent in 1920 over 1919, but the Dakotas, the Southwestern and Rocky Mountain States, and Washington fell not only behind their output in 1920 but below that in 1919.

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[3] U. S. Geol. Survey Mineral Resources, 1918, pt. 2, p. 704, 1921.

Bituminous coal and lignite produced in the United States, 1919–1921, by groups of States.[a]

	1919 (net tons).	1920			1921		
		Net tons.	Increase.		Net tons.	Decrease.	
			Net tons.	Percentage.		Net tons.	Percentage.
Pennsylvania, Maryland, West Virginia, and Virginia	242,143,000	276,022,000	33,879,000	13.9	198,121,000	77,901,000	28.2
Eastern Kentucky, Ohio, and Michigan	58,249,000	71,982,000	13,733,000	23.5	56,057,000	15,925,000	22.1
Tennessee	5,213,000	6,662,000	1,449,000	27.8	4,460,000	2,202,000	33.0
Alabama	15,537,000	16,294,000	757,000	4.9	12,569,000	3,725,000	22.9
Illinois, Indiana, and Western Kentucky	90,435,000	129,152,000	38,717,000	42.8	98,538,000	30,614,000	23.7
North Dakota, South Dakota, Iowa, Missouri, Kansas, Oklahoma, Arkansas, and Texas	22,596,000	28,639,000	6,043,000	26.7	17,985,000	10,654,000	37.2
Colorado, Montana, Wyoming, Utah, and New Mexico	28,550,000	36,011,000	7,461,000	26.1	25,590,000	10,421,000	28.9
Washington	2,990,000	3,757,000	767,000	25.6	2,429,000	1,328,000	35.3

[a] Does not include production in Alaska, California, Georgia, Idaho, North Carolina, and Oregon.

The production by States in 1919, 1920, and 1921 is shown in the tables on pages 476–478, which are discussed farther on in this report. The first column in these tables shows the quantity of coal loaded at the mines on railroad cars or on boats for shipment. The figures given represent all coal shipped, regardless of distance. Considerable coal mined near Birmingham, Ala., and near Pittsburgh, Pa., is used by the iron and steel industries of those cities, but as this coal is actually loaded on cars or boats it is reported as "loaded at the mine for shipment." Coal used for making coke, if actually loaded, is similarly reported, even if it has to be shipped less than a mile. All coal used as railroad fuel except that loaded directly into engine tenders at the mines is also so reported. The question whether such coal is revenue or nonrevenue freight does not enter into the classification.

The second column of the tables shows the coal "sold to local trade and used by employees." This designation includes wagon business, coal used by employees, coal loaded into engine tenders for railroad consumption, and coal used in the immediate vicinity of the mines by brick and sewer-pipe plants, power plants, and mills of different kinds. This coal is presumably carried from the mine to the place of consumption in mine cars, wagons, or trucks or on private tramroads.

The coal used to generate steam and heat for the operation of the mines is shown in the third column, and that charged into coke ovens at the mines is given in the fourth column.

The "total quantity" reported in the fifth column is the sum of the figures shown in the four preceding columns and represents only usable fuel. Refuse, slate, bone brought out of the mine or picked and sorted from the coal in the tipple, and refuse from washeries and dry-cleaning plants are not considered part of the coal produced, although the cost per ton of bringing this material to the surface is as great as that of the usable fuel.

The "total value" is the sum of all the values reported by the individual operators, and the "average value per ton" is that total divided by the total tons.

The schedules sent out by the Geological Survey request a statement of the total number of full days each mine was operated and the average number of employees, exclusive of office force and coke workers. For a given district the "average number of days worked" is obtained by multiplying the number of days worked by each mine by the number of men employed at that mine, adding together the products thus obtained, and dividing the sum by the total number of men employed in the district.

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Coal produced in the United States in 1919.

State.	Loaded at mines for shipment (net tons).	Sold to local trade and used by employees (net tons).	Used at mines for steam and heat (net tons).	Made into coke at mines (net tons).	Total quantity (net tons).	Total value.	Average value per ton.	Number of employees.[a] Under-ground.	Number of employees.[a] Surface.	Number of employees.[a] Total.	Average number of days worked.[a]
Alabama	13,869,680	200,535	541,149	925,357	15,536,721	$45,937,681	$2.96	20,660	6,214	26,874	239
Alaska	57,676	733	2,265		60,674	343,547	5.66	103	63	166	280
Arkansas	1,351,266	22,984	54,770		1,429,020	5,288,844	3.70	3,096	718	3,814	136
California and Idaho	2,448	3,591	515		6,554	22,174	3.38	54	23	77	59
Colorado	9,438,120	412,986	287,199	185,115	10,323,420	28,748,534	2.78	8,931	2,898	11,829	225
Georgia	15,028	679	4,600	33,030	53,337	198,033	3.71	108	60	168	284
Illinois	55,540,051	3,374,419	1,948,138		60,862,608	140,075,969	2.30	75,013	10,007	85,020	160
Indiana	19,423,744	804,624	683,920		20,912,288	46,345,750	2.22	25,316	4,671	29,987	148
Iowa	4,849,636	610,937	164,119		5,624,692	17,352,620	3.09	10,873	1,493	12,366	176
Kansas	4,919,654	136,202	168,868		5,224,724	15,917,053	3.05	8,173	1,753	9,926	182
Kentucky	27,907,773	978,857	677,227	472,204	30,036,061	73,891,049	2.46	35,530	10,068	45,598	189
Maryland	2,899,931	75,374	46,381		3,021,686	8,255,984	2.73	4,422	972	5,394	179
Michigan	901,263	11,458	83,824		996,545	3,864,228	3.88	1,851	253	2,104	179
Missouri	3,414,223	422,479	143,096		3,979,798	12,766,366	3.21	7,235	2,079	9,314	175
Montana	2,887,620	185,356	163,393		3,236,369	8,644,344	2.67	3,318	805	4,123	194
New Mexico	2,583,097	38,615	44,011	473,033	3,138,756	9,750,833	3.11	2,918	827	3,745	273
North Carolina	3,229	387	3,373		6,989	26,871	3.84	37	12	49	100
North Dakota	607,634	217,902	15,423		840,959	2,100,303	2.50	758	314	1,072	216
Ohio	33,054,103	2,161,716	659,571	1,292	35,876,682	79,496,301	2.22	41,336	8,288	49,624	164
Oklahoma	3,462,294	125,312	178,995	35,512	3,802,113	14,544,901	3.83	6,996	1,452	8,448	184
Oregon	10,917	3,103	4,719		18,739	63,794	3.40	52	15	67	259
Pennsylvania (bituminous)	120,704,245	5,141,075	3,305,764	21,607,070	150,758,154	365,430,504	2.42	143,838	30,712	174,550	218
South Dakota	450	13,939	28		14,417	45,707	3.17	43	3	46	164
Tennessee	4,744,543	128,420	146,631	193,611	5,213,205	14,448,168	2.77	8,976	2,547	11,523	201
Texas	1,629,795	3,920	46,941		1,680,656	4,527,640	2.69	3,018	626	3,644	227
Utah	4,051,464	101,233	81,706	396,920	4,631,323	12,760,613	2.76	2,709	1,148	3,857	239
Virginia	7,558,507	165,433	117,577	1,485,313	9,326,830	23,774,941	2.55	9,471	2,115	11,586	247
Washington	2,681,244	79,150	175,253	54,800	2,990,447	10,691,222	3.58	3,801	1,235	5,036	217
West Virginia	73,672,527	2,548,896	1,097,232	1,717,898	79,036,553	196,551,015	2.49	74,350	20,355	94,705	200
Wyoming	6,906,592	98,263	214,883		7,219,738	18,751,024	2.60	5,815	1,471	7,286	221
Total bituminous	409,148,754	18,068,578	11,061,571	27,581,155	465,860,058	1,160,616,013	2.49	508,801	113,197	621,998	195
Pennsylvania anthracite	76,128,970	2,360,821	9,602,410		88,092,201	364,926,950	4.14	107,829	46,742	154,571	266
Grand total	485,277,724	20,429,399	20,663,981	27,581,155	553,952,259	1,525,542,963	2.75	616,630	159,939	776,569	209

[a] The figures showing number of men and boys employed and the average number of days worked do not include figures for country banks and small wagon mines, but the product of these mines is included in the figures showing output and value.

Coal produced in the United States in 1920.

State.	Loaded at mines for shipment (net tons).	Sold to local trade and used by employees (net tons).	Used at mines for steam and heat (net tons).	Made into coke at mines (net tons).	Total quantity (net tons).	Total value.	Average value per ton.	Number of employees.[a] Underground. Miners.[b]	Underground. All others.	Surface.	Total.	Average number of days worked.[a]
Alabama	14,757,143	352,196	481,727	703,033	16,294,099	$59,410,000	$3.65	13,647	6,708	5,185	25,540	247
Alaska	58,522	128	2,461	....	61,111	356,000	5.83	85	20	102	207	240
Arkansas	2,019,916	13,196	70,484	....	2,103,596	9,592,000	4.56	2,390	964	612	3,966	176
California and Idaho	208	2,540	5	....	2,753	12,000	4.36	5	3	2	10	181
Colorado	11,250,746	453,969	291,522	281,988	12,278,225	42,829,000	3.49	7,543	3,462	2,706	13,711	255
Georgia	15,961	791	3,600	29,804	50,156	251,000	5.00	69	28	51	148	294
Illinois	82,574,029	3,766,533	2,384,331	....	88,724,893	273,509,000	3.08	53,363	23,630	10,091	87,084	213
Indiana	27,615,568	1,000,968	734,049	....	29,350,585	92,867,000	3.16	18,593	8,329	4,233	31,155	192
Iowa	6,929,214	711,187	173,515	....	7,813,916	30,794,000	3.94	7,677	3,080	1,148	11,905	250
Kansas	5,586,816	171,162	168,430	....	5,926,408	22,923,000	3.87	5,827	1,762	1,395	8,984	204
Kentucky	33,465,161	1,081,196	697,434	446,971	35,690,762	146,576,000	4.11	26,006	14,030	9,416	49,452	182
Maryland	3,915,333	108,311	41,595	....	4,065,239	18,815,000	4.63	3,283	1,347	918	5,548	207
Michigan	1,386,686	15,481	87,598	....	1,489,765	7,346,000	4.93	1,332	595	227	2,154	261
Missouri	4,811,598	420,318	137,649	....	5,369,565	22,230,000	4.16	4,842	2,023	1,973	8,838	233
Montana	4,082,281	156,816	174,769	....	4,413,866	13,923,000	3.16	2,304	1,120	780	4,204	250
New Mexico	3,147,268	43,376	38,852	453,944	3,683,440	13,568,000	3.68	1,858	1,082	798	3,738	302
North Carolina	8,660	....	2,880	....	11,540	81,000	7.02	25	15	10	50	288
North Dakota	746,289	164,757	37,579	....	948,625	2,724,000	2.87	526	227	357	1,110	218
Ohio	42,254,891	2,794,011	828,522	767	45,878,191	175,081,000	3.82	29,938	12,124	8,795	50,857	188
Oklahoma	4,600,437	54,902	193,949	....	4,849,288	23,294,000	4.80	4,415	2,463	1,366	8,244	217
Oregon	12,980	1,609	6,128	....	20,717	93,000	4.49	34	22	29	85	307
Pennsylvania (bituminous)	136,745,063	6,300,442	3,508,576	24,053,766	170,607,847	642,630,000	3.77	98,540	45,336	30,094	173,970	244
South Dakota	232	12,545	....	....	12,777	46,000	3.60	22	15	10	47	133
Tennessee	6,055,946	136,623	159,461	310,398	6,662,428	26,778,000	4.02	6,491	2,736	2,126	11,353	234
Texas	1,575,709	5,523	33,783	....	1,615,015	6,062,000	3.75	1,882	691	377	2,950	242
Utah	5,454,967	57,830	104,819	387,583	6,005,199	19,350,000	3.22	2,421	1,138	945	4,504	252
Virginia	9,353,822	299,273	103,012	1,622,499	11,378,606	45,446,000	3.99	5,937	4,616	3,457	14,010	262
Washington	3,470,784	87,663	150,770	47,876	3,757,093	14,560,000	3.88	2,387	1,579	1,028	4,994	260
West Virginia	83,712,005	2,953,638	1,035,460	2,269,604	89,970,707	390,046,000	4.34	50,236	32,657	20,057	102,950	198
Wyoming	9,264,825	122,451	242,995	....	9,630,271	28,741,000	2.98	3,982	2,350	1,447	7,779	264
Total bituminous	504,873,060	21,289,435	11,895,955	30,608,233	568,666,683	2,129,933,000	3.75	355,660	174,152	109,735	639,547	220
Pennsylvania anthracite	76,844,055	2,896,502	9,857,692	....	89,598,249	434,252,000	4.85	63,339	37,684	44,051	145,074	271
Grand total	581,717,115	24,185,937	21,753,647	30,608,233	658,264,932	2,564,185,000	3.90	418,999	211,836	153,786	784,621	230

[a] The figures showing number of men and boys employed and the average number of days worked do not include figures for country banks and small wagon mines, but the product of these mines is included in the figures showing output and value.

[b] Includes also loaders and shot firers.

Coal produced in the United States in 1921.

[Exclusive of product of wagon mines.]

State.	Loaded at mines for shipment (net tons).	Sold to local trade and used by employees (net tons).	Used at mines for steam and heat (net tons).	Made into coke at mines (net tons).	Total quantity (net tons).	Total value.	Average value per ton.	Number of employees. Underground. Miners, loaders, etc.[a]	Underground. All others.	Surface.	Total.	Average number of days worked.
Alabama	11,834,609	313,125	292,807	128,358	12,568,899	$38,713,000	$3.08	15,304	5,869	4,636	25,809	166
Alaska	71,999	3,005	1,813		76,817	496,000	6.46	104	79	218	401	244
Arkansas	1,174,584	19,477	33,716		1,227,777	5,360,000	4.37	2,315	848	453	3,616	112
California, Idaho, and Oregon	19,015	13,305	6,525		38,845	181,000	4.66	35	48	58	141	149
Colorado	8,408,613	399,816	253,718	60,613	9,122,760	32,377,000	3.55	8,456	3,450	2,623	14,529	164
Georgia	18,755	373	1,979	12,708	33,815	171,000	2.14	59	26	51	136	183
Illinois	64,174,112	3,371,482	2,057,169		69,602,763	190,986,000	2.74	60,466	25,043	9,922	95,431	152
Indiana	19,116,259	610,620	592,630		20,319,509	52,269,000	2.57	20,472	8,460	3,755	32,687	128
Iowa	3,891,368	521,465	118,559		4,531,392	17,256,800	3.81	7,597	2,815	974	11,386	148
Kansas	3,250,299	111,448	104,894		3,466,641	13,333,300	3.85	5,453	1,538	1,216	8,207	137
Kentucky	30,096,762	802,744	527,257	161,507	31,588,270	85,092,600	2.69	28,737	12,996	8,788	50,521	152
Maryland	1,743,710	56,734	27,296		1,827,740	6,602,000	3.61	2,964	978	726	4,668	120
Michigan	1,058,789	11,354	71,572		1,141,715	5,555,000	4.87	1,346	622	244	2,212	196
Missouri	3,209,496	242,136	99,989		3,551,621	13,915,500	3.92	5,141	1,830	1,584	8,555	166
Montana	2,492,344	115,538	126,076		2,733,958	8,921,600	3.26	2,396	1,064	718	4,178	143
New Mexico	2,326,034	34,754	62,259	30,435	2,453,482	9,585,000	3.91	2,735	1,120	722	4,577	150
North Carolina	20,000		3,438		23,438	135,000	5.76	38	7	15	60	300
North Dakota	700,950	135,550	28,403		864,903	2,329,500	2.69	566	209	289	1,064	194
Ohio	29,788,393	1,559,953	594,243	187	31,942,776	84,686,500	2.65	33,143	11,555	7,087	51,785	134
Oklahoma	3,208,381	25,559	128,683		3,362,623	15,546,000	4.62	5,000	2,425	1,429	8,854	141
Pennsylvania (bituminous)	102,025,340	4,315,590	2,552,372	7,120,640	116,013,942	322,538,300	2.78	119,818	44,404	26,421	190,643	151
South Dakota	450	7,069	34		7,553	21,200	2.81	43			43	129
Tennessee	4,194,364	88,199	123,730	54,033	4,460,326	14,932,000	3.35	6,061	2,500	1,786	10,347	154
Texas	947,589	2,691	22,559		972,839	2,563,600	2.64	1,989	609	294	2,892	139
Utah	3,668,661	74,705	73,365	262,053	4,078,784	13,662,000	3.35	2,450	1,041	931	4,422	151
Virginia	6,818,178	152,729	98,950	422,521	7,492,378	22,947,700	3.06	5,751	4,056	2,115	11,922	166
Washington	2,274,202	59,644	88,585	6,291	2,428,722	9,787,000	4.03	2,241	1,245	848	4,334	159
West Virginia	68,655,196	2,983,061	808,609	340,130	72,786,996	206,661,500	2.84	53,801	30,951	17,098	101,850	149
Wyoming	6,875,284	103,495	221,887		7,200,666	23,358,500	3.24	4,789	2,231	1,464	8,484	167
Total bituminous	382,063,736	16,135,621	9,123,117	8,599,476	415,921,950	1,199,983,600	2.89	399,270	168,019	96,465	663,754	149
Pennsylvania (anthracite)	77,901,110	2,812,551	9,759,790		90,473,451	452,305,000	5.00	73,977	42,840	42,682	159,499	271
Grand total	459,964,846	18,948,172	18,882,907	8,599,476	506,395,401	1,652,288,600	3.26	473,247	210,859	139,147	823,253	173

[a] Includes also shot firers.

The production of bituminous coal is not only responsive to the broad movements in industrial and domestic demand—movements that are national or international in their sweep—but is also extremely sensitive to slight changes within small areas. Local conditions of demand or competition in distribution brought about by one cause or another may throw the production or the prices in one district entirely out of line with those that prevail in the country generally. For these reasons the student of the economics of coal who attempts to deduce anything but the most sketchy generalizations from the comparative figures showing the production for any given period must read the statistics for individual areas in the light of the conditions peculiar to those areas. Otherwise he will find his generalizations hopelessly contradicted by inevitable variations in detail.

With these limitations in mind, a study of the changes in output and value in 1921 as compared with 1920, shown in the table on page 481, throws some interesting side lights on the reaction from the postwar boom of 1920. Of the sections listed in that table only two—North Carolina and the group that includes California, Alaska, Idaho, and Oregon—showed any increase in output in 1921. The aggregate quantity involved, however—139,100 tons out of a total production for the year of 415,921,950 tons—was so insignificant that it may be ignored.

The influence of the concurrence of an abnormal export demand, the movement of Lake cargoes, and the effects of the "outlaw" switchmen's strike on the railroads can be seen by comparing the items of production and value in 1920 and 1921 for Pennsylvania, the Virginias, Kentucky, and Maryland. Production in Virginia, which made a high record in 1920, dropped 34.2 per cent in 1921, and the value of the product declined 49.5 per cent. Production in Maryland, which has fluctuated since the maximum output was reached in 1907, fell off 55 per cent in quantity and 64.9 per cent in value. The output of West Virginia, which led in the sea-borne export trade and retained a greater share of it in 1921 than any other State, reached in 1921 80.9 per cent of that of 1920, but the value decreased 47 per cent. The output of Pennsylvania, a State that suffered heavily from the decline in the iron and steel industry in 1921, decreased 32.0 per cent, and the value decreased 49.8 per cent. Kentucky, which has been widening its area of distribution in recent years, received more indirect than direct benefits from the demand that pushed Pennsylvania and Virginia ahead in 1920. Its production in 1921 dropped only 11.5 per cent, but the value of the product declined 41.9 per cent. Illinois lost less heavily in percentage of both production and value than either Indiana or Ohio. A partial explanation for this difference in loss may be found in the fact that Illinois normally consumes less eastern coal than Indiana and Ohio and is protected by heavier differentials in transportation costs, so that the Illinois coals yielded less to competition with West Virginia and Kentucky coals in the intensified struggle for business in 1921. In South Dakota, where production received an impetus in the fall of 1920 because of the precarious coal situation on the Great Lakes, the output in 1921 dropped 40.9 per cent, or 5,224 tons. The output of North Dakota in 1921, which was 864,903 tons, was 83,722 tons less than that of 1920, but the percentage loss was only 8.8 per cent in tonnage and 14.5 per cent in value. Greater distance from eastern sources of supply and the limitations placed by transportation on the sale of coals in that State from the docks and from Illinois and Indiana have enhanced the advantages of location possessed by the local producers.

For the country as a whole production in 1921 as compared with that in 1920 showed an average decline of 26.9 per cent, but every coal-producing State west of the Mississippi, except Colorado, North Dakota, and Wyoming, showed a greater decline. Missouri, New Mexico, Oklahoma, and Utah showed losses ranging from 30.7 to 33.9 per cent. Arkansas, Iowa, Kansas, Montana, South Dakota, Texas, and Washington showed losses ranging from 35.4 per cent in Washington to 42 per cent in Iowa. In only four of the trans-Mississippi States, however, was the average decline in value, as compared with the value in 1920, greater than for the country as a whole. These four exceptions were Arkansas, 44.1 per cent; Iowa, 44.0 per cent; South Dakota, 53.9 per cent; and Texas, 57.7 per cent. The average for the United States as a whole was 43.7 per cent.

The quantity and value of the coal produced in each State in the three years 1919–1921 and the increase or decrease in quantity and in percentage in 1921 as compared with 1920 are shown in the following tables. The annual production of coal in each State from the time of the earliest recorded output until the end of 1921 is given in the tabular statement in the pocket. The second table below gives the total production of bituminous coal and Pennsylvania anthracite from 1807 to 1921 and the cumulative totals to 1921.

Coal produced in the United States, 1919–1921, and increase or decrease in 1921.

State.	1919		1920		1921.[a]		Increase or decrease, 1921, as compared with 1920.			
							Quantity.		Value.	
	Net tons.	Value.	Net tons.	Value.	Net tons.	Value.	Net tons.	Percentage.	Dollars.	Percentage.
Alabama	15,536,721	$45,937,681	16,294,099	$59,410,000	12,568,899	$38,713,000	−3,725,200	−22.9	−20,697,000	−34.8
Arkansas	1,429,020	5,288,844	2,103,596	9,592,000	1,227,777	5,360,000	−875,819	−41.6	−4,232,000	−44.1
California, Alaska and Idaho	67,228	365,721	[b] 84,581	[b] 461,000	[b] 115,662	[b] 677,000	+31,081	+36.7	+216,000	+46.9
Colorado	10,323,420	28,748,534	12,278,225	42,829,000	9,122,760	32,377,000	−3,155,465	−25.7	−10,452,000	−24.4
Georgia	53,337	198,033	50,156	251,000	33,815	171,000	−16,341	32.6	−80,000	−31.9
Illinois	60,862,608	140,075,969	88,724,893	273,509,000	69,602,763	190,986,000	−19,122,130	−21.6	−82,523,000	−30.2
Indiana	20,912,288	46,345,750	29,350,585	92,867,000	20,319,509	52,269,000	−9,031,076	−30.8	−40,598,000	−43.7
Iowa	5,624,692	17,352,620	7,813,916	30,794,000	4,531,392	17,256,800	−3,282,524	−42.0	−13,537,200	−44.0
Kansas	5,224,724	15,917,053	5,926,408	22,923,000	3,466,641	13,333,300	−2,459,767	−41.5	−9,589,700	−41.8
Kentucky	30,036,061	73,891,049	35,690,762	146,576,000	31,588,270	85,092,600	−4,102,492	−11.5	−61,483,400	−41.9
Maryland	3,021,686	8,255,984	4,065,239	18,815,000	1,827,740	6,602,000	−2,237,499	−55.0	−12,213,000	−64.9
Michigan	996,545	3,864,228	1,489,765	7,346,000	1,141,715	5,555,000	−348,050	−23.4	−1,791,000	−24.4
Missouri	3,979,798	12,766,366	5,369,565	22,230,000	3,551,621	13,915,500	−1,817,944	−33.9	−8,314,500	−37.4
Montana	3,236,369	8,644,344	4,413,866	13,923,000	2,733,958	8,921,600	−1,679,908	−38.1	−5,001,400	−35.9
New Mexico	3,138,756	9,750,833	3,683,440	13,568,000	2,453,482	9,585,000	−1,229,958	−33.4	−3,983,000	−29.3
North Carolina	6,989	26,871	11,540	81,000	23,438	135,000	+11,898	+103.1	+54,000	+66.7
North Dakota	840,959	2,100,303	948,625	2,724,000	864,903	2,329,500	−83,722	−8.8	−394,500	−14.5
Ohio	35,876,682	79,496,301	45,878,191	175,081,000	31,942,776	84,686,500	−13,935,415	−30.4	−90,394,500	−51.6
Oklahoma	3,802,113	14,544,901	4,849,288	23,294,000	3,362,623	15,546,000	−1,486,665	−30.7	−7,748,000	−33.3
Oregon	18,739	63,794	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Pennsylvania (bituminous)	150,758,154	365,430,504	170,607,847	642,630,000	116,013,942	322,538,300	−54,593,905	−32.0	−320,091,700	−49.8
South Dakota	14,417	45,707	12,777	46,000	7,553	21,200	−5,224	−40.9	−24.800	−53.9
Tennessee	5,213,205	14,448,168	6,662,428	26,778,000	4,460,326	14,932,000	−2,202,102	−33.1	−11,846,000	−44.2
Texas	1,680,656	4,527,640	1,615,015	6,062,000	972,839	2,563,600	−642,176	−39.8	−3,498,400	−57.7
Utah	4,631,323	12,760,613	6,005,199	19,350,000	4,078,784	13,662,000	−1,926,415	−32.1	−5,688,000	−29.4
Virginia	9,326,830	23,774,941	11,378,606	45,446,000	7,492,378	22,947,700	−3,886,228	−34.2	−22,498,300	−49.5
Washington	2,990,447	10,691,222	3,757,093	14,560,000	2,428,722	9,787,000	−1,328,371	−35.4	−4,773,000	−32.8
West Virginia	79,036,553	196,551,015	89,970,707	390,046,000	72,786,996	206,661,500	−17,183,711	−19.1	−183,384,500	−47.0
Wyoming	7,219,738	18,751,024	9,630,271	28,741,000	7,200,666	23,358,500	−2,429,605	−25.2	−5,382,500	−18.7
Total bituminous	465,860,058	1,160,616,013	568,666,683	2,129,933,000	415,921,950	1,199,983,600	−152,744,733	−26.9	−929,949,400	−43.7
Pennsylvania anthracite	88,092,201	364,926,950	89,598,249	434,252,000	90,473,451	452,305,000	+875,202	+.9	+18,053,000	+4.2
Grand total	553,952,259	1,525,542,963	658,264,932	2,564,185,000	506,395,401	1,652,288,600	−151,869,531	−23.1	−911,896,400	−35.6

[a] Exclusive of wagon mines.

[b] California includes Oregon.

Coal produced in the United States from 1807 to 1921, inclusive, in net tons.

Year.	Pennsylvania anthracite.	Bituminous.	Total.
1807–1820	12,000	3,000	15,000
1821.....	1,322	....	1,322
1822.....	4,583	54,000	58,583
1823.....	8,563	60,000	68,563
1824.....	13,685	67,040	80,725
1825.....	42,988	75,000	117,988
1826.....	59,194	88,720	147,914
1827.....	78,151	94,000	172,151
1828.....	95,500	100,408	195,908
1829.....	138,086	102,000	240,086
1830.....	215,272	104,800	320,072
1831.....	217,842	120,100	337,942
1832.....	447,550	146,500	594,050
1833.....	600,907	133,750	734,657
1834.....	464,015	136,500	600,515
1835.....	690,854	134,000	824,854
1836.....	842,832	142,000	984,832
1837.....	1,071,151	182,500	1,253,651
1838.....	910,075	445,452	1,355,527
1839.....	1,008,322	552,038	1,560,360
1840.....	967,108	1,102,931	2,070,039
1841.....	1,182,441	1,108,700	2,291,141
1842.....	1,365,563	1,244,494	2,610,057
1843.....	1,556,753	1,504,121	3,060,874
1844.....	2,009,207	1,672,045	3,681,252
1845.....	2,480,032	1,829,872	4,309,904
1846.....	2,887,815	1,977,707	4,865,522
1847.....	3,551,005	1,735,062	5,286,067
1848.....	3,805,942	1,968,032	5,773,974
1849.....	3,995,334	2,453,497	6,448,831
1850.....	4,138,164	2,880,017	7,018,181
1851.....	5,481,065	3,253,460	8,734,525
1852.....	6,151,957	3,664,707	9,816,664
1853.....	6,400,426	4,169,862	10,570,288
1854.....	7,394,875	4,582,227	11,977,102
1855.....	8,141,754	4,784,919	12,926,673
1856.....	8,534,779	5,012,146	13,546,925
1857.....	8,186,567	5,153,622	13,340,189
1858.....	8,426,102	5,548,376	13,974,478
1859.....	9,619,771	6,013,404	15,633,175
1860.....	8,115,842	6,494,200	14,610,042
1861.....	9,799,654	6,688,358	16,488,012
1862.....	9,695,110	7,790,725	17,485,835
1863.....	11,785,320	9,533,742	21,319,062
1864.....	12,538,649	11,066,474	23,605,123
1865.....	11,891,746	11,900,427	23,792,173
1866.....	15,651,183	13,352,400	29,003,583
1867.....	16,002,109	14,722,313	30,724,422
1868.....	17,003,405	15,858,555	32,861,960
1869.....	17,083,134	15,821,226	32,904,360
1870.....	15,664,275	17,371,305	33,035,580

Year.	Pennsylvania anthracite.	Bituminous.	Total.
1871.....	19,342,057	27,543,023	46,885,080
1872.....	24,233,166	27,220,233	51,453,399
1873.....	26,152,837	31,449,643	57,602,480
1874.....	24,818,790	27,787,130	52,605,920
1875.....	22,485,766	29,862,554	52,348,320
1876.....	22,793,245	30,486,755	53,280,000
1877.....	25,660,316	34,841,444	60,501,760
1878.....	21,689,682	36,245,918	57,935,600
1879.....	30,207,793	37,898,006	68,105,799
1880.....	28,649,812	42,831,758	71,481,570
1881.....	31,920,018	53,961,012	85,881,030
1882.....	35,121,256	68,429,933	103,551,189
1883.....	38,456,845	77,250,680	115,707,525
1884.....	37,156,847	82,998,704	120,155,551
1885.....	38,335,974	72,824,321	111,160,295
1886.....	39,035,446	74,644,981	113,680,427
1887.....	42,088,197	88,562,314	130,650,511
1888.....	46,619,564	102,040,093	148,659,657
1889.....	45,546,970	95,682,543	141,229,513
1890.....	46,468,641	111,302,322	157,770,963
1891.....	50,665,431	117,901,238	168,566,669
1892.....	52,472,504	126,856,567	179,329,071
1893.....	53,967,543	128,385,231	182,352,774
1894.....	51,921,121	118,820,405	170,741,526
1895.....	57,999,337	135,118,193	193,117,530
1896.....	54,346,081	137,640,276	191,986,357
1897.....	52,611,680	147,617,519	200,229,199
1898.....	53,382,644	166,593,623	219,976,267
1899.....	60,418,005	193,323,187	253,741,192
1900.....	57,367,915	212,316,112	269,684,027
1901.....	67,471,667	225,828,149	293,299,816
1902.....	41,373,595	260,216,844	301,590,439
1903.....	74,607,068	282,749,348	357,356,416
1904.....	73,156,709	278,659,689	351,816,398
1905.....	77,659,850	315,062,785	392,722,635
1906.....	71,282,411	342,874,867	414,157,278
1907.....	85,604,312	394,759,112	480,363,424
1908.....	83,268,754	332,573,944	415,842,698
1909.....	81,070,359	379,744,257	460,814,616
1910.....	84,485,236	417,111,142	501,596,378
1911.....	90,464,067	405,907,059	496,371,126
1912.....	84,361,598	450,104,982	534,466,580
1913.....	91,524,922	478,435,297	569,960,219
1914.....	90,821,507	422,703,970	513,525,477
1915.....	88,995,061	442,624,426	531,619,487
1916.....	87,578,493	502,519,682	590,098,175
1917.....	99,611,811	551,790,563	651,402,374
1918.....	98,826,084	579,385,820	678,211,904
1919.....	88,092,201	465,860,058	553,952,259
1920.....	89,598,249	568,666,683	658,264,932
1921.....	90,473,451	415,921,950	506,395,401
	3,180,692,867	11,346,937,079	14,527,629,946

STATISTICS OF LABOR.

LIMITATIONS ON COAL SUPPLY.

An assured coal supply sufficient to meet the requirements of the country must depend upon ample coal reserves, proper mine development, adequate transportation facilities, and sufficient labor. Although the rapidity with which some of the choicest of the eastern coal beds have been depleted in recent years has caused concern, the time when the exhaustion of the readily accessible coal deposits will reach the point where the country's coal supply is seriously threatened seems still far distant. As the years pass, however, the country will be forced to look more and more to fuels of lower grade. A former Director of the United States Bureau of Mines estimated the probable life of the fields that supply smokeless coal at 150 years, and Dr. George Otis Smith, of the United States Coal Commission, has declared that at the present rate of production the Pittsburgh bed will last less than 100 years. The Big Vein Georges Creek coal is almost a memory, and "similar statements," says Dr. Smith, "could be made regarding the glorious past of the Clearfield coal, founded on the Moshannon bed, which is already practically exhausted." In the fields of Illinois, Indiana, and Ohio "we may put the life expectancy at a few centuries." These predictions may deeply interest the conservationist and the forward-looking student of the economics of the coal trade, but they win hardly a passing thought from the present generation of coal producers and coal consumers.

Proper development of mines, the second essential to an adequate and assured coal supply, has been no more a question of present interest than the question of ample coal reserves. During the last few years the capacity of the bituminous coal mines of the country has been increasingly discussed, but the consensus of opinion has been that the productive capacity of the mining industry of the United States has been overdeveloped, not underdeveloped.

It naturally follows that if reserves, developed mines, transportation, and labor are essential to maintain a supply of coal sufficient for the needs of the country their lack will impose limitations on production. In considering current production, the reserves and the development of mines may be eliminated, for the reasons just stated. The nearest approach to limitation of production as affected by mine development is in the disability of mines, which, when it occurs, is generally local and of short duration. To shortage of labor, mine disability, and transportation disability as limitations on production, however, must be added a fourth limitation that ranks high in the scale of importance, lack of market.

Aside from general strikes, the effect produced by labor in limiting the output of bituminous coal captures the public fancy to a far greater extent than is warranted by the irregularity of operation thus caused in the bituminous coal industry.

Petty strikes, though they are of frequent occurrence and often cause losses to the individual operator or miner, have little effect on the total quantity of coal produced, on the level of prices, or on the working time of the mines. Losses of working time at the mines due to "vacations," funerals, festivals, and the like are also a local and unimportant rather than a major interference with the continuous operation of the mines. The weekly record of percentage of full-time operation and of the causes of nonoperation kept by the Geological Survey for the last five years shows that time lost through "labor shortage"—voluntary absence of men enough to force closing the mine other than that caused by strikes—makes up only a small part of the total time lost.

In considering the limitation of production imposed by the supply of labor, however, the conditions in the anthracite field of Pennsylvania must be distinguished from those prevailing in the bituminous coal fields of the country. In the anthracite field, from the beginning of the century, when 145,309 men were reported to be at work, there was a gradual increase to the maximum of 179,679 men. By the end of 1918, the number, which decreased each year during the war, had dropped to 147,121. In 1919, when men were returning from the war and when the opportunities for employment outside of the mining industry were less attractive, the number rose to 154,571; in 1920, when all classes of labor were at a premium throughout the United States, the number slipped back to 145,074; and in 1921 it rose to 159,499.

The total number of men employed in the bituminous mines, on the other hand, has been steadily increasing since 1915. From 557,456 in that year the number rose to 663,754 in 1921. In other words, in 1921 as compared with 1915 the number of men employed increased 19 per cent, but the total tonnage fell off 6 per cent. The explanation of this seeming paradox may be found not in diminished efficiency of labor—for the tonnage per man per day in 1921 was the highest on record—but in the smaller number of days worked. In the face of these statistics, the idea of anything suggesting a national shortage of labor in the bituminous fields must be dismissed.

METHOD OF COLLECTING STATISTICS OF LABOR.

Before we ask how much the supply of labor in the anthracite regions may have affected production and whether production in the bituminous fields may have been limited by some element of labor that is not disclosed in a consideration of the total number of men employed, we may note the method by which the United States Geological Survey obtains its statistics of labor and consider the limitations of the value of such statistics. In the annual schedules upon which coal-mine operators report to the Geological Survey the following questions are asked as to the men employed:

Total number of full days mine (tipple) was in operation during the year. (Parts of days should be reduced to equivalent in full days)............... ......
Average number of men employed during the year, excluding coke workers and office force:
 Underground... ......
 Surface.. ......

The number of days of operation for a given mine may easily be determined from the mine records. To determine accurately the average number of men employed in the year is more difficult, and no general instructions as to the method to be used in calculating the average have been issued by the Geological Survey.

The ideal method, where the records available permit its use, is to ascertain the total number of shifts or man-days of labor during the year and divide this by the number of days the mine worked. The number of man-days of day workers—that is, labor paid by the day—can be ascertained from the pay roll, but to get the man-days of the tonnage workers—the labor paid by the piece—would require special records, which are not kept by most bituminous operators at the present time. At few mines is a record kept of hours spent underground by the tonnage men; in fact, at the majority of mines the only evidence that a pick miner or loader had worked at all on a given day would be the presence or absence of his check number on the weigh sheets. The lack of such a record of the time worked by tonnage men, it should be noted, impairs the value of practically all studies of the coal industry involving wages, earnings, employment, accident rates, and efficiency of both management and labor.

Another method, which is followed by many operators in reporting to the Survey, is to calculate the average number of men on each of the pay rolls during the year. This method inflates the statistics to the extent that the same employees appear on the pay rolls of two or more operations in the same period—that is, duplication is introduced in proportion to the rapidity of labor turnover. Collateral evidence indicates, however, that inflation due to this cause is not large enough to impair the figures seriously. At a mine that worked steadily during the year the average of the 24 semimonthly pay rolls would give a fairly accurate measure of the number employed, but of course many mines do not work steadily. A strike that lasted through an entire pay period would cut the number drawing pay for that period to a small fraction of the normal working force, ordinarily to the engineers, firemen, and pumpmen. To include a pay roll for such a period in calculating the average number employed would be misleading, and the returns clearly show that the operators do not include pay rolls of this kind. Neither do they include pay periods when the mine is idle the entire time through lack of demand. Probably many small operators do not even average the pay rolls for the year, but rather set down the number shown by the last pay roll.

Careful study of the returns under the diverse conditions of the last three years—the strike year, 1919; the boom year, 1920; and the year of depression, 1921—indicates that the figures reported are not the average number of men actually working at any one time, nor the aggregate number of men who have worked at the mine during the year, nor the absolute average number on the pay rolls, but rather the number of men commonly dependent on the mine for employment. They represent the number ordinarily reporting for work when the mine starts plus the absentees, the men who have been working recently and who will work again but who for one reason or another are not on hand. The totals for districts and the United States are therefore a fair measure of the total number of coal-mine workers.

To determine the average number of days worked the two sets of figures reported for each mine—days and men—are multiplied together, and the sums of the products for each county, State, and the United States are divided by the respective sums of men employed. These statistics have their limitations. They are not accurate in all details, but they are comparable from year to year for each unit of the industry and represent the most accurate returns obtainable under present conditions, both as to records generally available at mine offices and as to the funds allotted to the Geological Survey for their collection.

MEN EMPLOYED IN THE ANTHRACITE COLLIERIES.

The supply of labor available for the production of Pennsylvania anthracite, which had decreased notably from 1914 to 1918 (from 179,679 to 147,121 men, or 18 per cent), increased slightly in 1919 but dropped to the lowest point on record since 1900 in 1920, when only 145,055 men were reported. In 1921 the number was 159,499, or 370 less than in 1916. From 1914 to 1918, though the number of men employed decreased 18 per cent, the production increased from 90,821,507 to 98,826,084 net tons, or nearly 9 per cent. From 1914 to 1921, though the number of men employed decreased more than 11 per cent, production decreased from 90,821,507 to 90,473,451 net tons, less than four-tenths of 1 per cent. This slight decrease in output between 1914 and 1921 was due largely to an increase in the number of days worked—271 days in 1921 against 245 days in 1914. There was also a slight increase of 0.03 ton in the average daily output per man.

From 1915 to 1918 there was a steady increase in the number of days the anthracite mines were operated. This increase offset in part the decrease in the number of men employed during the same period. The increase in the output per man per day and in the average annual tonnage per man was augmented by the heavy washery output in 1917 and 1918. In 1919 and 1921, when the slack demand for bituminous coal made it difficult to market the fresh-mined steam sizes of anthracite, washery production declined and average daily and yearly outputs per man were more nearly comparable with those of preceding years, when the washeries furnished a smaller percentage of the total production of anthracite.

In 1918, when the anthracite mines were working nearly full time (293 days out of a theoretical year of 308 working days), it was thought that the practical limit of production with the labor then available had been reached. Transportation disabilities, even in the seasons of greatest demand, have not often affected production seriously in the anthracite fields. Since 1918 there has been an increase in the number of men employed, but in no year has production come within 8,000,000 net tons of the total in 1918. The decrease in the number of days the mines were worked in 1921 as compared with 1917 and 1918, as well as the decrease in washery output, indicates that a falling off in demand rather than shortage in labor caused the decrease in production in 1921. Nevertheless it is clear that in each year there must be an increase in the expenditure of labor per ton produced because of the greater depth of mining and the thinner beds of coal that must be mined.

The table on page 497 headed "Coal produced per man employed, 1890–1921," shows the number of men employed in the anthracite mines during the last 32 years, the number of days worked, and the average output. The average output per man per year is obtained by dividing the total output for the year by the number of men employed, and the average output per man per day is obtained by dividing the average per year thus determined by the number of days worked. These averages therefore reflect not only the efficiency of the miners but the changes in the percentage of underground and top men employed year by year and the proportion of washery coal entering into the total production for the year. How these factors affect the anthracite man's efficiency is considered in the labor statistics in the part of this report devoted to the production of coal by States. (See p. 627.)

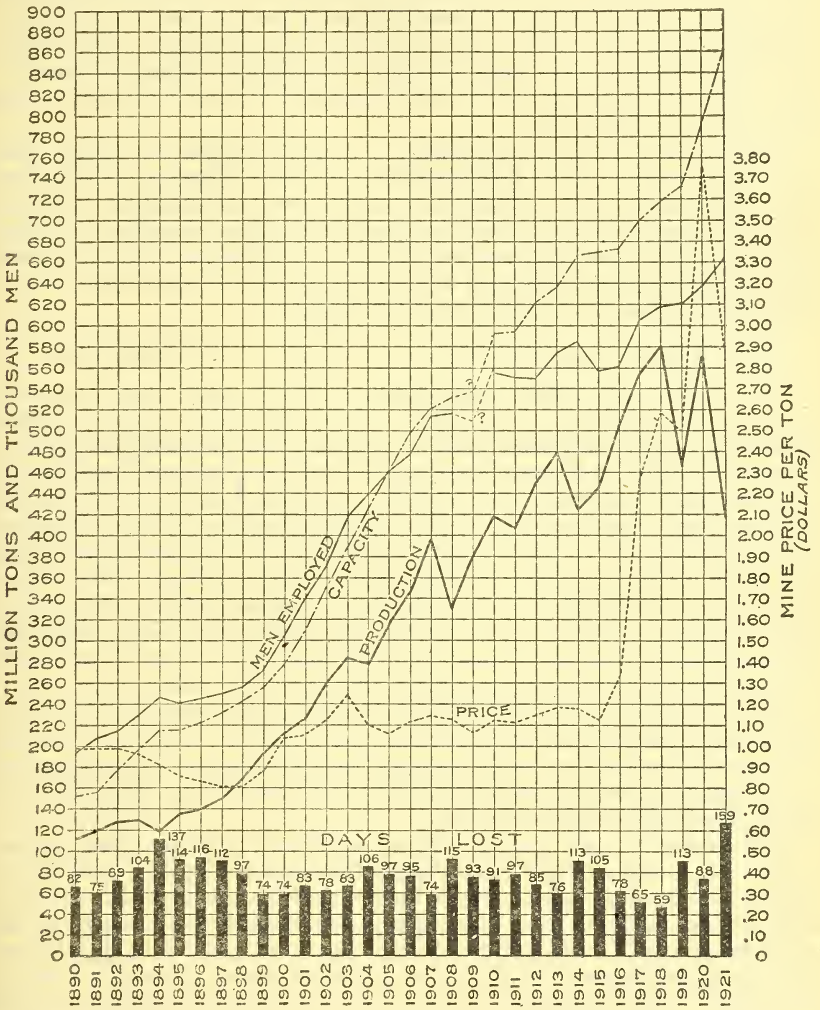


FIGURE 45.—Production, capacity, men employed, mine price per ton, and average number of days lost at bituminous coal mines, 1890–1921.

MEN EMPLOYED IN THE BITUMINOUS MINES.

COMPARATIVE SUMMARY.

A new record in the total number of men employed in the bituminous coal mines of the United States was reached in 1921, when the number reported was 663,754. In 1918, when all records of production of soft coal were broken, the total number of men employed was 615,305. The tonnage raised in 1921—415,921,950 tons—more nearly approached that of 1910 than any other year. In 1910 the output was 417,111,142 tons and the number of men employed 555,533. Labor, as measured by the average tonnage per man employed per day worked, however, was more productive in 1921 than in any previous year. The average tonnage per man per day was 4.20 tons as compared with 3.78 tons in 1918 and 3.46 tons in 1910. The reason for the low output for the year is found in the number of days worked—149. This is the low mark in the Geological Survey's records of the bituminous coal industry.

As the daily output, according to the averages for 1921, was equivalent to a total of 860,000,000 tons for a theoretical full-time year of 308 days, it is certain that there was nothing approaching a labor shortage in the bituminous regions in that year, but as complaints of labor shortage are heard from individual mines or districts even in the years of greatest depression, it will be profitable to examine the causes that lead to these complaints.

RELATION OF LABOR SUPPLY TO CAUSES OF NONOPERATION.

Causes of nonoperation.—As stated above (p. 483) there are four recognized causes for nonoperation of a coal mine—transportation disability, which interferes with or prevents the carrying of the coal to market; lack of labor to operate the mine; physical disability in or about the mine that prevents its operation; and lack of market for the coal. Except in periods of general strikes, such as those in Ohio and Colorado in 1914 and throughout the organized bituminous coal fields of the country in November and December, 1919, labor shortage has little effect in limiting mine operating time. Operators may not have as many names on the pay roll as they desire, but usually a sufficient number of men report for work each day upon which cars are set for loading to justify operation of the mine.

Mine disability.—Mine disability also has slight effect on operating time, and, except for a disaster such as the Cabin Creek flood in 1916 or a power breakdown where a number of mines are operating on central-station service, mine disability seldom affects all mines in a particular field simultaneously.

Transportation and market.—Transportation disability and lack of market are the leading causes of interruptions in running time at the bituminous coal mines of the country, and in the intimate relation between car supply and labor supply is found the source of the common complaints of labor shortage made by individual producers. Lack of market may be due to any one or more of several factors, including overdevelopment, changes in competitive conditions, mild weather, seasonal fluctuations in demand, or industrial depression. When reduced to its simplest terms, lack of market means that the coal producer is unable to market all the coal that his mine can produce and that he would like to sell. Sectionally, its effects may be seen in the spring and summer drop in the number of days operated at mines in Illinois and Indiana, as shown in the State reports prior to the World War. Nationally, its effects may be seen in the low average number of days the bituminous coal mines of the country operated in 1921. Although there were other causes of nonoperation that year, they were distinctly minor limitations on production; the major limitation was the general industrial depression that followed the collapse of the postwar boom in trade.

When, on the other hand, as in the spring and summer of 1920, the demand is great and consumers are concentrating their orders for coal so much that the work of filling them at once would require full-time operation of most of the mines, the railroads are unable to meet the demand for cars and for transportation. Orders for cars are placed with the railroads in numbers far in excess of the supply, and the cry of "car shortage" is heard. The very inability of the railroads to meet all the demands placed upon them—an inability that probably is as often due to shortage of motive power or to inadequate passing tracks and terminal facilities as to an insufficient number of cars suitable for loading coal—not only sharpens the eagerness of the buyer but actually creates a fictitious demand for coal, as many consumers duplicate their orders with several shippers with one of two ideas in mind—either to accumulate abnormal reserves as a protection and insurance against possible increased delay in transportation or to cancel the duplicated orders when the first one comes through. Under such circumstances there is an apparent or real demand for all the coal that can be produced, the prices of spot coal (that is, the portion of the output not covered by contracts) advance, and the question of car supply becomes a vital one to the operators.

Mine ratings and labor supply.—When the orders for cars placed by the operators exceed the number a railroad can furnish the available supply is prorated among the mines in accordance with what are known as "mine ratings." These mine ratings are designed to determine the relative capacity of all the mines on a particular railroad to produce and load coal. The supply of cars received at a mine at the time when the operator has the greatest need of cars is therefore dependent on the mine rating. Prior to 1906 discrimination in distribution of cars at times of shortage of equipment was a subject of bitter complaint. On many roads there was no fixed basis for allotment, there was little uniformity, and charges of favoritism were common. When the Interstate Commerce Commission assumed control and a number of suits for damages based on discrimination were brought, intentional and flagrant acts of favoritism began to disappear. The principles that should govern the railroads in allocating their equipment were set forth in a number of decisions handed down by the Interstate Commerce Commission. The movement toward greater uniformity gained ground until the advent of the United States Railroad Administration during the World War, when complete uniformity was attempted through the promulgation, in Circular CS–31, of a code of mine rating and a system of regulations for car distribution.

The basis for mine rating prescribed in this circular is the daily capacity of the mine. The rating thus determined is subject to certain modifications with respect to joint mines—that is, mines served by more than one carrier—and mines that coke a part of their own output. The circular provides that the daily capacity shall be determined by dividing the total coal tonnage shipped by the mine during the preceding month by the number of hours worked in producing it and multiplying the quotient by the number of hours in the recognized work day (not more than 10 hours) of the mine. The result is termed the daily rating of the mine, and the rules provide that this rating shall be revised monthly. Whenever the car supply on a road or division is insufficient to fill all orders, it is prorated according to the mine ratings. In other words, each mine is supposed to receive the same percentage of the available supply that its rating bears to the total rating of the mines in its field.

It therefore follows that anything an operator can do to increase his mine rating adds to his car supply in times of car shortage. If, for example, there are 20 mines on a certain division of a railroad and each mine has the same daily rating, theoretically each mine will receive just as many cars as every other mine, but practically modifications may arise out of the use of assigned and private cars. Except as noted below (p. —), however, these modifications are ignored in this explanation for the sake of simplicity, because their effect has no influence on the labor question. If these modifications are disregarded, each of the 20 mines on the division mentioned is evidently entitled to 5 per cent of the available car supply for the division whether that supply be equal to the combined total ratings or not. Thus, if each mine is rated at 20 cars a day, a 100 per cent supply on that division would be 400 cars. If the supply of cars available drops to 300, each mine will receive 75 per cent of its rating, or 15 cars. But if one operator by increasing his labor supply can raise his daily rating to 25 cars his daily rating becomes a fraction over 6 per cent of the total daily rating for the division, and when the supply drops to 300 cars he is entitled to approximately 18 cars a day instead of 15.

This system of rating furnishes the key to the intimate relation between car supply and labor supply and explains how there may be individual complaints of labor shortage even when the country is calling on the producers for coal faster than the railroads can furnish cars in which to load it. The rules are so worded that a mine which augments its working force so as to produce 3,000 tons in 5 hours is rated higher than a mine that has a normal working force and takes 8 hours to produce 4,000 tons because the rating of the first mine, on an 8-hour basis, would be 4,800 tons, although it might be impossible to market that quantity in ordinary times, whereas the second mine might have a normal market for its entire daily output. "As it is generally true that the mines are [physically] developed beyond the present labor supply, the desire to obtain more men and increase output in times of car shortage is logical and warranted. Individual operators can correctly say that they are short of labor." [4]

Under the circumstances cited, however, the public would not gain in increased coal supply if the individual mine were able to augment its working force, because the limitation on production would be the car supply; there would be a shifting of output between the different mines, but no increase.

At times the conditions of car supply may affect the labor supply at a mine or in a district adversely. An insufficient run of cars over extended periods naturally increases the idle time and drives the workers to other mines or other fields. In turn, this diminished labor supply means a diminished productive capacity and a corresponding reduction in mine ratings by the railroads. This is why the use of assigned cars for loading railroad fuel has provoked so much bitterness. The right of the railroad to protect its own requirements for fuel is recognized in the rules for car distribution. Except where the railroad takes the entire output of a mine on a contract for six months

[4] U. S. Geol. Survey Mineral Resources, 1918, pt. 2, pp. 714-715, 1921.

or more, private cars and cars placed for loading railroad fuel, both of which are termed assigned cars, are counted against the allotment of the mine, but such equipment is not distributed upon a pro rata basis in times of shortage, so that mines with contracts for railroad fuel or mines that own private cars are commonly assured of steadier running time than mines that depend on the general commercial market and ordinary railroad equipment. This condition naturally attracts the better class of mine labor that desires steady work to the mines so favored and causes dissatisfaction among both operators and workers in other mines. So bitter were the objections of operators and the mine workers' union to this practice of assigning cars during the war that at one time the United States Fuel Administrator ordered its abolition. As this report was going to press the Interstate Commerce Commission handed down a decision ("Assigned cars at bituminous coal mines," 80 I. C. C., 520), ordering that assigned and private cars be counted in the same manner as unassigned equipment.

One other phase of the mine-rating question is worthy of passing note because it is a feature that is attracting more and more public attention. That is the relation of mine ratings, forced upward by an augmented supply of labor, to the actual requirements of the country for consumption. As is stated above (p. 488), although the bituminous coal mines of the country worked fewer days in 1921 than in any other year for which the Geological Survey has compiled records, the daily average output of bituminous coal was equivalent to a total of 860,000,000 tons on a full-time year. Obviously the country can not support any such production at the present time. The result is that mine ratings have become so inflated that continuous operation at the ratings fixed would be commercially impossible. When demand is at its height, however, the operators base their productive capacity upon those ratings and charge that their inability to meet the immediate call for fuel is due to deficient railroad service, but the transportation lines, thus placed on the defensive, retort that the mines are grossly overrated. A recent decision of the Interstate Commerce Commission [5] asserted that evidence before it showed that in times of car shortage mine ratings became inflated an average of $33\frac{1}{2}$ per cent. The United States Coal Commission [6] has stated that

> a full car supply for the country's soft-coal mines, as rated by the railroads, would have furnished transportation in December [1922] for more than 75,000,000 tons, or 20,000,000 tons more than the country ever took from the mines in a single month. Plainly "100 per cent car supply" as based on such inflated ratings would create a car surplus or a coal surplus beyond the ability of the market to absorb.

Yet, as previously pointed out, the higher the operator can have his mine rating fixed the greater will be his supply of cars during peak demand, and he naturally feels warranted in taking all steps open to him to have that rating placed as high as possible.

INSIDE AND OUTSIDE EMPLOYEES.

There is another phase of the labor supply that is not disclosed in the preceding discussion. That is the percentages of inside and outside men employed. From 1916 to 1918 the total number of men employed in the bituminous coal mines increased from 561,102 to

[5] Bell & Zoller Co. et al. *v.* Baltimore & Ohio Southwestern R. R. Co. et al., 74 I. C. C. 433.
[6] Preliminary report of the U. S. Coal Commission: 67th Cong., 4th sess., H. Doc. 533, 1923.

615,305, or approximately 10 per cent, but the number of men employed inside increased only 4.6 per cent. In 1916 the percentage of inside or underground employees was 84.5; by 1918 it had dropped to 80.7 per cent. In the anthracite mines the percentage of underground labor dropped from 73.0 per cent in 1916 to 69.1 per cent in 1918. The explanation offered for the proportionately greater increase in outside or surface labor was the market demands of 1917 and 1918. In their efforts to increase the number of men at their mines and thereby their capacity, mine rating, and car supply, operators added any and all labor obtainable, pushed repairs, construction, and development, and, in the anthracite region, added more men to the crews working washeries at the culm banks.

With the slackening in demand that accompanied the postwar slump, the prediction was made that a large proportion of the extra men who had been employed would be dropped and that the percentage of underground workers would be increased. This prediction was fulfilled to a marked degree at the bituminous mines and to a less extent at the anthracite mines. In 1919 the percentage of underground labor at the bituminous mines had risen to 81.8 per cent; in 1920 to 82.8 per cent; and in 1921 to 85.5 per cent. This increase, however, was not due to a decrease in the total number of men employed, for during those years there was a steady increase in the total, which was 621,998 men in 1919, 639,547 in 1920, and 663,754 in 1921, though the number of surface employees dropped from 119,053 in 1918 to 113,197 in 1919, 109,735 in 1920, and 96,465 in 1921, partly because some of them were transferred to underground labor as they developed greater skill in their work.

Other causes of the increase in the proportion of underground labor were the return of experienced miners from military service; the slowing up of repair, construction, and development work; and the desire of the operators to cut down the number of day employees and increase the number of piece-work employees at a time when the margin of profit was small, as it was in 1921.

As already noted, the total number employed at the anthracite mines in 1921 was 20,180 less than in 1914, the peak year for labor supply at those mines. Although the release of men from war duty is plausibly assumed to explain the increase in the number employed in 1919 over that in 1918, we must assume, in the absence of detailed analysis, that the decrease in the number in 1920 was due to the drifting away of men from the mines either to more lucrative employment in other industry or to work in the bituminous coal mines, which offer a higher day rate in the union fields than that offered by the anthracite mines, though the working time is less steady. In 1921, when the bituminous coal mines averaged only 149 days, as against 271 at the anthracite mines, and when general industry was at a low ebb, it would not be strange if some of those who had left the anthracite mines returned to their former work. The percentage of underground men in the anthracite mines in 1918 was 69.1; in 1919 it rose to 69.8 per cent, but in 1920 it dropped back to 69.7 per cent. In 1921 it was 73.2 per cent. This change in the relative proportions of underground and surface workers was also influenced by the increase and decrease in the number of men employed in culm-bank washeries, who are included with the surface workers.

Men employed in the coal mines of the United States in 1919, 1920, and 1921.

State.	Underground.		Surface.		Total.
	Number.	Percentage.	Number.	Percentage.	
1919.					
Alabama	20,660	76.9	6,214	23.1	26,874
Alaska	103	62.0	63	38.0	166
Arkansas	3,096	81.2	718	18.8	3,814
California and Idaho	54	70.1	23	29.9	77
Colorado	8,931	75.5	2,898	24.5	11,829
Georgia	108	64.3	60	35.7	168
Illinois	75,013	88.2	10,007	11.8	85,020
Indiana	25,316	84.4	4,671	15.6	29,987
Iowa	10,873	87.9	1,493	12.1	12,366
Kansas	8,173	82.3	1,753	17.7	9,926
Kentucky	35,530	77.9	10,068	22.1	45,598
Maryland	4,422	82.0	972	18.0	5,394
Michigan	1,851	88.0	253	12.0	2,104
Missouri	7,235	77.7	2,079	22.3	9,314
Montana	3,318	80.5	805	19.5	4,123
New Mexico	2,918	77.9	827	22.1	3,745
North Carolina	37	75.5	12	24.5	49
North Dakota	758	70.7	314	29.3	1,072
Ohio	41,336	83.3	8,288	16.7	49,624
Oklahoma	6,996	82.8	1,452	17.2	8,448
Oregon	52	77.6	15	22.4	67
Pennsylvania (bituminous)	143,838	82.4	30,712	17.6	174,550
South Dakota	43	93.5	3	6.5	46
Tennessee	8,976	77.9	2,547	22.1	11,523
Texas	3,018	82.8	626	17.2	3,644
Utah	2,709	70.2	1,148	29.8	3,857
Virginia	9,471	81.7	2,115	18.3	11,586
Washington	3,801	75.5	1,235	24.5	5,036
West Virginia	74,350	78.5	20,355	21.5	94,705
Wyoming	5,815	79.8	1,471	20.2	7,286
Total bituminous	508,801	81.8	113,197	18.2	621,998
Pennsylvania anthracite	107,829	69.8	46,742	30.2	154,571
Grand total	616,630	79.4	159,939	20.6	776,569
1920.					
Alabama	20,355	79.7	5,185	20.3	25,540
Alaska	105	50.7	102	49.3	207
Arkansas	3,354	84.6	612	15.4	3,966
California and Idaho	8	80.0	2	20.0	10
Colorado	11,005	80.3	2,706	19.7	13,711
Georgia	97	65.5	51	34.5	148
Illinois	76,993	88.4	10,091	11.6	87,084
Indiana	26,922	86.4	4,233	13.6	31,155
Iowa	10,757	90.4	1,148	9.6	11,905
Kansas	7,589	84.5	1,395	15.5	8,984
Kentucky	40,036	81.0	9,416	19.0	49,452
Maryland	4,630	83.5	918	16.5	5,548
Michigan	1,927	89.5	227	10.5	2,154
Missouri	6,865	77.7	1,973	22.3	8,838
Montana	3,424	81.4	780	18.6	4,204
New Mexico	2,940	78.7	798	21.3	3,738
North Carolina	40	80.0	10	20.0	50
North Dakota	753	67.8	357	32.2	1,110
Ohio	42,062	82.7	8,795	17.3	50,857
Oklahoma	6,878	83.4	1,366	16.6	8,244
Oregon	56	65.9	29	34.1	85
Pennsylvania (bituminous)	143,876	82.7	30,094	17.3	173,970
South Dakota	37	78.7	10	21.3	47
Tennessee	9,227	81.3	2,126	18.7	11,353
Texas	2,573	87.2	377	12.8	2,950
Utah	3,559	79.0	945	21.0	4,504
Virginia	10,553	75.3	3,457	24.7	14,010
Washington	3,966	79.4	1,028	20.6	4,994
West Virginia	82,893	80.5	20,057	19.5	102,950
Wyoming	6,332	81.4	1,447	18.6	7,779
Total bituminous	529,812	82.8	109,735	17.2	639,547
Pennsylvania anthracite	101,023	69.7	44,051	30.3	145,074
Grand total	630,835	80.4	153,786	19.6	784,621

Men employed in the coal mines of the United States in 1919, 1920, and 1921—Contd.

State.	Underground.		Surface.		Total.
	Number.	Percentage.	Number.	Percentage.	
1921.					
Alabama	21,173	82.0	4,636	18.0	25,809
Alaska	183	45.6	218	54.4	401
Arkansas	3,163	87.5	453	12.5	3,616
California and Idaho [a]	83	58.9	58	41.1	141
Colorado	11,906	81.9	2,623	18.1	14,529
Georgia	85	62.5	51	37.5	136
Illinois	85,509	89.6	9,922	10.4	95,431
Indiana	28,932	88.5	3,755	11.5	32,687
Iowa	10,412	91.4	974	8.6	11,386
Kansas	6,991	85.2	1,216	14.8	8,207
Kentucky	41,733	82.6	8,788	17.4	50,521
Maryland	3,942	84.4	726	15.6	4,668
Michigan	1,968	89.0	244	11.0	2,212
Missouri	6,971	81.5	1,584	18.5	8,555
Montana	3,460	82.8	718	17.2	4,178
New Mexico	3,855	84.2	722	15.8	4,577
North Carolina	45	75.0	15	25.0	60
North Dakota	775	72.8	289	27.2	1,064
Ohio	44,698	86.3	7,087	13.7	51,785
Oklahoma	7,425	83.9	1,429	16.1	8,854
Oregon	(a)	(a)	(a)	(a)	(a)
Pennsylvania (bituminous)	164,222	86.1	26,421	13.9	190,643
South Dakota	43	100.0	....	....	43
Tennessee	8,561	82.7	1,786	17.3	10,347
Texas	2,598	89.8	294	10.2	2,892
Utah	3,491	78.9	931	21.1	4,422
Virginia	9,807	82.3	2,115	17.7	11,922
Washington	3,486	80.4	848	19.6	4,334
West Virginia	84,752	83.2	17,098	16.8	101,850
Wyoming	7,020	82.7	1,464	17.3	8,484
Total bituminous	567,289	85.5	96,465	14.5	663,754
Pennsylvania anthracite	116,817	73.2	42,682	26.8	159,499
Grand total	684,106	83.1	139,147	16.9	823,253

[a] California and Idaho include Oregon in 1921.

Statistics of labor employed in coal mines of the United States, 1918–1921.

State.	1918		1919		1920		1921	
	Number of days active.	Average number employed.	Number of days active.	Average number employed.	Number of days active.	Average number employed.	Number of days active.	Average number employed.
Alabama	278	26,221	239	26,874	247	25,540	166	25,809
Alaska	254	239	280	166	240	207	244	401
Arkansas	204	3,978	136	3,814	176	3,966	112	3,616
California and Idaho	240	15	59	77	181	10	[a] 149	[a] 141
Colorado	255	14,483	225	11,829	255	13,711	164	14,529
Georgia	258	190	284	168	294	148	183	136
Illinois	238	85,965	160	85,020	213	87,084	152	95,431
Indiana	227	30,376	148	29,987	192	31,155	128	32,687
Iowa	245	13,328	176	12,366	250	11,905	148	11,386
Kansas	234	10,665	182	9,926	204	8,984	137	8,207
Kentucky	230	39,342	189	45,598	182	49,452	152	50,521
Maryland	261	5,568	179	5,394	207	5,548	120	4,668
Michigan	237	2,558	179	2,104	261	2,154	196	2,212
Missouri	235	9,590	175	9,314	233	8,838	166	8,555
Montana	264	4,559	194	4,123	250	4,204	143	4,178
New Mexico	301	4,095	273	3,745	302	3,738	150	4,577
North Carolina	40	50	100	49	288	50	300	60
North Dakota	229	828	216	1,072	218	1,110	194	1,064
Ohio	223	48,450	164	49,624	188	50,857	134	51,785
Oklahoma	228	8,451	184	8,448	217	8,244	141	8,854
Oregon	292	40	259	67	307	85	(a)	(a)
Pennsylvania (bituminous)	269	174,306	218	174,550	244	173,970	151	190,643
South Dakota	145	21	164	46	133	47	129	43
Tennessee	265	10,694	201	11,523	234	11,353	154	10,347
Texas	262	3,936	227	3,644	242	2,950	139	2,892
Utah	258	4,160	239	3,857	252	4,504	151	4,422
Virginia	277	11,004	247	11,586	262	14,010	166	11,922
Washington	275	5,109	217	5,036	260	4,994	159	4,334
West Virginia	238	89,530	200	94,705	198	102,950	149	101,850
Wyoming	268	7,554	221	7,286	264	7,779	167	8,484
Total bituminous	249	615,305	195	621,998	220	639,547	149	663,754
Pennsylvania (anthracite)	293	147,121	266	154,571	271	145,074	271	159,499
Grand total	258	762,426	209	776,569	230	784,621	173	823,253

[a] California includes Oregon.

PRODUCTION PER MAN PER DAY.

METHOD OF COMPUTATION AND VALUE OF THE AVERAGE.

If the total output in a year is divided by the number of men employed the quotient will show the production per man for the year. If this figure in turn is divided by the average number of days the mines worked, the final quotient will show the average production per man per day. For the bituminous coal mines in 1921 the average production per man for the year was 627 net tons, and the average per man per day was 4.20 tons.

The average production per man per day is thus determined by arithmetical calculation rather than by engineering observation. The man who actually digs the coal gets out considerably more per 8-hour day than 4.20 tons. The average daily product of his work is pulled down by the inclusion of the daymen, above and below ground, by the fact that at any one time some of the men supposed to be at work are absent, by the fact that tonnage men frequently go home before the mine as a whole stops, and by the fact that men underground can not work continuously because of unavoidable delays, such as that caused by waiting for mine cars. Nevertheless the average thus determined is of value because it can be so easily calculated from the records available and it affords at least a rough indication of the units of labor necessary to raise a ton of coal and prepare it for shipment under the conditions that prevail at any time and place.

AVERAGE DAILY OUTPUT FOR ALL MEN EMPLOYED.

The following table shows the average production per man in each State for the last four years. No doubt the miners in different parts of the country are unequal in skill and diligence, but the great difference in productivity per man between, for example, Missouri, with its 2.5 tons per day, and Illinois, with its 4.8 tons, is due rather to differences in the physical conditions under which the work is done, and particularly to differences in the thickness of the coal beds.

Coal produced per man and average number of days worked per year in the United States in 1918, 1919, 1920, and 1921, by States.

State.	1918			1919			1920			1921		
	Days mine worked.	Average tonnage.		Days mine worked.	Average tonnage.		Days mine worked.	Average tonnage.		Days mine worked.	Average tonnage.	
		Per year.	Per day.		Per year.	Per day.		Per year.	Per day.		Per year.	Per day.
Alabama	278	732	2.63	239	578	2.42	247	632	2.56	166	487	2.93
Arkansas	204	560	2.75	136	375	2.76	176	517	2.94	112	340	3.03
Colorado	255	857	3.36	225	873	3.88	255	895	3.51	164	628	3.83
Illinois	238	1,039	4.37	160	716	4.48	213	1,018	4.78	152	729	4.80
Indiana	227	1,010	4.45	148	698	4.72	192	934	4.86	128	622	4.86
Iowa	245	615	2.51	176	455	2.59	250	653	2.61	148	398	2.69
Kansas	234	709	3.03	182	526	2.89	204	650	3.19	137	422	3.08
Kentucky	230	804	3.50	189	659	3.49	182	718	3.95	152	625	4.11
Maryland	261	808	3.10	179	560	3.13	207	726	3.50	120	392	3.27
Michigan	237	573	2.42	179	474	2.65	261	691	2.65	196	516	2.63
Missouri	235	591	2.51	175	427	2.44	233	596	2.56	166	415	2.50
Montana	264	994	3.77	194	785	4.05	250	1,048	4.19	143	654	4.57
New Mexico	301	982	3.26	273	838	3.07	302	985	3.26	150	536	3.58
North Dakota	229	869	3.79	216	784	3.63	218	818	3.75	194	813	4.19
Ohio	223	946	4.24	164	723	4.41	188	890	4.73	134	617	4.60
Oklahoma	228	570	2.50	184	450	2.45	217	586	2.70	141	380	2.70
Pennsylvania:												
Anthracite	293	[a]672	[a]2.29	266	570	2.14	271	[a]618	[a]2.28	271	567	2.09
Bituminous	269	1,024	3.81	218	864	3.96	244	966	3.96	151	609	4.03
Tennessee	265	639	2.41	201	452	2.25	234	580	2.48	154	431	2.80
Texas	262	574	2.19	227	461	2.03	242	547	2.26	139	336	2.42
Utah	258	1,235	4.79	239	1,201	5.03	252	1,333	5.29	151	922	[b]6.10
Virginia	277	935	3.38	247	805	3.26	262	803	3.06	166	628	3.78
Washington	275	799	2.91	217	594	2.74	260	752	2.89	159	560	3.52
West Virginia	238	1,005	4.22	200	835	4.18	198	869	4.39	149	715	4.79
Wyoming	268	1,249	4.66	221	991	4.48	264	1,237	4.69	167	849	5.08

[a] Heavy washery output.
[b] See p. 647 for explanation of this figure, which though correctly computed is misleading.

Still other causes may be found, however, for the changes in production per man during the last 32 years shown in the table on page 497, giving coal produced per man employed from 1890 to 1921. How much of the increase in the daily output of bituminous coal per man from 2.56 tons in 1890 to 4.20 tons in 1921 was due to the increased intelligence and application of the individual worker, and how much to better mining methods, introduction of machines, recovery of slack coal, and superior organization? This question can not be answered precisely, but we do know that there has been a steady increase and that the increase was greater during the last decade than during the two decades preceding it.

The increase in human efficiency in mining bituminous coal is thus clearly evident, but a long record of the average daily output of anthracite per man seems to tell a far different story. The output of anthracite per day per man in 1921, including all coal, fresh mined, washery, and dredge, amounted to 2.09 net tons, which was less than that in 1911. Any attempt, however, to compare the average daily output per man of anthracite and bituminous coal from year to year for long periods is made impossible by the following facts:

As the coal that is most easily accessible is mined first, the difficulties of mining increase from year to year, especially in the anthracite region, where the mines are getting deeper, thinner beds are being mined, and more water must be pumped.

As the mines become larger men must spend more time in going from the opening to the working face.

The increase in the value of the coal has encouraged its more complete extraction, which involves an increase in labor per ton raised.

The figures showing "men employed" probably include children. The number of children employed is now small, and it has been decreasing, a fact which influences the average.

The figures showing production represent only marketable coal. A generation ago it was not uncommon to ship only the lumps and leave the fines either underground or in dumps at the mouth of the mine. The productivity of the miner then would therefore appear less than if he were credited with both fines and lump, as he is today.

During the last 30 years there has been a marked improvement in the care given to the preparation of bituminous coal after it is mined, before shipment. This additional work has helped to increase the number of surface employees.

The most effective means of increasing output has been the introduction of mining machinery. In 1891 only 5 per cent of the output of bituminous coal was machine mined. In 1900 the proportion was 25 per cent, and in 1921 it had risen to 65.6 per cent. At the same time many other mechanical improvements have been introduced, all of which have increased the output per man.

A small effect, but a growing one, arises from the inclusion in the average output per man of the product of steam-shovel pits, which make a much higher output per man employed.

A greater effect is that produced by the inclusion in the average daily output of anthracite per man of the results of the operations of dredges and culm-bank washeries, for the daily output of these operations per man is much higher than that of the deep mines. The production of washery coal, too, may be great or small, for it fluctuates greatly from year to year.

The average daily output is affected by changes in the length of the working day. Such changes have been relatively insignificant except at certain periods of readjustment, such as 1898 to 1903 and 1916 to 1919.

Coal produced per man employed, 1890–1921.

Year.	Anthracite.				Bituminous.			
	Men employed.	Days worked.	Average tonnage.		Men employed.	Days worked.	Average tonnage.	
			Per day.	Per year.			Per day.	Per year.
1890	126,000	200	1.85	369	192,402	226	2.56	579
1891	126,350	203	1.98	401	205,803	223	2.57	573
1892	129,050	198	2.06	407	212,893	219	2.72	596
1893	132,944	197	2.06	406	230,365	204	2.73	557
1894	131,603	190	2.08	395	244,603	171	2.84	486
1895	142,917	196	2.07	406	239,962	194	2.90	563
1896	148,991	174	2.10	365	244,171	192	2.94	564
1897	149,884	150	2.34	351	247,817	196	3.04	596
1898	145,504	152	2.41	367	255,717	211	3.09	651
1899	139,608	173	2.50	433	271,027	234	3.05	713
1900	144,206	166	2.40	398	304,375	234	2.98	697
1901	145,309	196	2.37	464	340,235	225	2.94	664
1902	148,141	116	2.40	279	370,056	230	3.06	703
1903	150,483	206	2.41	496	415,777	225	3.02	680
1904	155,861	200	2.35	469	437,832	202	3.15	637
1905	165,406	215	2.18	470	460,629	211	3.24	684
1906	162,355	195	2.25	439	478,425	213	3.36	717
1907	167,234	220	2.33	512	513,258	234	3.29	769
1908	174,174	200	2.39	478	516,264	193	3.34	644
1910	169,497	229	2.17	498	555,533	217	3.46	751
1911	172,585	246	2.13	524	549,775	211	3.50	738
1912	174,030	231	2.10	485	548,632	223	3.68	820
1913	175,745	257	2.02	520	571,882	232	3.61	837
1914	179,679	245	2.06	505	583,506	195	3.71	724
1915	176,552	230	2.19	504	557,456	203	3.91	794
1916	159,869	253	2.16	548	561,102	230	3.90	896
1917	154,174	285	[a] 2.27	[a] 646	603,143	243	3.77	915
1918	147,121	293	[a] 2.29	[a] 672	615,305	249	3.78	942
1919	154,571	266	2.14	570	621,998	195	3.84	749
1920	145,074	271	[a] 2.28	[a] 618	639,547	220	4.00	881
1921	159,499	271	2.09	567	663,754	149	4.20	627

[a] Heavy washery output.

AVERAGE FOR DEEP MINES PER MAN EMPLOYED UNDERGROUND.

A better index of changes in output per man is the average production of coal from deep mines per man employed underground. This figure, which is given in the following table, eliminates the errors due to inclusion of coal from strip pits, dredges, and washeries, and the variations in the number of workers employed in preparing the coal at the tipple or breaker. Unfortunately the records do not permit a calculation of this average for the years prior to 1911.

Coal produced from deep mines per man employed underground per day worked in 1911–1921, in net tons.[a]

Year.	Anthracite.	Bituminous.	Year.	Anthracite.	Bituminous.
1911	2.75	4.01	1917	2.89	4.51
1912	2.69	4.24	1918	2.94	4.62
1913	2.67	4.16	1919	2.81	4.64
1914	2.67	4.28	1920	2.93	4.80
1915	2.78	4.49	1921	2.70	4.86
1916	2.74	4.57			

[a] In making this computation certain estimates had to be made of the division of workers above and below ground and of the production of strip pits in the years 1911 to 1913. The probable error introduced by these estimates is too small to impair the value of the averages.

It will be noted that this average of deep-mine coal per man employed underground fluctuates much less than the simple average of all coal per man employed.

The average for bituminous coal shows a steady increase from 1911 to 1921, amounting in all to 0.85 ton, or 21 per cent. The average for anthracite coal, on the other hand, shows but little change during the 11-year period, for though the average for 1920 was above that for 1911, the average for 1921 was slightly below it.

The increase in the production of bituminous coal per man underground from 1920 to 1921 was only 0.06 ton, an amount entirely within the probabilities indicated by the record of the preceding decade. This fact confirms the accuracy of the figure showing the average number of days worked in 1921, which at first sight appears

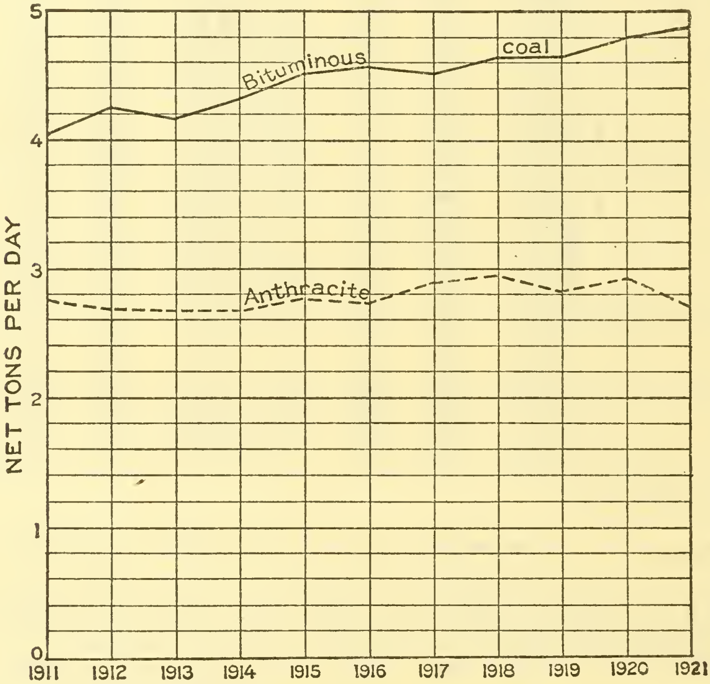


FIGURE 46.—Production of coal from deep mines per man employed underground per day worked.

low—149 days as against a previous low mark of 171. Were the figure of 149 days too low, the production per man per day would have shown a sudden and impossible increase.

HOURS OF LABOR.

Rapid progress in the adoption of the 8-hour day was made in 1916 and 1917, and by 1918 approximately 91 per cent of the men in the bituminous industry were employed in mines where the established working day was 8 hours. A further change from 9 or 10 to 8 hours was made in 1919, chiefly in West Virginia and Kentucky, and the percentage employed in 8-hour mines rose to 95.5. In 1920 this percentage was even higher, 97.1 per cent, and it changed but little in the following year. The 10-hour day has practically disappeared from coal mining in the United States, and the 9-hour day prevails at only a small proportion of the mines. There are, of course, certain occupations about the mine for which the working day exceeds the day established for the mine as a whole, and at some operations in Colorado and elsewhere the 9-hour day has been retained for workers on the tipple after the 8-hour day had been established as the standard for work underground.

When the length of the working day is stated, however, reference is made to the number of hours the mines are supposed to be in operation, cars and orders permitting, and not to the number of hours the miners actually work. In both the anthracite and bituminous fields practically all the coal is mined by contract at a fixed rate per ton or on some other basis of payment. The miner is a pieceworker and is

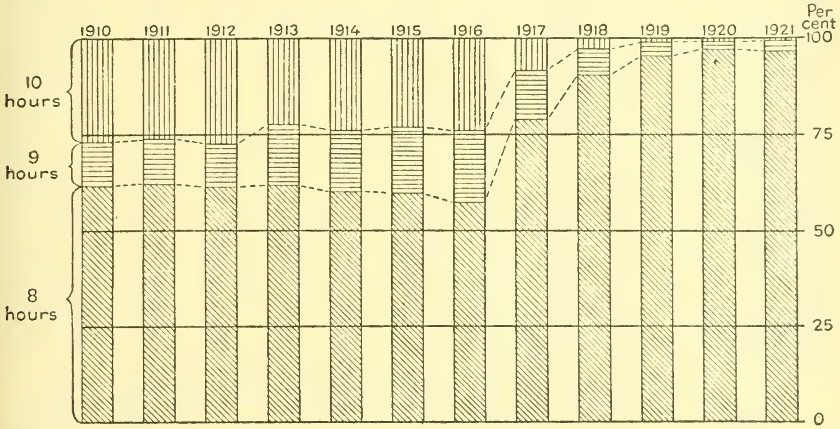


FIGURE 47.—Percentage of labor in bituminous coal mines with established working days of 8, 9, and 10 hours, 1910–1921.

not obliged to put in a certain number of hours at his working place. The figures in the following tables therefore really indicate the number of hours the men had an opportunity to work during a full day on the assumption that there was a full run of cars and that the market conditions were favorable to full-time operation; they do not mean that all employees worked the number of hours stated.

From 1903, after the settlement of the anthracite strike, until 1916 the established working day in the Pennsylvania anthracite region was 9 hours. Since 1916 the 8-hour day has prevailed.

The decrease in length of the working day must be considered in calculating the productivity per man. In 1903 the weighted average established work day at bituminous mines was 8.7 hours; to-day it is 8.04 hours.

Number of bituminous coal mines in the United States having established working days of certain length and number of men employed, 1919, 1920, and 1921.

[Wagon mines not included.]

State.	8 hours.		9 hours.		10 hours.		All others.[a]		Total.	
	Mines.	Men.	Mines.	Men.	Mines.	Men.	Mines.	Men.	Mines.	Men.
1919.										
Alabama	268	24,054	1	5	3	562	23	2,253	295	26,874
Alaska	4	138					6	28	10	166
Arkansas	91	3,782	1	30			1	2	93	3,814
California	1	9					2	8	3	17
Colorado	157	[b]10,224	6	1,187	2	15	21	403	186	11,829
Georgia	1	168							1	168
Idaho	1	60							1	60
Illinois	486	83,882	7	48			38	1,090	531	85,020
Indiana	303	29,721	3	9			28	257	334	29,987
Iowa	175	11,700	1	6			32	660	208	12,366
Kansas	174	9,803	1	7			3	116	178	9,926
Kentucky	585	36,807	75	5,849	34	1,062	94	1,880	788	45,598
Maryland	85	5,127					7	267	92	5,394
Michigan	14	2,104							14	2,104
Missouri	193	8,831	8	176	2	44	22	263	225	9,314
Montana	61	4,050			3	11	20	62	84	4,123
New Mexico	38	3,560	1	[b]165			4	20	43	3,745
North Carolina	1	49							1	49
North Dakota	62	927	2	14	10	52	19	79	93	1,072
Ohio	816	47,980	12	382	9	116	164	1,146	1,001	49,624
Oklahoma	118	8,087	3	22	1	27	10	312	132	8,448
Oregon	2	57					1	10	3	67
Pennsylvania	2,325	160,490	136	6,138	37	2,400	286	5,522	2,784	174,550
South Dakota	2	5	1	4	2	6	11	31	16	46
Tennessee	142	10,002	3	316	2	665	10	540	157	11,523
Texas	17	2,273	22	1,115	6	148	6	108	51	3,644
Utah	30	3,809	2	9			5	39	37	3,857
Virginia	104	10,966	11	288	9	232	7	100	131	11,586
Washington	45	5,022					2	14	47	5,036
West Virginia	1,232	[b]85,815	46	5,353	10	787	96	2,750	1,384	94,705
Wyoming	69	7,276					2	10	71	7,286
	7,602	576,778	342	21,123	130	6,127	920	17,970	8,994	621,998
1920.										
Alabama	251	24,851	1	260	2	419	3	10	257	25,540
Alaska	5	174					5	33	10	207
Arkansas	93	3,934	1	2			2	30	96	3,966
California	1	3					1		2	3
Colorado	156	[b]13,320	2	204			25	187	183	13,711
Georgia	1	148							1	148
Idaho	1	7							1	7
Illinois	472	86,865	2	9			48	210	522	87,084
Indiana	279	30,839	3	179			36	137	318	31,155
Iowa	150	11,538					36	367	186	11,905
Kansas	154	8,946					8	38	162	8,984
Kentucky	661	43,602	63	4,824	23	523	64	503	811	49,452
Maryland	98	5,486					5	62	103	5,548
Michigan	14	2,154							14	2,154
Missouri	168	8,621	5	63	2	36	30	118	205	8,838
Montana	49	4,116			2	7	28	81	79	4,204
New Mexico	33	3,182	1	21			9	535	43	3,738
North Carolina	1	50							1	50
North Dakota	43	910	2	12	4	79	30	109	79	1,110
Ohio	887	50,033	2	52	8	359	133	413	1,030	50,857
Oklahoma	129	7,954	3	84	2	68	8	138	142	8,244
Oregon	3	85							3	85
Pennsylvania	2,288	163,063	90	5,404	17	821	299	4,682	2,694	173,970
South Dakota							17	47	17	47
Tennessee	162	10,638	1	25	1	600	2	90	166	11,353
Texas	13	1,395	21	892	7	571	3	92	44	2,950
Utah	34	4,496	1	6	1	2	3		39	4,504
Virginia	130	13,387	4	226	5	355	2	42	141	14,010
Washington	45	4,985					2	9	47	4,994
West Virginia	1,396	100,320	13	465	10	1,922	37	243	1,456	102,950
Wyoming	68	7,775					1	4	69	7,779
	7,785	612,877	215	12,728	84	5,762	837	8,180	8,921	639,547

[a] Includes employees in mines where the established working day was changed during the year, or where the working day was irregular, or which failed to answer the inquiry.

[b] Includes outside employees working 9 hours or 10 hours a day at certain mines where the established time for underground workers is 8 hours.

Number of bituminous coal mines in the United States having established working days of certain length and number of men employed, 1919, 1920, and 1921—Continued.

[Wagon mines not included.]

State.	8 hours.		9 hours.		10 hours.		All others.[a]		Total.	
	Mines.	Men.	Mines.	Men.	Mines.	Men.	Mines.	Men.	Mines.	Men.
1921.										
Alabama	215	22,479	21	1,431	7	554	3	1,345	246	25,809
Alaska	2	150					13	251	15	401
Arkansas	76	3,613	1	3					77	3,616
California	1	62							1	62
Colorado	179	[b]14,305	2	116			32	108	213	14,529
Georgia	1	136							1	136
Idaho	1	7							1	7
Illinois	497	94,590	2	7			173	834	672	95,431
Indiana	256	32,578	2	27			19	82	277	32,687
Iowa	134	11,307			1	4	18	75	153	11,386
Kansas	130	8,109					7	98	137	8,207
Kentucky	602	45,449	43	4,481	17	514	28	77	690	50,521
Maryland	82	4,644			1	6	4	18	87	4,668
Michigan	14	2,212							14	2,212
Missouri	148	8,272	6	201	1	27	16	55	171	8,555
Montana	47	4,154			1	3	10	21	58	4,178
New Mexico	37	4,548	1	20			3	9	41	4,577
North Carolina	1	60							1	60
North Dakota	41	939	1	9	4	49	14	67	60	1,064
Ohio	692	50,854	6	174	4	204	120	553	822	51,785
Oklahoma	124	8,697	2	67	2	80	4	10	132	8,854
Oregon	1	69					1	3	2	72
Pennsylvania (bit.)	2,115	181,572	92	8,244	9	399	181	428	2,397	190,643
South Dakota							18	43	18	43
Tennessee	139	9,977	3	354			1	16	143	10,347
Texas	14	1,571	16	723	5	545	1	53	36	2,892
Utah	33	4,412	1	6			2	4	36	4,422
Virginia	96	11,428	5	241	4	253			105	11,922
Washington	51	4,334							51	4,334
West Virginia	1,253	97,750	26	2,731	12	789	27	580	1,318	101,850
Wyoming	63	8,484							63	8,484
	7,045	636,762	230	18,835	68	3,427	695	4,730	8,038	663,754

[a] Includes employees in mines where the established working day was changed during the year, or where the working day was irregular, or which failed to answer the inquiry.
[b] Includes outside employees working 9 hours or 10 hours a day at certain mines where the established time for underground workers is 8 hours.

Percentage of men employed in bituminous coal mines that have established working day of 8, 9, and 10 hours.[a]

Year.	Per cent of total employees in—			Weighted average working day (hours).
	8-hour mines.	9-hour mines.	10-hour mines.	
1903	56.4	17.1	26.5	8.7
1904	62.1	13.8	24.1	8.6
1905	61.1	13.6	25.3	8.6
1906	63.0	13.5	23.5	8.6
1907	64.0	11.6	24.4	8.6
1908	63.5	11.1	25.4	8.6
1910	62.1	11.3	26.6	8.6
1911	62.9	10.9	26.2	8.6
1912	61.6	11.5	26.9	8.6
1913	61.9	15.2	22.9	8.6
1914	60.7	15.4	23.9	8.6
1915	59.6	17.0	23.4	8.6
1916	58.6	17.4	24.0	8.6
1917	79.0	12.6	8.4	8.3
1918	90.6	6.7	2.7	8.12
1919	95.5	3.5	1.0	8.06
1920	97.1	2.0	.9	8.04
1921	96.6	2.9	.5	8.04

[a] Percentages are calculated on base of total number of men in mines definitely reported as having 8-hour, 9-hour, or 10-hour day. A small number of mines that work more than 10 hours or less than 8 hours have been excluded, as have also all mines for which the reports were defective or which changed their working day during the year.

STRIKES AND LOCKOUTS.

Scope and value of the statistics.—The period of the war had been remarkably free from strikes, but the three years of readjustment that immediately followed the war were marked by several widespread and bitterly contested struggles between operators and men. Of these the outstanding one was the general bituminous strike of 1919. In that year 453,418 men were on strike at one time or another. These men were out an average of 35 days, and the total number of man-days of idleness was 15,761,410.

These statistics are based on reports received from the operators, submitted in writing but not under oath, in reply to the questions:

Were there any strikes at the mine during the year?

If so, give number of men on strike and duration of strike in days (Sundays and holidays excluded).

The operator is not asked to state the cause of the strike—a subject on which his opinion might differ from that of his employees. He is asked, however, to determine whether a particular stoppage is or is not a strike. Naturally, therefore, the operators have reported as "strikes" some stoppages that the employees would have considered "lockouts," and for this reason the tables given are here headed "Strikes and lockouts."

Reports of this kind that have been submitted by one party to a controversy should, if possible, be checked by evidence given by others. Beginning with 1917, it has been possible to obtain such checks for strikes affecting any considerable number of mines. Weekly reports of shipments, furnished by the railroads, have measured the extent to which the movement of coal outside of a given area was in fact curtailed by an alleged strike. The statements of the operators have been checked by accounts in newspapers and trade journals and, where it seemed necessary, by questioning representatives of the miners. For the five years from 1917 to 1921, inclusive, the returns have been personally examined by the senior author, who is satisfied that as far as district strikes and general suspensions are concerned they are substantially correct. It has not been possible to check the reports of petty strikes, but they are relatively unimportant in terms of man-days of idleness. Subject to these qualifications the statistics here presented are unique and are of peculiar value, because they are comparable, continuous, and quantitative.

Statistical record, 1899–1921.—The first of the accompanying tables gives the statistical record of strikes and lockouts during the last 23 years. Those for each year show the number of men on strike, the total man-days of idleness, and the average number of days each man on strike was idle.

Summary of strikes and lockouts in the coal mines of the United States, 1899–1921.

Year.	Number of men on strike.	Total man-days idle.	Average number of days lost per man striking.	Year.	Number of men on strike.	Total man-days idle.	Average number of days lost per man striking.
1899	45,981	2,124,154	46	1911	41,413	983,737	24
1900	131,973	4,878,102	37	1912	311,056	12,527,305	40
1901 [a]	20,593	733,802	35	1913	135,395	3,049,412	22.5
1902	200,452	16,672,217	83	1914	161,720	11,013,667	68
1903 [a]	47,481	1,341,031	28	1915	67,190	2,467,431	37
1904	77,661	3,382,830	44	1916	170,633	3,344,586	20
1905	37,542	796,735	21	1917	160,240	2,348,399	15
1906	372,343	19,201,348	51.5	1918	79,395	508,526	6
1907 [a]	32,540	462,392	14	1919	453,418	15,761,410	35
1908 [a]	145,145	5,449,938	38	1920	282,419	5,914,473	21
1909	24,763	723,634	29	1921	151,263	3,106,103	21
1910	218,493	19,250,524	88				

[a] Bituminous mines only. No strikes of consequence occurred in the anthracite region in these years.

It would be misleading, however, to show the days lost on account of strikes without at the same time showing the days lost through other causes.

In the 22-year period from 1900–1921, inclusive, the operators reported a total loss of 133,925,618 man-days through strikes, but the loss attributable to other causes was 1,217,483,809 man-days, a loss nine times as great as that through strikes. To state it in another way, in two decades American coal miners lost one and a third billion working days, of which less than 10 per cent was ascribable to strikes and about 90 per cent to other causes, chief of which are no market, car shortage, and mine disability. The man-days lost on account of other causes are calculated from the operators' reports of number of days of mine operation, the full working year being taken as 308 days.

The time lost through "suspensions" during the period of the biennial wage negotiations, between the termination of one agreement and the signing of another, is included in the statistics as lost through strikes. That the greater part of the loss by strikes is due to such "suspensions" is seen from the fact that with few exceptions the years of large losses by strikes are the "even" years, when the wage negotiations occur, particularly 1902, 1906, 1910, 1912, and 1914. The losses by strikes in the "odd" years have been by comparison small, except in 1919, when a general strike of union bituminous miners was called.

During the period covered by the statistics the year in which the largest number of man-days was lost on account of strikes was 1910, yet the 19,250,524 days lost by strikes in that year amounted to only 30 per cent of the total days lost, for a loss of 44,693,242 man-days was due to causes other than strikes. The total loss for all causes in that year was slightly less than that in either the year before or the year after. As 1910 established a new record for production, these figures illustrate the well-known fact that American bituminous coal mines are developed so far above the actual demand that full-time operation, year in and year out, is not obtainable.

It does not follow that if the men in a district had not been on strike they could have worked, because some other cause of non-operation, such as no market or car shortage, might have kept the mines idle.

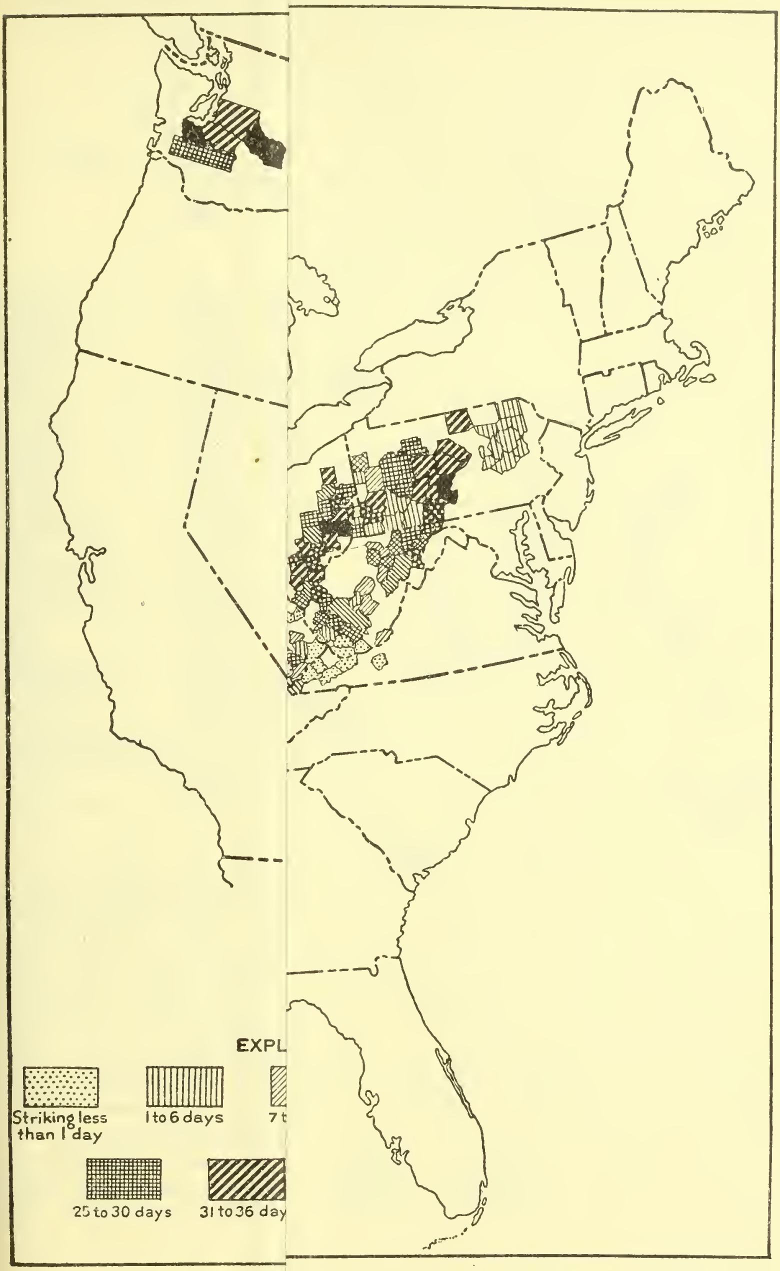
Days lost at coal mines in the United States on account of strikes compared with days lost for other causes, 1900–1921.

[Includes both anthracite and bituminous coal mines.]

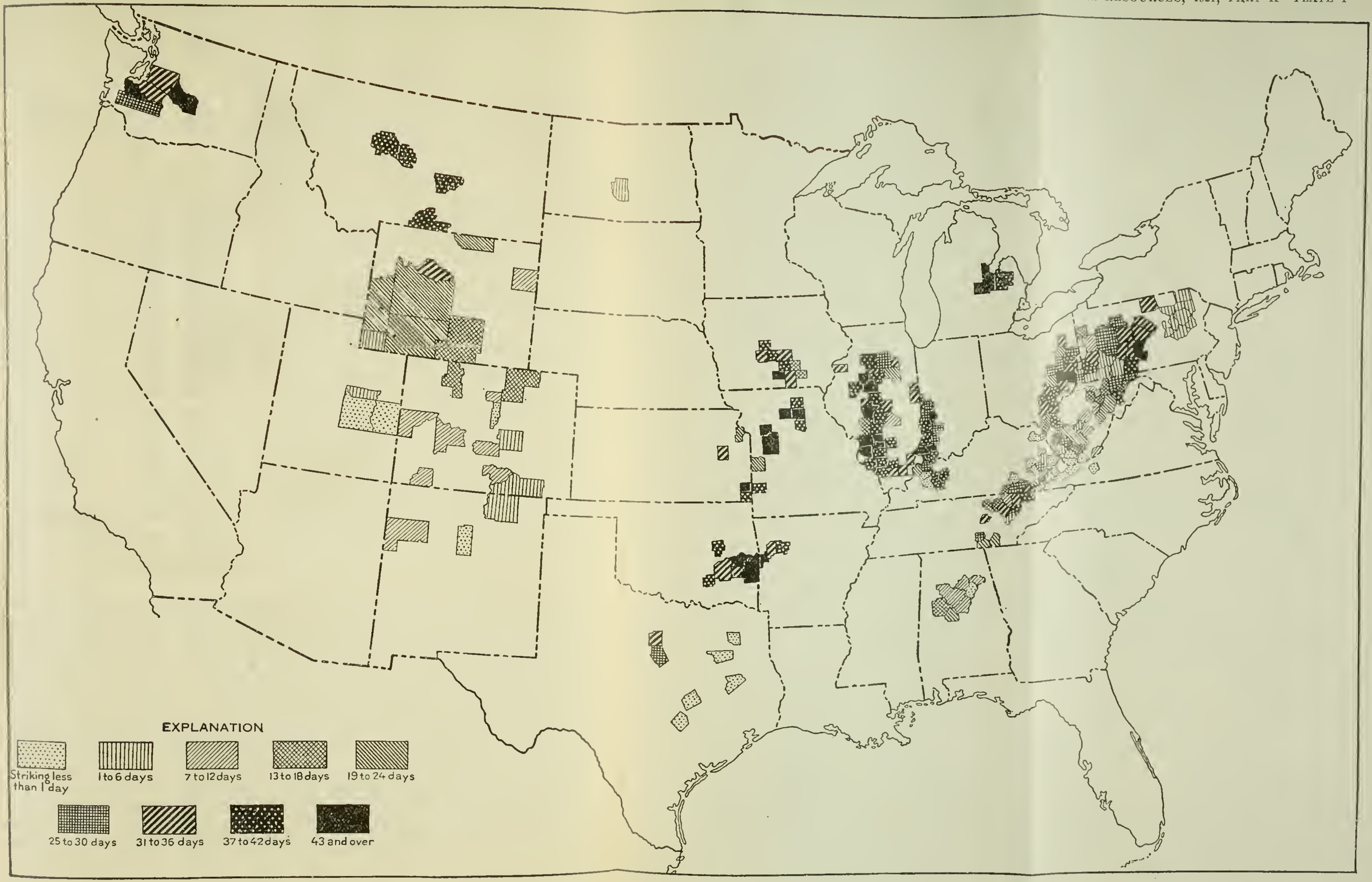
Year.	Days lost.		
	On account of strikes.	On account of no market, car shortage, and similar difficulties.	Total.
1900	4,878,102	38,122,900	43,001,002
1901 [a]	733,802	43,780,311	44,514,113
1902	16,672,217	40,635,223	57,307,440
1903 [a]	1,341,031	48,517,726	49,858,757
1904	3,382,830	59,860,350	63,243,180
1905	796,735	59,267,036	60,063,771
1906	19,201,348	44,595,142	63,796,490
1907 [a]	462,392	52,235,292	52,697,684
1908 [a]	5,449,938	72,731,214	78,181,152
1909	731,650	64,332,335	65,063,985
1910	19,250,524	44,693,242	63,943,766
1911	983,737	63,044,708	64,028,445
1912	12,527,305	47,506,725	60,034,030
1913	3,049,412	49,376,615	52,426,027
1914	11,013,667	66,242,288	77,255,955
1915	2,467,431	69,836,505	72,303,936
1916	3,344,586	49,214,165	52,558,751
1917	2,348,399	40,401,898	42,750,297
1918	508,526	38,001,284	38,509,810
1919	15,761,410	61,023,906	76,785,316
1920	5,914,473	55,732,698	61,647,171
1921	3,106,103	108,332,246	111,438,349
	133,925,618	1,217,483,809	1,351,409,427

[a] No serious strikes occurred in the anthracite region in these years.

Review for 1919–1921.—The great strike of 1919 was foreshadowed by stoppages at many places in the Middle West, particularly in the Belleville district of Illinois, which were chiefly significant because they indicated a feeling of unrest among the mine workers. The call for the great strike itself went to all union miners of bituminous coal and therefore furnished a test of the extent to which the mines of the country were organized. In round numbers 415,000 men walked out, not including the monthly men and maintenance forces, and when the strike reached its maximum intensity it put out of business 71 per cent of the coal-producing capacity of the country. How the men in the several districts responded to the call is shown in the accompanying tables and map (Pl. I).



On November 1, 1919, a gene average number of days lost through strikes per man employed. The map ther xtent of the strike but its intensity, In using the map certain qualifications mus e, is a composite of what happened in union New River and nonunion Winding G Belleville, Ill., there were other strikes during the year, so that the total time sho



STRENGTH OF THE UNITED MINE WORKERS IN THE STRIKE OF 1919.

On November 1, 1919, a general strike of bituminous mine workers was called. The map shows the effect in each county producing 100,000 tons or more, as indicated by the average number of days lost through strikes per man employed. The map therefore shows not only the counties where the men struck but also the approximate length of time they stayed out. It measures not only the areal extent of the strike but its intensity. In using the map certain qualifications must be kept in mind. Boundaries between union and nonunion fields in places cut county lines. The average for Raleigh County, W. Va., for example, is a composite of what happened in union New River and nonunion Winding Gulf. In organized fields, like Alabama, some mines closed and others did not, and the county average is fixed accordingly. In some districts, such as Belleville, Ill., there were other strikes during the year, so that the total time shown as lost is somewhat in excess of that lost in the great strike itself.

Strikes and lockouts in the coal mines of the United States in 1919, 1920, and 1921.

State.	1919			1920			1921		
	Number of men on strike.	Total man-days idle.	Average number of days lost per man striking.	Number of men on strike.	Total man-days idle.	Average number of days lost per man striking.	Number of men on strike.	Total man-days idle.	Average number of days lost per man striking.
Alabama	13,431	269,242	20	8,490	800,519	94	2,329	157,401	68
Arkansas	3,681	161,069	44	956	28,015	29	1,677	17,400	10
Colorado	6,186	89,392	14	2,012	18,240	9	2,497	72,830	29
Georgia	168	2,016	12						
Illinois	81,600	3,558,094	44	68,481	948,408	14	18,088	226,112	13
Indiana	28,431	1,135,013	40	19,068	411,991	22	17,634	321,593	18
Iowa	11,350	433,884	38	4,966	24,366	5	897	1,840	2
Kansas	9,104	531,791	58	5,461	161,485	30	7,285	538,811	74
Kentucky	22,598	696,165	31	9,192	312,460	34	1,789	64,448	36
Maryland	5,337	143,523	27	1,733	25,514	15	123	4,463	36
Michigan	2,087	153,351	73	1,659	24,993	15	780	2,826	4
Missouri	8,315	458,588	55	1,841	36,015	20	2,089	50,108	24
Montana	3,833	153,159	40	377	6,952	18	92	2,035	22
New Mexico	1,183	18,307	15				425	1,700	4
North Dakota	576	4,281	7	49	473	9	15	225	15
Ohio	42,724	1,717,426	40	17,333	245,314	14	17,682	176,605	10
Oklahoma	7,963	317,538	40	2,267	24,053	11	1,520	12,231	8
Pennsylvania (bituminous)	97,089	3,765,144	39	27,728	479,708	17	14,895	302,525	20
Tennessee	10,199	334,315	33	202	1,478	7	638	17,350	27
Texas	1,747	52,858	30	824	9,737	12			
Utah	317	4,866	15	113	791	7	100	200	2
Virginia	947	22,956	24	48	1,736	36			
Washington	4,369	186,942	43	201	22,962	114	802	139,126	173
West Virginia	48,062	1,158,094	24	12,340	511,225	41	7,198	170,017	24
Wyoming	6,982	157,843	23	238	2,722	11	591	2,978	5
Total bituminous	418,279	15,525,857	37	185,579	4,099,157	22	99,146	2,282,824	23
Pennsylvania (anthracite)	35,139	235,553	7	96,840	1,815,316	19	52,117	823,279	16
Grand total	453,418	15,761,410	35	282,419	5,914,473	21	151,263	3,106,103	21

In the following table the percentages of capacity closed down on account of the great strike of 1919 are taken from the weekly reports of production and running time, as furnished to the Geological Survey by operators of about 3,000 mines. The percentage given represents the average condition for an entire week, but the week selected is the one in which the strike reached a maximum in the district indicated. In many fields the strike was 100 per cent effective from November 1 to the middle of December. In some other districts the men were out for only a week or two. In still others there was a gradual drift back to work extending over several weeks. Furthermore, the week of maximum stoppage did not come in all fields at the same time. For these reasons, the shutdown was never quite as complete as shown in the table, though during the first week of the strike it was almost as complete.

Maximum extent to which the bituminous coal districts were shut down during the great strike of 1919, with the annual tonnage of each district.

District.	Maximum percentage of district capacity closed during 1919 strike.	District production in 1918 (net tons).
Central Pennsylvania:		
Section A, Pennsylvania R. R. and connections	67	[a] 25,000,000
Section B, New York Central R. R. and connections	99	[a] 16,000,000
Section C, Buffalo, Rochester & Pittsburgh Ry. and other roads	91	[a] 20,629,000
Northern Pennsylvania	100	8,051,000
Pittsburgh, Pa	100	48,299,000
Panhandle of West Virginia	61	3,255,000
Westmoreland, Latrobe, Greensburg, and Ligonier	5	17,701 000
Connellsville	0	35 677,000
Somerset	6	7,194,000
Cumberland-Piedmont	98	7,073,000
Fairmont, W. Va	[b] 90	20,104,000
Northern Ohio	100	30,287,000
Michigan	100	1,465,000
Southern Ohio	100	15,768,000
Northeastern Kentucky	70	7,109,000
Hazard, Ky	0	2,364,000
Kanawha	88	[c] 13,324,000
Kenova-Thacker	0	7,024,000
Logan	0	10,307,000
New River	98	9,292,000
Winding Gulf	0	5,156,000
Pocahontas and Tug River	0	23,128,000
Southwestern Virginia	8	9,041,000
Southern Appalachian	100	[d] 11,712,000
Harlan, Ky	[e] 60	[e] 3,202,000
Alabama and Georgia	48	19,252,000
Western Kentucky	58	10,833,000
Indiana	100	30,679,000
Illinois	100	89,291,000
Iowa	100	8,192,000
Missouri	99	5,668,000
Kansas	99	7,562,000
Arkansas	100	2,227,000
Oklahoma	100	4,813,000
Texas	[b] 50	2,261,000
North Dakota	[b] 30	720,000
Montana	[b] 90	4,533,000
Colorado	55	12,408,000
Utah	0	5,137,000
New Mexico	15	4,023,000
Washington	100	4,082,000
Wyoming	[b] 95	9,438,000
Total, United States	71.4	579,281,000

[a] The apportionment of the total production for central Pennsylvania between sections A, B, and C is partly estimated.
[b] Partly estimated.
[c] Includes all mines that produce coal high in volatile matter in southern West Virginia that are not included in the New River, Logan, and Kenova-Thacker districts.
[d] Includes Tennessee and southeastern Kentucky except Harlan County.
[e] Of the capacity of the Harlan County Operators' Association 81 per cent was closed, but the Lynch mines continued to operate.

In 1920 there was no general suspension, but there were rather large strikes in both the anthracite and bituminous regions. In the anthracite region two-thirds of the men walked out in a so-called "vacation" strike, in protest against the award of the Anthracite Coal Commission of 1920. In the bituminous region there were two types of strikes. Late in June and in July and August there was a series of short strikes by the day men in Illinois, Indiana, Iowa, Kansas, Arkansas, and parts of Ohio and Pennsylvania, which led to an increase in the day-wage scale in most of the organized fields. In addition to these strikes of the day men, there was a long contest in Alabama, in which 8,490 men were out for an average of 94 days.

The most bitterly contested strike of the year occurred in the Kenova-Thacker (Mingo) district, in the valley of Tug River, between West Virginia and Kentucky. According to the operators' reports, 3,540 men in West Virginia and 1,061 men in Kentucky were out for a total of 502,164 man-days during 1920.

The year 1921 passed without strikes of magnitude, except in Kansas, where 88 per cent of the men employed were idle for nearly three months in protest against the imprisonment of Alexander Howat and August Dorchy, who were serving sentences imposed by the Kansas Industrial Court. There was a long contest in Washington, but the number of men involved was small.

PRODUCTION CLASSIFIED BY MINING METHODS.

EXPLANATION OF TERMS.

The term "mining method," as used in the following tables, refers to the manner in which the coal is broken down in the mine and not to the system of mining, as by room and pillar or long wall. Coal in the mine is either blasted from a solid face—shot from the solid—as in hard-rock mining, or is shot loose or otherwise broken down after a cut has been made in the bed. This cut may be made either by hand or machine. Underground methods are therefore classified as shooting from the solid, mining by hand, and mining by machine. An increased quantity of coal is being recovered by stripping the cover or overburden from the bed in open pits by steam shovels. The bed thus exposed is generally shattered by powder, and the coal is shoveled into cars by hand or by steam shovels.

Opposition to the practice of shooting from the solid has been growing in recent years because this practice injures the mining property and creates dangerous conditions in the mines. The heavy charges of powder weaken the roof and pillars and thus increase the danger of falls of roof and coal, the most prolific cause of fatal accidents to coal miners. Another objection to this method, based upon commercial rather than humanitarian considerations, is that the heavy charges of explosives required to blow down coal that has not been undercut or sheared produce a much higher proportion of fine or small coal and make the lump coal so friable that it disintegrates in handling and in transportation. The growing use of mechanical stokers and the developments made in the use of powdered coal have robbed this objection of much of its force, but the danger to the mine and to the workers still continues, and in some States shooting from the solid is forbidden by law.

SUMMARY OF PERCENTAGES FOR 1919–1921.

The percentage of coal recovered by the use of machines has been steadily increasing in recent years. In 1918, the year of the maximum production of bituminous coal, the percentage mined by machine was 55.9; in 1919 it rose to 59.2; in 1920 to 59.8; and in 1921 to 65.6 per cent. Of the 24 coal-producing States included in the following tables 9 showed increases in the percentage of production mined by machine for each of the three years 1919, 1920, and 1921; in Wyoming the percentage in 1921 was less than in 1919 or 1920. In Arkansas, Indiana, Kentucky, Michigan, North Dakota, Ohio

Tennessee, and Utah the percentage recovered by machine declined in 1920, as compared with 1919, and increased in 1921, as compared with 1920. In Iowa, Kansas, Maryland, Montana, New Mexico, and Washington the percentage rose in 1920 and fell in 1921.

The output for which the mining method is not specified in the following tables was made mainly at small operations, and most of it was probably shot from the solid.

PRODUCTION BY MINING MACHINES.

In 1919 the quantity of bituminous coal mined by machines was 276,019,799 tons, as against 323,931,133 tons so mined in the preceding year. The percentage of the total quantity mined by machines in 1919 as against 1918, however, increased from 55.9 to 59.2 per cent. In 1920 the machine-mined coal amounted to 339,813,476 tons, or 59.8 per cent, of the total output, and in 1921 the machine output, 272,702,389 tons, represented 65.6 per cent of the total. The number of machines in use has also increased steadily, although the increase since 1918, when 1,228 more machines were in use than in 1917, has been less marked. The figures by States show increases in 1921 over 1919 in the total number of machines in use, except in Alabama, Indiana, Kansas, Kentucky, Pennsylvania, and Tennessee. There were fewer machines in use in Alabama, Iowa, Kansas, Michigan, Missouri, Ohio, Tennessee, and West Virginia in 1921 than in 1920, although the increase for the country as a whole, in 1921 over 1920, was 284 machines. The average output per machine was 14,559 tons in 1919, 17,788 tons in 1920, and 13,901 tons in 1921. The output per machine in 1920 was the highest on record, but in 1921, because of the small number of days worked, the output was the lowest since 1914.

The quantity of anthracite mined in Pennsylvania by machines decreased from 1,406,433 gross tons in 1919 to 837,565 gross tons in 1920. The quantity mined by machine in 1921 showed a slight increase over the preceding year.

Bituminous coal mined by different methods in 1919.

State.	Mined by hand.		Shot off the solid.		Mined by machines.		From strip pits.		Not specified.		Total production (net tons).
	Net tons.	Percentage.	Net tons.	Percentage.	Net tons.	Percentage.	Net tons.	Percentage.	Net tons.	Percentage.	
Alabama	2,765,365	17.8	7,289,462	46.9	5,135,655	33.1	276,454	1.8	69,785	0.4	15,536,721
Arkansas	54,702	3.8	1,238,187	86.6	113,218	7.9	10,982	.8	11,931	.9	1,429,020
Colorado	5,056,839	49.0	1,025,639	9.9	4,157,836	40.3			83,106	.8	10,323,420
Georgia			53,337	100.0							53,337
Illinois	4,518,306	7.4	19,794,179	32.5	35,913,902	59.0	413,909	.7	222,312	.4	60,862,608
Indiana	1,651,565	7.9	7,373,601	35.3	10,819,551	51.7	908,873	4.3	158,698	.8	20,912,288
Iowa	1,144,701	20.4	3,709,060	65.9	659,209	11.7			111,722	2.0	5,624,692
Kansas	144,861	2.8	4,421,792	84.7	54,670	1.0	584,112	11.2	19,289	.3	5,224,724
Kentucky	1,229,768	4.1	4,536,474	15.1	23,965,661	79.8	11,261		292,897	1.0	30,036,061
Maryland	2,288,571	75.7	401,066	13.3	311,324	10.3	8,357	.3	12,368	.4	3,021,686
Michigan	12,880	1.3	39,600	4.0	943,519	94.7			546		996,545
Missouri	614,286	15.4	1,370,414	34.4	888,657	22.3	960,511	24.2	145,930	3.7	3,979,798
Montana	377,849	11.7	1,372,239	42.4	1,429,304	44.2			56,977	1.7	3,236,369
New Mexico	2,039,413	65.0	129,216	4.1	957,549	30.5			12,578	.4	3,138,756
North Dakota	51,352	6.1	326,698	38.8	324,961	38.6	11,003	1.3	126,945	15.2	840,959
Ohio	1,354,739	3.8	943,464	2.6	31,238,608	87.1	1,749,435	4.9	590,436	1.6	35,876,682
Oklahoma	30,761	.8	1,798,838	47.3	1,798,933	47.3	158,694	4.2	14,887	.4	3,802,113
Pennsylvania (bituminous)	57,222,242	38.0	5,369,605	3.6	86,382,120	57.3	670,507	.4	1,113,680	.7	150,758,154
Tennessee	1,290,934	24.8	2,305,833	44.2	1,597,489	30.6	9,944	.2	9,005	.2	5,213,205
Texas	1,293,826	77.0	376,348	22.4	10,267	.6			215		1,680,656
Utah	1,123,606	24.3	314,332	6.8	3,187,766	68.8			5,619	.1	4,631,323
Virginia	1,286,853	13.8	1,717,290	18.4	6,312,020	67.7			10,667	.1	9,326,830
Washington	1,937,697	64.8	779,635	26.1	273,115	9.1					2,990,447
West Virginia	20,939,708	26.5	2,375,934	3.0	55,562,196	70.3			158,715	.2	79,036,553
Wyoming	1,256,360	17.4	1,976,096	27.3	3,982,269	55.2			5,013	.1	7,219,738
Other States	28,748	26.8	64,954	60.5			858	.8	12,813	1.9	107,373
	109,715,932	23.6	71,103,293	15.3	276,019,799	59.2	5,774,900	1.2	3,246,134	.7	465,860,058

Bituminous coal mined by different methods in 1920.

State.	Mined by hand.		Shot off the solid.		Mined by machines.		From strip pits.		Not specified.		Total production (net tons).
	Net tons.	Percentage.	Net tons.	Percentage.	Net tons.	Percentage.	Net tons.	Percentage.	Net tons.	Percentage.	
Alabama	2,584,229	15.8	7,638,431	46.9	5,654,437	34.7	224,491	1.4	192,511	1.2	16,294,099
Arkansas	73,179	3.5	1,875,561	89.2	68,107	3.2	1,860	.1	84,889	4.0	2,103,596
Colorado	5,927,929	48.3	916,411	7.5	5,388,964	43.8			44,921	.4	12,278,225
Georgia			50,156	100.0							50,156
Illinois	5,222,532	5.9	27,732,476	31.2	54,923,724	61.9	610,209	.7	235,952	.3	88,724,893
Indiana	2,424,228	8.3	10,899,625	37.1	14,291,782	48.7	1,361,869	4.6	373,081	1.3	29,350,585
Iowa	1,190,115	15.2	4,900,462	62.7	1,616,333	20.7			107,006	1.4	7,813,916
Kansas	393,983	6.6	4,566,923	77.2	66,518	1.1	706,586	11.9	192,398	3.2	5,926,408
Kentucky	1,508,256	4.2	6,091,230	17.0	27,685,488	77.6	20,687	.1	385,101	1.1	35,690,762
Maryland	2,839,814	69.9	724,164	17.8	457,150	11.2			44,111	1.1	4,065,239
Michigan	20,000	1.4	75,228	5.0	1,392,537	93.5			2,000	.1	1,489,765
Missouri	614,686	11.5	2,016,011	37.5	1,396,188	26.0	1,142,617	21.3	200,063	3.7	5,369,565
Montana	453,692	10.3	1,827,853	41.4	2,095,738	47.5			36,583	.8	4,413,866
New Mexico	2,223,551	60.3	194,518	5.3	1,254,993	34.1			10,378	.3	3,683,440
North Dakota	12,643	1.3	370,380	39.1	357,833	37.7	108,376	11.4	99,393	10.5	948,625
Ohio	1,480,066	3.2	1,826,479	4.0	38,192,460	83.3	3,322,387	7.2	1,056,799	2.3	45,878,191
Oklahoma	25,553	.5	2,203,036	45.4	2,348,041	48.4	239,422	5.0	33,236	.7	4,849,288
Pennsylvania (bituminous)	60,887,686	35.7	6,114,550	3.6	98,853,831	57.9	1,244,537	.7	3,507,243	2.1	170,607,847
Tennessee	1,574,917	23.6	3,267,547	49.1	1,707,046	25.6	15,706	.2	97,212	1.5	6,662,428
Texas	1,121,435	69.5	442,825	27.4	32,755	2.0			18,000	1.1	1,615,015
Utah	2,151,255	35.8	326,264	5.4	3,523,148	58.7			4,532	.1	6,005,199
Virginia	345,679	3.0	2,945,463	25.9	7,950,964	69.9			136,500	1.2	11,378,606
Washington	2,101,036	55.9	1,204,230	32.1	395,125	10.5			56,702	1.5	3,757,093
West Virginia	21,056,176	23.4	3,343,876	3.7	64,921,571	72.2	31,854		617,230	.7	89,970,707
Wyoming	1,337,218	13.9	2,997,310	31.2	5,238,743	54.4	50,000	.5	7,000		9,630,271
Other States	38,581	35.4	57,500	52.9			800	.7	12,017	11.0	108,898
	117,608,439	20.7	94,608,509	16.6	339,813,476	59.8	9,081,401	1.6	7,554,858	1.3	568,666,683

Bituminous coal mined by different methods in 1921.

State.	Mined by hand.		Shot off the solid.		Mined by machines.		From strip pits.		Not specified.		Total production (net tons).
	Net tons.	Percentage.	Net tons.	Percentage.	Net tons.	Percentage.	Net tons.	Percentage.	Net tons.	Percentage.	
Alabama	2,197,394	17.5	4,973,545	39.6	5,012,152	39.9	342,033	2.7	43,775	0.3	12,568,899
Arkansas	21,827	1.8	1,036,582	84.4	159,591	13.0	3,350	.3	6,427	.5	1,227,777
Colorado	4,403,048	48.2	475,553	5.2	4,182,342	45.8			76,686	.8	9,137,629
Georgia			23,252	68.8			10,563	31.2			33,815
Illinois	3,833,728	5.5	19,473,525	28.0	45,609,876	65.5	586,203	.8	99,431	.2	69,602,763
Indiana	1,484,360	7.3	7,246,546	35.7	10,737,554	52.8	800,738	3.9	50,311	.3	20,319,509
Iowa	572,754	12.7	3,227,867	71.2	698,443	15.4			32,328	.7	4,531,392
Kansas	258,956	7.5	2,772,340	80.0	34,269	1.0	367,207	10.6	33,869	.9	3,466,641
Kentucky	1,565,959	5.0	3,289,743	10.4	26,509,773	83.9	134,729	.4	88,066	.3	31,588,270
Maryland	1,526,022	83.5	113,578	6.2	186,165	10.2			1,975	.1	1,827,740
Michigan	10,000	.9	40,260	3.5	1,091,455	95.6					1,141,715
Missouri	453,440	12.8	1,215,841	34.2	1,063,127	29.9	782,243	22.0	36,970	1.1	3,551,621
Montana	666,451	24.4	947,714	34.7	1,106,567	40.5			13,226	.4	2,733,958
New Mexico	1,614,718	65.7	84,381	3.4	743,864	30.3			13,979	.6	2,456,942
North Dakota	37,243	4.3	328,946	38.0	336,848	39.0	122,889	14.2	38,977	4.5	864,903
Ohio	852,590	2.7	387,583	1.2	29,256,048	91.6	1,260,815	3.9	185,740	.6	31,942,776
Oklahoma	21,184	.6	1,189,953	35.4	1,908,959	56.8	230,059	6.8	12,468	.4	3,362,623
Pennsylvania (bituminous)	38,401,118	33.1	2,185,598	1.9	73,842,026	63.6	488,253	.4	1,096,947	1.0	116,013,942
Tennessee	1,409,752	31.6	1,789,562	40.1	1,239,611	27.8	2,406	.1	18,995	.4	4,460,326
Texas	656,848	67.5	271,251	27.9	44,740	4.6					972,839
Utah	870,982	21.3	137,220	3.4	3,070,582	75.1			11,611	.2	4,090,395
Virginia	229,507	3.1	1,421,176	19.0	5,841,695	77.9					7,492,378
Washington	1,171,434	48.2	1,041,112	42.9	131,566	5.4			84,610	3.5	2,428,722
West Virginia	14,835,874	20.4	1,532,828	2.1	56,163,635	77.2	6,000		248,659	.3	72,786,996
Wyoming	967,324	13.4	2,433,519	33.8	3,731,501	51.8	68,322	1.0			7,200,666
Other States	55,138	37.6	83,962	57.3					7,553	5.1	146,653
	78,117,651	18.8	57,723,437	13.9	272,702,389	65.6	5,205,810	1.2	2,202,603	.5	415,951,890

Bituminous coal mined by machines in the United States, 1918–1921.

State.	Machines in use.				Quantity mined by machines (net tons).				Percentage of total product mined by machines.			
	1918	1919	1920	1921	1918	1919	1920	1921	1918	1919	1920	1921
Alabama	403	423	427	310	5,951,547	5,135,655	5,654,437	5,012,152	31.0	33.1	34.7	39.9
Arkansas	24	20	23	26	242,984	113,218	68,107	159,591	10.9	7.9	3.2	13.0
Colorado	352	387	429	439	4,574,017	4,157,836	5,388,964	4,182,342	36.9	40.3	43.8	45.8
Illinois	2,152	2,217	2,516	2,769	50,566,911	35,913,902	54,923,724	45,609,876	56.6	59.0	61.9	65.5
Indiana	904	862	795	856	14,997,532	10,819,551	14,291,782	10,737,554	49.0	51.7	48.7	52.8
Iowa	72	75	100	98	876,754	659,209	1,616,333	698,443	10.7	11.7	20.7	15.4
Kansas	16	17	15	8	56,314	54,670	66,518	34,269	.7	1.0	1.1	1.0
Kentucky	1,634	1,765	1,718	1,759	24,808,171	23,965,661	27,685,488	26,509,773	78.5	79.8	77.6	83.9
Maryland	25	30	29	35	301,965	311,324	457,150	186,165	6.7	10.3	11.2	10.2
Michigan	111	85	110	90	1,272,285	943,519	1,392,537	1,091,455	86.8	94.7	93.5	95.6
Missouri	104	72	140	134	1,244,682	888,657	1,396,188	1,063,127	22.0	22.3	26.0	29.9
Montana	116	109	119	126	2,268,318	1,429,304	2,095,738	1,106,567	50.0	44.2	47.5	40.5
New Mexico	97	90	96	99	1,236,709	957,549	1,254,993	743,864	30.7	30.5	34.1	30.3
North Dakota	16	14	16	17	344,482	324,961	357,833	336,848	47.9	38.6	37.7	39.0
Ohio	1,987	2,065	2,262	2,149	38,841,452	31,238,608	38,192,460	29,256,048	84.8	87.1	83.3	91.6
Oklahoma	178	194	209	224	1,899,487	1,798,933	2,348,041	1,908,959	39.5	47.3	48.4	56.8
Pennsylvania	6,207	6,508	5,823	6,332	98,334,139	86,382,120	98,853,831	73,842,026	55.0	57.3	57.9	63.6
Tennessee	200	241	211	176	1,549,945	1,597,489	1,707,046	1,239,611	22.7	30.6	25.6	27.8
Texas	1	3	6	6	2,000	10,267	32,755	44,740	.1	.6	2.0	4.6
Utah	141	146	154	182	2,767,084	3,187,766	3,523,148	3,070,582	53.9	68.8	58.7	75.1
Virginia	231	232	248	257	6,394,276	6,312,020	7,950,964	5,841,695	62.2	67.7	69.9	77.9
Washington	48	40	41	57	249,110	273,115	395,125	131,566	6.1	9.1	10.5	5.4
West Virginia	3,281	3,136	3,626	3,229	60,688,232	55,562,196	64,921,571	56,163,635	67.5	70.3	72.2	77.2
Wyoming	163	228	221	240	4,462,737	3,982,269	5,238,743	3,731,501	47.3	55.2	54.4	51.8
	18,463	18,959	19,334	19,618	323,931,133	276,019,799	339,813,476	272,702,389	[a] 55.9	[a] 59.2	[a] 59.8	[a] 65.6

[a] Average.

Bituminous coal mined by machines in the United States, 1891–1921.

Year.	Machines in use.	Quantity mined by machine (net tons). Total.	Average per machine.	Year.	Machines in use.	Quantity mined by machine (net tons). Total.	Average per machine.
1891	545	6,211,732	11,398	1909	13,049	142,496,878	10,920
1896	1,446	16,424,932	11,373	1910	13,254	174,012,293	13,127
1897	1,956	22,649,220	11,579	1911	13,829	178,158,236	12,854
1898	2,622	32,413,144	12,362	1912	15,298	210,538,822	13,763
1899	3,125	43,963,933	14,068	1913	16,379	242,421,713	14,801
1900	3,907	52,784,523	13,510	1914	16,507	218,399,287	13,231
1901	4,341	57,843,335	13,325	1915	15,692	243,237,551	15,501
1902	5,418	69,611,582	12,848	1916	16,198	283,691,475	17,514
1903	6,658	77,974,894	11,712	1917	17,235	306,396,127	17,777
1904	7,663	78,606,997	10,258	1918	18,463	323,931,133	17,545
1905	9,184	103,396,452	11,258	1919	18,959	276,019,799	14,559
1906	10,212	118,847,527	11,638	1920	19,103	339,813,476	17,788
1907	11,144	138,547,823	12,432	1921	19,618	272,702,389	13,901
1908	11,569	123,183,334	10,648				

Anthracite (Pennsylvania) mined by machines, 1916–1921.

Year.	Gross tons.	Year.	Gross tons.
1916	1,642,416	1919	1,406,433
1917	1,745,735	1920	837,565
1918	1,658,495	1921	874,237

PRODUCTION FROM STEAM-SHOVEL PITS.

In 1919, as compared with 1918, there was a decrease in the output of bituminous coal mined by steam shovels, but an increase in the number of shovels. In 1918 the output mined by steam shovels amounted to 8,288,245 net tons. In that year the number of shovels, including both steam and electric shovels, was 276. In 1919 the output amounted to 5,634,951 tons, and the number of shovels in operation was 287. The high mark, both in output of coal and in the number of shovels, was reached in 1920, when 8,859,553 tons was produced with 312 shovels. Although in 1921 there was a decline both in the number of shovels and in output—279 shovels and 4,699,511 tons—more States had begun the use of steam shovels. Pits worked with steam shovels were reported in 1918, 1919, and 1920 in 13 States; in 1921 in 15 States. Mining by steam shovels was stopped in Maryland after 1919. Operations in Wyoming and West Virginia, which were discontinued at the end of 1918, were resumed in 1920, although in West Virginia fewer shovels were in use when work was resumed.

The number of shovels reported in use in the Pennsylvania anthracite regions increased from 82 in 1918 to 89 in 1919 and 96 in 1920; in 1921 the number dropped to 85, but in none of the years named did the output equal that reported in 1917 or 1918 (2,301,588 and 2,360,183 net tons, respectively). In 1916 105 shovels were in use, but the output was only 1,987,800 tons.

Coal recovered from steam-shovel strip pits in 1919–1921.

State.	1919		1920		1921	
	Number of shovels.	Coal mined (net tons).	Number of shovels.	Coal mined (net tons).	Number of shovels.	Coal mined (net tons).
Alabama	16	274,954	11	193,023	15	340,120
Arkansas	1	10,982			1	700
Georgia					1	10,563
Illinois	12	400,640	15	589,540	22	564,168
Indiana	43	833,915	49	1,356,519	38	793,604
Kansas	24	540,472	29	704,898	23	364,479
Kentucky	2	11,261	2	20,587	5	134,729
Maryland	2	8,357				
Missouri	40	960,511	40	1,126,792	37	780,006
North Dakota	3	11,003	3	80,704	3	86,419
Ohio	87	1,749,435	90	3,310,875	83	835,836
Oklahoma	10	158,694	10	178,898	13	229,400
Pennsylvania	45	664,783	56	1,224,566	28	482,759
Tennessee	2	9,944	2	15,706	2	2,406
West Virginia			2	7,445	5	6,000
Wyoming			3	50,000	3	68,322
Total bituminous	287	5,634,951	312	8,859,553	279	4,699,511
Pennsylvania anthracite	89	2,006,879	96	2,054,441	85	2,027,790
Grand total	376	7,641,830	408	10,913,994	364	6,727,301

COAL-WASHING OPERATIONS.

The quantity of coal washed in 1919 was 19,187,837 net tons, from which 16,884,062 tons (about 88 per cent) of marketable coal was recovered. In 1920 the total coal washed was 20,595,750 tons; the usable coal recovered was 17,984,289 tons—about 87.3 per cent. In 1921 the total coal washed was 15,355,169 tons and the quantity recovered was 13,628,724 tons—about 88.7 per cent. The totals for 1919, 1920, and 1921 as compared with the totals for the three preceding years show losses, the maximum having been reached in 1917, when 28,587,137 tons was washed and a marketable product of 25,483,696 tons (about 89.1 per cent) was obtained. Alabama continues to hold first place in the total quantity of coal washed, and Illinois is second. Pennsylvania and West Virginia alternate from year to year for the third place. In the percentage of washed coal to the total output Alabama is far ahead of any other large coal-producing State. In 1919 the washed coal shipped represented 54.3 per cent of the total output of the State; in 1920 it was 57.5 per cent, and in 1921 57.7 per cent.

Bituminous coal washed at the mines in 1919, 1920, and 1921.

State.	Coal washed (net tons).	Cleaned coal (net tons).	Refuse (net tons).	Percentage of cleaned coal to total State output.
1919.				
Alabama	9,657,235	8,433,729	1,223,506	54.3
Colorado	226,913	202,921	23,992	2.0
Georgia	40,155	34,423	5,732	64.5
Illinois	3,800,232	3,421,296	378,936	5.6
Indiana	52,878	47,170	5,708	.2
Kentucky	53,500	47,184	6,316	.2
Michigan	81,517	74,315	7,202	7.5
Missouri	47,564	38,052	9,512	1.0
Montana	228,441	191,270	37,171	5.9
New Mexico	253,125	217,850	35,275	6.9
Ohio	3,300	3,215	85	.01
Oregon	17,300	15,064	2,236	80.4
Pennsylvania	1,200,697	1,097,205	103,492	.7
Tennessee	241,570	206,398	35,172	4.0
Texas	18,293	13,730	4,563	.8
Virginia	207,567	183,305	24,262	2.0
Washington	1,183,953	958,951	225,002	32.1
West Virginia	1,873,597	1,697,984	175,613	2.1
	19,187,837	16,884,062	2,303,775	3.6
1920.				
Alabama	10,741,189	9,369,763	1,371,426	57.5
Colorado	291,564	251,678	39,886	2.0
Georgia	40,982	31,472	9,510	62.7
Illinois	2,767,550	2,379,520	388,030	2.7
Indiana	37,908	34,004	3,904	.1
Kentucky	132,741	121,975	10,766	.3
Michigan	160,373	141,215	19,158	9.5
Missouri	132,800	106,200	26,600	2.0
Montana	320,629	283,728	36,901	6.4
New Mexico	288,851	260,681	28,170	7.1
Ohio	5,406	4,900	506	.01
Oregon	20,300	18,291	2,009	88.3
Pennsylvania	1,908,182	1,762,071	146,111	1.0
Tennessee	672,206	591,448	80,758	8.9
Texas	24,282	18,374	5,908	1.1
Virginia	126,001	108,799	17,202	1.0
Washington	1,384,433	1,103,904	280,529	29.4
West Virginia	1,540,353	1,396,266	144,087	1.5
	20,595,750	17,984,289	2,611,461	3.2
1921.				
Alabama	8,125,998	7,251,719	874,279	57.7
Colorado	314,221	280,020	34,201	3.1
Georgia	16,803	12,708	4,095	37.6
Illinois	2,182,043	1,915,109	266,934	2.8
Indiana	81,330	71,757	9,573	.4
Kentucky	162,146	144,487	17,659	.5
Michigan	193,247	162,466	30,781	14.2
Missouri	98,000	78,500	19,500	2.2
Montana	233,922	220,064	13,858	8.0
New Mexico	38,730	31,643	7,087	1.3
Ohio	6,370	6,224	146	.02
Oregon	(a)	(a)	(a)	(a)
Pennsylvania	1,407,108	1,269,569	137,539	1.1
Tennessee	148,341	131,748	16,593	3.0
Texas	31,391	23,211	8,180	2.4
Virginia	88,695	74,657	14,038	1.0
Washington	[a] 496,680	[a] 397,820	[a] 98,860	[a] 16.2
West Virginia	1,730,144	1,557,022	173,122	2.1
	15,355,169	13,628,724	1,726,445	3.3

[a] Washington includes Oregon.

NUMBER AND SIZE OF MINES.

CLASSES OF MINES BY OUTPUT.

In discussing the number of mines distinction must be made between commercial mines and the small workings known as "wagon mines," "snowbirds," and "country banks." The line between the commercial mines and the small workings, however, is difficult to draw. Mere size of output is not a criterion, for some "wagon mines" ship rather large quantities of coal. Absence of a railroad switch is not a criterion, for this would exclude from the commercial class some large mines that ship by river or truck or that deliver their product to associated industries at the mouth of the mine.

In practice the Geological Survey has found a safer criterion to be size in conjunction with steady operation. All mines that produce 10,000 tons a year or more are classed by the Survey as "commercial," but the commercial class includes also much smaller mines, some of which make an output of 1,000 tons, or less, but which make an output year after year and show a fairly continuous existence.

Workings still smaller or less continuous in operation have been classed by the Survey as "small mines." The term is not satisfactory, however, because it is not sufficiently definite, and in the present report these workings are generally called "wagon mines," the term that in common usage most nearly describes them. However, a mine may be shifted from the list of commercial mines to the list of wagon mines or vice versa, as the course of the work at the mine may make it advisable.

In the first of the following tables the wagon mines have been excluded, because the record for them does not begin until 1913. In the succeeding tables (pp. 520–523) the record is given in detail for all workings, large and small, for which the Geological Survey received information in 1919 and 1920.

For convenience in studying production by size of mines, the Geological Survey divides the mines into five classes. Class 1 includes mines that produce each year more than 200,000 tons; class 2, those that produce less than 200,000 and more than 100,000 tons; class 3, those that produce less than 100,000 and more than 50,000 tons; class 4, those that produce between 10,000 and 50,000 tons; and class 5, those that produce less than 10,000 tons. As this classification is made according to performance, not according to capacity, the number of mines in a given class is not constant. In 1918, for example, 821 mines were listed in class 1; in 1919 the number dropped to 550; in 1920 it rose to 701; and in 1921 it dropped to 482. These fluctuations do not indicate a corresponding change from year to year in the number of mines having the acreage and the development that would enable them to produce annually 200,000 tons or more, but they do indicate that in a given year only the number of mines listed in class 1 were able to market over 200,000 tons.

During periods of business depression the production of the coal mines of the country as a whole is limited by the condition of the industry. Many mines in class 1 that can market 200,000 tons or more in a favorable year are able to market much less in an unfavorable year; many mines in class 2 slip back into class 3, and so on down the line, until most of the smaller mines which are not included in any class probably drop out altogether or produce so little coal that their effect upon the industry may be ignored. The first table below shows that in 1920, as compared with 1919, there was an increase of 151 in mines of class 1, an increase of 177 in those of class 2, of 98 in those of class 3, and of 376 in those of class 4—a total increase of 802. The number of commercial mines in class 5, however, decreased. In 1919 mines of class 5 produced 2.8 per cent of the total output of all commercial mines; in 1920, only 1.9 per cent. In 1921, as compared with 1920, the figures show a decrease of 219 in the number of mines of class 1, of 224 in mines of class 2, of 276 in class 3 mines, and of 814 in mines of class 4—a total decrease of 1,533 mines. The mines of class 5, on the other hand, showed an increase of 650, which made a net decrease of 883 in the number of commercial mines in operation for the year.

In every year a number of mines cease operations, either temporarily or permanently. Old mines become exhausted and are abandoned. In times of poor demand the high cost of recovery forces some mines to close down; and others suspend because of financial difficulties, until conditions become more favorable or new owners take over the properties. It is a fair conclusion, however, that the percentage of suspension is higher in the smaller mines. Bituminous mines that can hoist 3,000 to 5,000 tons of coal in an 8-hour day are no longer a novelty. The owners of such mines would not incur the cost of development to such capacity and the expense of building up a sales organization equal to the task of marketing so much coal without providing sufficient reserve acreage of coal land to give the mine a long life.

Number and yearly output of bituminous coal mines, by classes, 1905–1921.[1]

[Exclusive of wagon mines.]

Year.	Class 1 (more than 200,000 tons).	Class 2 (100,000 to 200,000 tons).	Class 3 (50,000 to 100,000 tons).	Class 4 (10,000 to 50,000 tons).	Class 5 (less than 10,000 tons).	Total.
Number of mines:						
1905	411	612	808	1,514	1,715	5,060
1910	618	763	960	1,568	1,909	5,818
1913	694	837	959	1,563	1,723	5,776
1917	792	914	1,044	1,996	2,193	6,939
1918	821	929	1,198	2,636	2,735	8,319
1919	550	854	1,181	2,784	3,625	8,994
1920	701	1,031	1,279	3,140	2,770	8,921
1921	482	807	1,003	2,346	3,400	8,038
Net tons produced:						
1905	126,499,000	85,920,000	57,386,000	38,995,000	6,034,000	314,834,000
1910	191,519,000	107,552,000	68,358,000	42,282,000	6,561,000	416,272,000
1913	241,463,000	118,476,000	69,018,000	42,292,000	6,280,000	477,529,000
1917	285,366,000	129,486,000	74,894,000	51,596,000	8,824,000	550,166,000
1918	281,267,000	131,027,000	87,143,000	67,453,000	11,387,000	578,277,000
1919	174,348,000	120,926,000	84,625,000	71,334,000	13,198,000	464,431,000
1920	237,468,000	142,[illegible]	90,369,000	82,129,000	10,716,000	563,732,000
1921	162,438,000	115,307,000	71,160,000	56,099,000	10,618,000	415,622,000
Percentage of total number of mines:						
1905	8.1	12.1	16.0	29.9	33.9	100.0
1910	10.6	13.1	16.5	27.0	32.8	100.0
1913	12.0	14.5	16.6	27.1	29.8	100.0
1917	11.4	13.2	15.0	28.8	31.6	100.0
1918	9.9	11.2	14.4	31.7	32.9	100.0
1919	6.1	9.5	13.1	31.0	40.3	100.0
1920	7.9	11.6	14.3	35.4	30.8	100.0
1921	6.0	10.0	12.5	29.2	42.3	100.0
Percentage of total tonnage:						
1905	40.2	27.3	18.2	12.4	1.9	100.0
1910	46.0	25.7	16.5	10.2	1.6	100.0
1913	50.6	24.8	14.4	8.9	1.3	100.0
1917	51.9	23.5	13.6	9.4	1.6	100.0
1918	48.6	22.7	15.1	11.6	2.0	100.0
1919	37.6	26.0	18.2	15.4	2.8	100.0
1920	42.1	25.3	16.1	14.6	1.9	100.0
1921	39.1	27.8	17.1	13.5	2.5	100.0

[1] This table shows mines, not companies, and should not be confused with other tables that include country banks and many wagon mines shipping by rail.

PRODUCTION OF BITUMINOUS COAL BY MINES OF DIFFERENT CLASSES.

The sizes of the mines in each State in 1919 and 1920 are indicated in the two accompanying tables, which cover all that reported, both country banks and wagon mines. The percentages here given therefore differ slightly from those given in the preceding historical table.

MINES IN 1919.

Illinois led the States east of Mississippi River in 1919 in percentage of output by mines of class 1. In that year 16.5 per cent of the mines in the State hoisted 67 per cent of the output, an average of 354,562 tons per mine. The highest average output east of the Mississippi, 429,782 tons, however, was made in Virginia, where 9.7 per cent of the mines of class 1 produced 64.6 per cent of the output. Utah led the States west of Mississippi River in mines of class 1, with 20.8 per cent of the mines raising 76.6 per cent of the output, or an average of 322,688 tons per mine for the year. Utah stood at the top of the list both in its percentage of mines of class 1 and in its percentage of production produced by them. The highest average tonnage, however, was reported from Montana. The largest number of class 1 mines, 229, was reported by Pennsylvania, which also ranked first in tonnage from class 1 mines, although these mines represented only 6.8 per cent of the total number, and their output—70,652,180 tons—was 46.9 per cent of the output of bituminous coal in the State. The average production of class 1 mines for the United States was 317,906 tons. Class 2 mines, which included 7 per cent of the total, made 26 per cent of the total output and averaged 141,599 tons per mine. Class 5 mines, which constituted 56.7 per cent of the total number, averaged 2,007 tons per mine.

MINES IN 1920.

Commercial mines.—The figures for 1920 show an increase of 51 in the number of mines of class 1 in Illinois, as compared with those for 1919, but the total number of mines in operation in the State decreased. The mines of class 2 increased 10, but those of class 3 decreased 22, those of class 4 decreased 11, and those of class 5 decreased 72. Except Alabama and Virginia, which showed no change, and Oklahoma, which showed a decrease, the number of mines of class 1 in 1920 increased in every State that reported mines of class 1 in 1919. Illinois again led the States east of the Mississippi in the percentage of the total output mined by mines of class 1; Virginia came second and Pennsylvania third. The highest average production per mine of class 1 was again reported by Virginia—440,021 tons. Montana, where 65.9 per cent of the output came from mines of class 1, ranked second in the average per mine—415,781 tons. Illinois made a close third, reporting 415,592 tons per mine. Utah again led the country in the percentage of mines of class 1 (32.6 per cent) and in the percentage of the total output for the State produced by mines of that class. The actual number of mines of class 1 in Utah, however, was only 15, and the actual output was 5,077,622 tons. On the other hand, although the 249 mines of class 1 of Pennsylvania formed only 4.5 per cent of the mines in the State, they produced 80,892,474 tons. Illinois came second in its output from mines of class 1, which produced 68,988,267 tons.

The average production per mine for all mines of class 1 in the United States was 338,756 tons. The average output for all mines of class 5 was 1,821 tons. The increase in the number of these mines in Pennsylvania, 1,853, was 298 more than the total increase in such mines for the rest of the United States. As compared with 1919 the number of mines of class 5 increased 1,555, whereas the total number of mines of all classes increased 2,357. The large increase in the number of small operations and the demands of "wagon" mines for a share of available railroad equipment in 1920 caused much complaint and bitterness, and the question of car supply for such operations was taken to both the Pennsylvania Public Service Commission and the Interstate Commerce Commission.

Number and production of bituminous coal mines in the United States in 1919, by classes.

[Includes wagon mines and country banks.]

State.	Class 1 (more than 200,000 tons).					Class 2 (100,000 to 200,000 tons).					Class 3 (50,000 to 100,000 tons).				
	Mines.		Production.			Mines.		Production.			Mines.		Production.		
	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.
Alabama	15	5.0	4,689,441	312,629	30.2	30	10.0	4,214,997	140,500	27.1	43	14.4	2,918,244	67,866	18.8
Arkansas	......	......	......	......	......	2	1.8	241,404	120,702	16.9	4	3.6	246,501	61,625	17.2
Colorado	8	3.7	2,210,597	276,325	21.4	31	14.2	4,622,976	149,128	44.8	23	10.5	1,650,942	71,780	16.0
Georgia	......	......	......	......	......	......	......	......	......	......	1	100.0	53,337	53,337	100.0
Illinois	115	16.5	40,774,620	354,562	67.0	77	11.0	11,173,337	145,108	18.4	75	10.7	5,670,918	75,612	9.3
Indiana	23	5.0	7,100,579	308,721	34.0	52	11.4	7,297,898	140,344	34.9	54	11.7	3,823,279	70,801	18.3
Iowa	1	0.4	299,861	299,861	5.3	13	5.1	1,714,048	131,850	30.4	24	9.5	1,748,681	72,862	31.1
Kansas	......	......	......	......	......	8	3.7	1,023,844	127,980	19.6	31	14.2	2,294,378	74,012	43.9
Kentucky	15	1.0	4,700,293	313,353	15.6	69	4.5	9,205,578	133,414	30.7	116	7.6	8,329,777	71,808	27.7
Maryland	......	......	......	......	......	7	6.0	934,344	133,478	30.9	11	9.4	850,142	77,286	28.1
Michigan	......	......	......	......	......	3	17.6	420,499	140,166	42.2	5	29.4	391,588	78,318	39.3
Missouri	......	......	......	......	......	4	1.0	496,334	124,083	12.5	17	4.1	1,210,285	71,193	30.4
Montana	4	3.2	1,759,792	439,948	54.5	3	2.4	399,779	133,259	12.3	8	6.4	685,552	85,694	21.2
New Mexico	2	4.4	821,222	410,611	26.2	5	10.9	752,208	150,442	24.0	17	37.0	1,368,831	80,519	43.6
North Dakota	1	0.4	249,829	249,829	29.7	......	......	......	......	......	1	0.4	61,655	61,655	7.3
Ohio	33	2.0	9,383,878	284,360	26.2	83	5.0	11,940,823	143,865	33.3	86	5.2	6,272,129	72,932	17.5
Oklahoma	1	0.6	210,922	210,922	5.5	3	1.8	406,979	135,660	10.7	19	11.5	1,343,445	70,708	35.4
Pennsylvania	229	6.8	70,652,180	308,525	46.9	224	6.6	32,588,990	145,487	21.6	319	9.4	22,317,815	69,962	14.8
Tennessee	3	1.8	653,169	217,723	12.5	9	5.4	1,277,064	141,896	24.5	21	12.7	1,561,703	74,367	30.0
Texas	......	......	......	......	......	2	3.9	285,048	142,524	16.9	9	17.6	511,003	56,775	30.4
Utah	11	20.8	3,549,566	322,688	76.6	6	11.3	843,411	140,569	18.3	1	1.9	79,852	79,852	1.7
Virginia	14	9.7	6,016,950	429,782	64.6	8	5.6	1,132,092	141,511	12.1	14	9.7	973,672	69,548	10.4
Washington	4	8.5	971,516	242,879	32.5	6	12.8	869,835	144,972	29.1	8	17.0	575,026	71,878	19.2
West Virginia	62	3.3	18,246,622	294,300	23.1	186	9.9	25,769,234	138,544	32.6	259	13.8	18,540,102	71,583	23.5
Wyoming	9	9.2	2,557,375	284,153	35.4	23	22.5	3,315,064	144,133	45.9	15	15.3	1,146,160	76,411	15.9
	550	4.4	174,848,412	317,906	37.5	854	7.0	120,925,786	141,599	26.0	1,181	9.5	84,625,017	71,655	18.1

State.	Class 4 (10,000 to 50,000 tons). Mines. Number.	Class 4 Mines. Percentage.	Class 4 Production. Total (net tons).	Class 4 Production. Average per mine (net tons).	Class 4 Production. Percentage.	Class 5 (less than 10,000 tons). Mines. Number.	Class 5 Mines. Percentage.	Class 5 Production. Total (net tons).	Class 5 Production. Average per mine (net tons).	Class 5 Production. Percentage.	Total. Mines.	Total. Production (net tons). Total.	Total. Production (net tons). Average per mine.
Alabama	129	43.3	3,407,427	26,414	21.9	81	27.3	306,612	3,785	2.0	298	15,536,721	52,137
Arkansas	34	30.6	728,952	21,440	51.0	71	64.0	212,163	2,988	14.9	111	1,429,020	12,874
California, Idaho, and Alaska	1	7.0	40,377	40,377	60.0	13	93.0	26,851	2,065	40.0	14	67,228	4,802
Colorado	57	26.0	1,589,117	27,879	15.4	100	45.6	249,788	2,498	2.4	219	10,323,420	47,139
Georgia											1	53,337	53,337
Illinois	101	14.5	2,594,021	25,683	4.2	330	47.3	649,712	1,969	1.1	698	60,862,608	87,196
Indiana	85	18.6	2,206,358	25,957	10.5	244	53.3	484,174	1,984	2.3	458	20,912,288	45,660
Iowa	62	24.5	1,511,007	24,371	27.0	153	60.5	351,095	2,295	6.2	253	5,624,692	22,232
Kansas	48	22.1	1,521,022	31,688	29.1	130	60.0	385,480	2,965	7.4	217	5,224,724	24,077
Kentucky	253	16.5	6,473,844	25,588	21.6	1,079	70.4	1,326,569	1,229	4.4	1,532	30,036,061	19,606
Maryland	38	32.5	1,073,834	28,259	35.6	61	52.1	163,366	2,678	5.4	117	3,021,686	25,826
Michigan	5	29.4	177,312	35,462	17.8	4	23.6	7,146	1,787	0.7	17	996,545	58,620
Missouri	71	17.2	1,756,222	24,735	44.1	320	77.7	516,957	1,615	13.0	412	3,979,798	9,660
Montana	10	7.9	218,757	21,875	6.7	101	80.1	172,489	1,708	5.3	126	3,236,369	25,685
New Mexico	7	15.2	159,962	22,852	5.1	15	32.5	36,533	2,436	1.1	46	3,138,756	68,233
North Carolina						1	100.0	6,989	6,989	100.0	1	6,989	6,989
North Dakota	14	6.3	240,544	17,182	28.7	206	92.9	288,931	1,403	34.3	222	840,959	3,788
Ohio	254	15.2	6,179,627	24,329	17.2	1,213	72.6	2,100,225	1,731	5.8	1,669	35,876,682	21,496
Oklahoma	72	43.6	1,673,059	23,237	44.0	70	42.5	167,708	2,396	4.4	165	3,802,113	23,043
Oregon	1	25.0	14,264	14,264	76.1	3	75.0	4,475	1,491	23.9	4	18,739	4,685
Pennsylvania	827	24.5	20,557,207	24,858	13.6	1,778	52.7	4,641,962	2,611	3.1	3,377	150,758,154	44,643
South Dakota						17	100.0	14,417	848	100.0	17	14,417	848
Tennessee	68	41.2	1,478,107	21,737	28.3	64	38.9	243,162	3,799	4.7	165	5,213,205	31,595
Texas	30	58.9	850,584	28,353	50.7	10	19.6	34,021	3,402	2.0	51	1,680,656	32,954
Utah	4	7.5	121,363	30,341	2.6	31	58.5	37,131	1,198	0.8	53	4,631,323	87,383
Virginia	38	26.4	1,021,073	26,870	10.9	70	48.6	183,043	2,615	2.0	144	9,326,830	64,769
Washington	18	38.3	513,479	28,527	17.2	11	23.4	60,591	5,508	2.0	47	2,990,447	63,627
West Virginia	551	29.4	15,066,886	27,345	19.0	819	43.6	1,413,709	1,726	1.8	1,877	79,036,553	42,108
Wyoming	6	6.1	160,150	26,691	2.2	45	45.9	40,989	911	0.6	98	7,219,738	73,671
	2,784	22.4	71,334,555	25,623	15.3	7,040	56.7	14,126,288	2,007	3.1	12,409	465,860,058	37,542

Number and production of bituminous coal mines in the United States in 1920, by classes.

[Includes wagon mines and country banks.]

State.	Class 1 (more than 200,000 tons).					Class 2 (100,000 to 200,000 tons).					Class 3 (50,000 to 100,000 tons).				
	Mines.		Production.			Mines.		Production.			Mines.		Production.		
	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.
Alabama	15	4.6	5,071,351	338,090	31.1	30	9.2	4,468,887	148,963	27.4	47	14.3	3,151,249	67,048	19.3
Arkansas						4	3.3	537,762	134,440	25.6	5	4.1	343,043	68,609	16.3
Colorado	15	7.4	4,370,197	291,346	35.7	31	15.4	4,128,365	133,173	33.6	28	13.9	2,050,606	73,236	16.7
Georgia											1	100.0	50,156	50,156	100.0
Illinois	166	25.4	68,988,267	415,592	77.8	87	13.4	12,332,988	141,758	13.9	53	8.1	4,205,511	79,349	4.7
Indiana	36	6.9	11,949,173	331,921	40.7	81	15.6	11,318,317	139,732	38.6	57	10.9	4,275,862	75,016	14.6
Iowa	4	1.8	1,240,416	310,104	15.9	23	10.5	3,226,109	140,266	41.2	25	11.4	1,734,682	69,387	22.2
Kansas	1	0.4	216,075	216,075	3.6	13	5.0	1,690,412	130,032	28.5	31	11.9	2,120,901	68,416	35.8
Kentucky	21	1.8	6,080,789	289,561	17.0	83	6.9	11,476,093	138,266	32.2	115	9.6	7,859,970	68,348	22.0
Maryland						9	4.7	1,177,557	130,840	29.0	27	14.1	1,753,855	64,958	43.1
Michigan	2	11.1	477,492	238,746	32.1	3	16.7	424,289	141,430	28.5	6	33.3	507,171	84,529	34.0
Missouri	2	0.6	408,443	204,222	7.6	10	2.9	1,281,555	128,156	23.9	21	6.1	1,387,161	66,055	25.8
Montana	7	6.6	2,910,468	415,781	65.9	5	4.7	587,746	117,549	13.3	6	5.7	462,478	77,083	10.5
New Mexico	3	7.0	1,104,656	368,219	30.0	16	37.2	1,937,022	121,064	52.5	5	11.6	405,865	81,173	11.1
North Dakota	1	0.6	244,695	244,695	25.8						2	1.2	122,678	61,339	12.9
Ohio	44	2.3	12,043,192	273,709	26.2	108	5.5	15,145,211	140,233	33.0	118	6.0	8,327,702	70,574	18.2
Oklahoma						8	4.9	870,496	108,812	17.9	40	24.9	2,098,390	52,460	43.3
Pennsylvania	249	4.5	80,892,474	324,869	47.4	244	4.5	34,912,700	143,085	20.4	342	6.4	24,307,053	71,073	14.2
Tennessee	7	2.8	1,790,130	255,733	26.9	11	4.4	1,336,906	121,537	20.1	19	7.7	1,310,471	68,972	19.6
Texas						3	6.8	359,681	119,894	22.3	7	15.9	427,111	61,016	26.4
Utah	15	32.6	5,077,622	338,508	84.6	5	10.9	737,647	147,529	12.3	1	2.2	82,607	82,607	1.4
Virginia	14	6.1	6,160,297	440,021	54.1	16	6.9	2,147,237	134,202	18.9	21	9.1	1,508,735	71,845	13.3
Washington	5	10.2	1,494,818	298,964	39.8	8	16.3	1,316,526	164,566	35.0	6	12.2	406,508	67,751	10.8
West Virginia	74	3.5	20,940,911	282,985	23.3	213	10.1	28,482,366	133,720	31.7	289	13.8	21,260,002	73,564	23.6
Wyoming	20	24.1	6,006,310	300,316	62.4	20	24.1	2,854,387	142,719	29.6	7	8.3	508,935	72,705	5.3
	701	4.7	237,467,776	338,756	41.8	1,031	7.0	142,750,259	138,458	25.1	1,279	8.7	90,668,702	70,660	15.9

State.	Class 4 (10,000 to 50,000 tons). Mines. Number.	Class 4 Mines. Percentage.	Class 4 Production. Total (net tons).	Class 4 Production. Average per mine (net tons).	Class 4 Production. Percentage.	Class 5 (less than 10,000 tons). Mines. Number.	Class 5 Mines. Percentage.	Class 5 Production. Total (net tons).	Class 5 Production. Average per mine (net tons).	Class 5 Production. Percentage.	Total. Mines.	Total. Production (net tons) Total.	Total. Production (net tons) Average per mine.
Alabama	120	36.7	3,228,460	26,904	19.9	115	35.2	374,152	3,253	2.3	327	16,294,099	49,829
Arkansas	40	32.8	1,005,364	25,134	47.8	73	59.8	217,427	2,978	10.3	122	2,103,596	17,243
California, Idaho, and Alaska	2	15.4	46,443	23,222	72.8	11	84.6	17,421	1,584	27.2	13	63,864	4,913
Colorado	52	25.7	1,540,922	29,633	12.5	76	37.6	188,135	2,475	1.5	202	12,278,225	60,783
Georgia	......	......	......	......	......	......	......	......	......	......	1	50,156	50,156
Illinois	90	13.7	2,661,080	29,568	3.0	258	39.4	537,047	2,082	0.6	654	88,724,893	135,665
Indiana	54	10.3	1,250,864	23,164	4.3	294	56.3	556,369	1,892	1.8	522	29,350,585	56,227
Iowa	56	25.6	1,340,941	23,945	17.2	111	50.7	271,768	2,448	3.5	219	7,813,916	35,680
Kansas	52	19.9	1,540,426	29,624	26.0	164	62.8	358,594	2,187	6.1	261	5,926,408	22,707
Kentucky	347	28.9	9,139,069	26,337	25.6	634	52.8	1,134,841	1,790	3.2	1,200	35,690,762	29,742
Maryland	36	18.7	958,328	26,620	23.6	120	62.5	175,499	1,462	4.3	192	40,652,239	21,173
Michigan	3	16.7	78,813	26,271	5.3	4	22.2	2,000	500	0.1	18	1,489,765	82,765
Missouri	69	20.1	1,807,564	26,196	33.7	242	70.3	484,842	2,003	9.0	344	5,369,565	15,609
Montana	13	12.3	339,435	26,110	7.7	75	70.7	113,739	1,517	2.6	106	4,413,866	41,640
New Mexico	9	20.9	206,329	22,926	5.6	10	23.3	29,568	2,957	0.8	43	3,683,440	85,661
North Carolina	1	100.0	11,540	11,540	100.0	......	......	......	......	......	1	11,540	11,540
North Dakota	15	9.6	327,417	21,828	34.6	138	88.6	253,835	1,839	26.7	156	948,625	6,081
Ohio	320	16.4	8,045,363	25,142	17.6	1,364	69.8	2,316,723	1,698	5.0	1,954	45,878,191	23,479
Oklahoma	56	34.8	1,707,185	30,485	35.2	57	35.4	173,217	3,039	3.6	161	4,849,288	30,120
Oregon	1	33.3	18,291	18,291	88.3	2	66.7	2,426	1,213	11.7	3	20,717	6,906
Pennsylvania	982	18.0	24,383,872	24,831	14.4	3,631	66.6	6,111,748	1,683	3.6	5,448	170,607,847	31,316
South Dakota	......	......	......	......	......	17	100.0	12,777	752	100.0	17	12,777	752
Tennessee	76	30.8	1,871,746	24,628	28.1	134	54.3	353,175	2,636	5.3	247	6,662,428	26,973
Texas	31	70.5	822,543	26,534	50.9	3	6.8	5,680	1,893	0.4	44	1,615,015	36,705
Utah	3	6.5	81,555	27,185	1.3	22	47.8	25,768	1,171	0.4	46	6,005,199	130,548
Virginia	50	21.6	1,239,331	24,787	10.9	130	56.3	323,006	2,485	2.8	231	11,378,606	49,258
Washington	20	40.9	489,873	24,494	13.1	10	20.4	49,368	4,937	1.3	49	3,757,093	76,675
West Virginia	651	31.0	17,757,059	27,276	19.7	875	41.6	1,530,369	1,749	1.7	2,102	89,970,707	42,802
Wyoming	11	13.4	229,347	20,850	2.4	25	30.1	31,292	1,252	0.3	83	9,630,271	116,027
	3,160	21.4	82,129,160	26,012	14.4	8,595	58.2	15,650,786	1,821	2.8	14,766	568,666,683	38,512

Wagon mines.—The production of the "small mines" reached its maximum in 1920, under the incentive of spot prices of coal that at one time reached $10 and $15 a ton f. o. b. at mines. Reports from the railroads identified at least 4,405 wagon mines that shipped 4,513,800 tons by rail. The number and output in each State are given below. For Kentucky, Tennessee, Alabama, and part of southern West Virginia the record is far from complete; for other States it is believed to be trustworthy. The table includes only mines not on the commercial list of the Geological Survey.

Number and production of bituminous wagon mines and country banks in 1920.

State.	Country banks.		Wagon mines shipping by rail.		Total number.	Total production (net tons).	Total estimated value.
	Number.	Production (net tons).	Number.	Production (net tons).			
Alabama			70	154,000	70	154,000	$773,000
Arkansas	7	2,000	19	51,000	26	53,000	264,000
Colorado	13	3,000	6	1,000	19	4,000	12,000
Illinois	73	30,000	59	64,000	132	94,000	369,000
Indiana	47	12,000	157	248,000	204	260,000	1,083,000
Iowa	18	9,000	15	30,000	33	39,000	188,000
Kansas	17	6,000	82	82,000	99	88,000	419,000
Kentucky	282	31,000	107	131,000	389	162,000	647,000
Maryland	16	7,000	73	28,000	89	35,000	208,000
Michigan	4	2,000			4	2,000	9,000
Missouri	98	14,000	41	89,000	139	103,000	483,000
Montana	18	7,000	9	3,000	27	10,000	33,000
North Dakota	65	20,000	12	21,000	77	41,000	106,000
Ohio	385	105,000	539	497,000	924	602,000	2,845,000
Oklahoma	8	1,000	11	18,000	19	19,000	90,000
Pennsylvania	180	161,000	2,574	2,363,000	2,754	2,524,000	15,211,000
Tennessee	6	200	75	76,600	81	76,800	417,000
Utah	7	2,000			7	2,000	9,000
Virginia	3	300	87	134,200	90	134,500	867,000
Washington			2	4,000	2	4,000	16,000
West Virginia	183	7,000	463	513,000	646	520,000	3,145,000
Wyoming	10	1,000	4	6,000	14	7,000	24,000
	1,440	420,500	4,405	4,513,800	5,845	4,934,300	27,218,000

The fact that shipments of coal from wagon mines fluctuate directly with the price is shown by a study made by the car-service division of the American Railway Association, the results of which are summarized below. During the first quarter of the year the prices were fixed by the Government, and comparatively little wagon coal was in demand. Price control ceased April 1; prices rose quickly, and by July the railroads were being called to serve thousands of new shippers. The drop in cars loaded that appears in the table for the week ended September 4 marks the issue of regulations governing supply of cars to wagon mines (Interstate Commerce Commission Service Order No. 14). A later service order (No. 16, effective September 19) relaxed the restrictions on supply of equipment to wagon mines and was immediately followed by a sudden increase in loadings. The market, however, soon began to weaken; shipments from wagon mines rapidly declined, and by the end of December much of the mushroom-like growth of the summer had disappeared.

Number of wagon mines in operation and number of cars loaded by them as reported by the American Railway Association, March to November, 1920.[a]

Week ended—	Number of wagon mines ordering cars.	Number of cars loaded.	Week ended—	Number of wagon mines ordering cars.	Number of cars loaded.
Mar. 6	1,355	1,803	July 24	3,341	4,739
13	1,361	1,739	31	3,477	4,847
20	1,306	1,700	Aug. 7	3,270	4,707
27	1,330	1,904	14	3,358	4,388
Apr. 3	1,319	1,725	21	3,196	4,625
10	1,321	1,737	28	2,989	4,111
17	1,316	1,465	Sept. 4	2,913	3,611
24	1,330	1,739	11	2,968	3,950
May 1	1,409	1,802	18	3,054	4,035
8	1,532	1,999	25	3,032	4,440
15	1,559	1,577	Oct. 2	3,123	4,335
22	1,597	2,253	9	3,177	5,103
29	1,722	2,396	16	3,145	4,922
June 5	2,058	2,771	23	3,079	5,188
12	2,194	2,878	30	3,115	5,000
19	2,521	3,354	Nov. 6	2,783	4,301
26	2,607	3,538	13	2,510	4,116
July 3	3,263	3,627	20	2,345	3,555
10	3,076	3,823	27	2,207	3,471
17	3,331	4,379			

[a] As this study was not complete and as the railroads included in the return many mines classified by the Geological Survey as "commercial mines," the numbers stated in this table do not agree with those obtained by the more careful count that was made later in the year.

MINES IN 1921.

Every State except North Dakota and West Virginia showed a decrease in mines of class 1 in 1921 as compared with 1920. The single mine in that class in North Dakota maintained an output of over 200,000 tons. In West Virginia the number of mines of class 1 increased 1, and the average production per class 1 mine also increased slightly. In Illinois 71.3 per cent of the coal mined came from mines of class 1, and this State was first in percentage of coal mined and first in actual production. Pennsylvania ranked second. Montana ranked second in percentage of coal from mines of class 1 and first in average output per mine. Utah fell to third place in percentage of total coal mined by class 1 mines.

The average output of mines of class 1 throughout the United States was 337,008 tons. The output of mines of class 5 averaged 3,123 tons, but as the output of the wagon mines was not included in the tables for 1921 this figure is not comparable with those for the two preceding years. The average output of mines of class 5 (except wagon mines) was 3,896 tons in 1920 and 3,641 tons in 1919.

Number and production of commercial bituminous coal mines in the United States in 1921, by classes.

[Exclusive of wagon mines.]

State.	Class 1 (more than 200,000 tons).					Class 2 (100,000 to 200,000 tons).					Class 3 (50,000 to 100,000 tons).				
	Mines.		Production.			Mines.		Production.			Mines.		Production.		
	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.
Alabama	13	5.3	4,175,000	321,154	33.2	26	10.6	3,368,000	129,538	26.8	28	11.4	1,933,000	69,036	15.4
Arkansas						1	1.3	160,000	160,000	13.0	3	3.9	226,000	75,333	18.4
Colorado	7	3.3	1,869,000	267,000	20.5	24	11.3	3,322,000	138,417	36.4	32	15.0	2,249,000	70,281	24.7
Illinois	123	18.2	49,602,000	403,268	71.3	82	12.2	12,049,000	146,939	17.3	59	8.8	4,303,000	72,932	6.2
Indiana	29	10.5	9,048,000	312,000	44.5	42	15.2	5,880,000	140,000	28.9	47	17.0	3,370,000	71,702	16.6
Iowa	3	2.0	837,000	279,000	18.5	6	3.9	817,000	136,167	18.0	24	15.7	1,641,000	68,375	36.2
Kansas						4	2.9	473,000	118,250	13.7	20	14.6	1,336,000	66,800	38.5
Kentucky	18	2.6	6,400,000	355,556	20.3	80	11.6	11,124,000	139,050	35.2	110	15.9	7,690,000	69,909	24.3
Maryland						4	4.6	529,000	132,250	28.9	8	9.2	599,000	74,875	32.8
Michigan	1	7.1	261,000	261,000	22.9	5	35.7	595,000	119,000	52.1	1	7.1	64,000	64,000	5.6
Missouri						5	2.9	614,000	122,800	17.3	19	11.1	1,387,000	73,000	39.0
Montana	4	6.9	1,672,000	418,000	61.2	4	6.9	584,000	146,000	21.4	2	3.4	145,000	72,500	5.3
New Mexico	2	4.9	543,000	271,500	22.1	5	12.2	610,000	122,000	24.9	15	36.6	1,040,000	69,333	42.4
North Dakota	1	1.7	225,000	225,000	26.0						3	5.0	186,000	62,000	21.5
Ohio	40	4.9	12,277,000	306,925	38.4	68	8.3	9,713,000	142,838	30.4	66	8.0	4,671,000	70,773	14.6
Oklahoma						6	4.5	859,000	143,167	25.5	14	10.6	970,000	69,286	28.9
Pennsylvania	131	5.5	43,194,000	329,725	37.2	226	9.4	34,000,000	150,442	29.3	274	11.4	19,322,000	70,518	16.7
Tennessee	1	.7	292,000	292,000	6.5	11	7.7	1,502,000	136,545	33.7	14	9.8	917,000	65,500	20.6
Texas						1	2.8	104,000	104,000	10.7	4	11.1	224,000	56,000	23.0
Utah	8	22.2	2,374,000	296,750	58.2	8	22.2	1,278,000	159,750	31.3	4	11.1	315,000	78,750	7.7
Virginia	10	9.5	4,066,000	406,600	54.3	13	12.4	1,746,000	134,308	23.3	10	9.5	704,000	70,400	9.4
Washington	4	7.9	1,314,000	328,500	54.1	2	3.9	322,000	161,000	13.3	7	13.7	450,000	64,286	18.5
West Virginia	75	5.7	21,269,000	283,587	29.2	163	12.4	22,828,000	140,049	31.4	227	17.2	16,556,000	72,934	22.7
Wyoming	12	19.0	3,020,000	251,667	41.9	21	33.3	3,130,000	149,048	43.5	12	19.1	862,000	71,833	12.0
	482	6.0	162,438,000	337,008	39.1	807	10.0	115,607,000	143,255	27.8	1,003	12.5	71,160,000	70,947	17.1

State.	Class 4 (10,000 to 50,000 tons).					Class 5 (less than 10,000 tons).					Total.		
	Mines.		Production.			Mines.		Production.			Mines.	Production (net tons).	
	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.	Number.	Percentage.	Total (net tons).	Average per mine (net tons).	Percentage.		Total.	Average per mine.
Alabama	110	44.7	2,840,000	25,818	22.6	69	28.0	253,000	3,667	2.0	246	12,569,000	51,093
Arkansas	29	37.7	696,000	24,000	56.7	44	57.1	146,000	3,318	11.9	77	1,228,000	15,948
California, Idaho, Alaska, and Oregon	4	21.1	93,000	23,250	80.9	15	78.9	22,000	1,467	19.1	19	115,000	6,053
Colorado	63	29.6	1,471,000	23,349	16.1	87	40.8	212,000	2,437	2.3	213	9,123,000	42,831
Georgia	1	100.0	34,000	34,000	100.0						1	34,000	34,000
Illinois	116	17.3	2,867,000	24,716	4.1	292	43.5	782,000	2,678	1.1	672	69,603,000	103,576
Indiana	63	22.7	1,699,000	26,968	8.4	96	34.6	322,000	3,354	1.6	277	20,319,000	73,354
Iowa	45	29.4	979,000	21,756	21.6	75	49.0	257,000	3,427	5.7	153	4,531,000	29,614
Kansas	57	41.6	1,476,000	25,895	42.6	56	40.9	182,000	3,250	5.2	137	3,467,000	25,307
Kentucky	226	32.8	5,557,000	24,588	17.6	256	37.1	817,000	3,191	2.6	690	31,588,000	45,780
Maryland	25	28.7	556,000	22,240	30.4	50	57.5	144,000	2,880	7.9	87	1,828,000	21,011
Michigan	6	42.9	215,000	35,833	18.8	1	7.2	7,000	7,000	.6	14	1,142,000	81,571
Missouri	57	33.3	1,263,000	22,158	35.6	90	52.7	287,000	3,189	8.1	171	3,551,000	20,766
Montana	11	19.0	231,000	21,000	8.4	37	63.8	102,000	2,757	3.7	58	2,734,000	47,138
New Mexico	9	22.0	236,000	26,222	9.6	10	24.3	24,000	2,400	1.0	41	2,453,000	59,829
North Carolina	1	100.0	23,000	23,000	100.0						1	23,000	23,000
North Dakota	18	30.0	330,000	18,333	38.2	38	63.3	124,000	3,263	14.3	60	865,000	14,417
Ohio	182	22.1	3,981,000	21,874	12.5	466	56.7	1,301,000	2,792	4.1	822	31,943,000	38,860
Oklahoma	64	48.5	1,373,000	21,453	40.8	48	36.4	161,000	3,354	4.8	132	3,363,000	25,477
Pennsylvania	680	28.4	15,947,000	23,451	13.7	1,086	45.3	3,551,000	3,270	3.1	2,397	116,014,000	48,400
South Dakota						18	100.0	8,000	444	100.0	18	8,000	444
Tennessee	63	44.0	1,544,000	24,508	34.6	54	37.8	205,000	3,796	4.6	143	4,460,000	31,189
Texas	27	75.0	622,000	23,037	63.9	4	11.1	23,000	5,750	2.4	36	973,000	27,028
Utah	4	11.1	86,000	21,500	2.1	12	33.4	26,000	2,167	.7	36	4,079,000	113,306
Virginia	35	33.3	845,000	24,143	11.3	37	35.3	131,000	3,541	1.7	105	7,492,000	71,352
Washington	10	19.6	251,000	25,100	10.3	28	54.9	92,000	3,286	3.8	51	2,429,000	47,627
West Virginia	433	32.9	10,733,000	24,788	14.8	420	31.8	1,401,000	3,336	1.9	1,318	72,787,000	55,225
Wyoming	7	11.1	151,000	21,571	2.1	11	17.5	38,000	3,455	.5	63	7,201,000	114,302
	2,346	29.2	56,099,000	23,913	13.5	3,400	42.3	10,618,000	3,123	2.5	8,038	415,922,000	51,744

VALUE OF COAL PRODUCED.

DEFINITION OF VALUES REPORTED.

The value given in this report is the value realized at the mine f. o. b. cars, and the average value per ton is the average value realized, obtained by dividing the total value by the number of tons sold or produced. Coal used at the mine, coal coked by the producing company, and coal used in some other industry by that company—in all forming a considerable part of the total output—is not sold, and the value placed upon it is either estimated or is the amount at which it is carried on the company's books. Either value is presumably the amount the coal would have brought if it had been sold or the cost of other fuel for the purposes stated if it had been purchased. In other words, the values given represent returns to the operators for coal actually sold plus the estimated value of that not sold. The value thus fixed is more or less arbitrary and does not necessarily represent the current prices for coal sold commercially. Many mines are owned by consumers who take all or a great part of their output at nominal prices. The output of such mines is not known accurately, but it is probably between 20 and 25 per cent of the entire output. Even where the coal is actually sold large quantities may be moved on "cost plus" contracts that provide for prices far below both the average spot prices in the field or the average prices realized on deliveries by ordinary contracts. The figures in the following tables therefore do not necessarily show prices or even an average of the prices of coal at the mines. Taken over a period of years, however, they do furnish an index to the rise and fall in the value of coal.

Value of coal produced in the United States in 1919.

State.	Loaded at mines for shipment.		Sold to local trade and used by employees.		Used at mine for steam and heat.		Made into coke at mines.		Total.	Average per ton.
	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.		
Alabama	$41,426,847	$2.99	$532,218	$2.65	$1,487,472	$2.75	$2,491,144	$2.69	$45,937,681	$2.96
Alaska	326,741	5.67	3,616	4.93	13,190	5.82			343,547	5.66
Arkansas	5,039,124	3.73	84,687	3.69	165,033	3.01			5,288,844	3.70
California and Idaho	5,452	2.23	15,445	4.30	1,277	2.48			22,174	3.38
Colorado	26,602,007	2.82	1,092,039	2.64	623,166	2.17	431,322	2.33	28,748,534	2.78
Georgia	59,065	3.93	1,679	2.47	14,015	3.05	123,274	3.73	198,033	3.71
Illinois	126,861,838	2.28	9,095,155	2.70	4,118,976	2.11			140,075,969	2.30
Indiana	42,884,110	2.21	2,065,145	2.57	1,396,495	2.04			46,345,750	2.22
Iowa	14,672,888	3.03	2,294,561	3.76	385,171	2.35			17,352,620	3.09
Kansas	14,996,236	3.05	445,611	3.27	475,206	2.81			15,917,053	3.05
Kentucky	68,993,927	2.47	2,296,221	2.35	1,488,944	2.20	1,111,957	2.35	73,891,049	2.46
Maryland	7,932,739	2.74	194,559	2.58	128,686	2.77			8,255,984	2.73
Michigan	3,545,230	3.93	54,124	4.72	264,874	3.16			3,864,228	3.88
Missouri	10,810,606	3.17	1,546,446	3.66	409,314	2.86			12,766,366	3.21
Montana	7,793,743	2.70	575,528	3.10	275,073	1.68			8,644,344	2.67
New Mexico	8,318,611	3.22	102,006	2.64	118,930	2.70	1,211,286	2.56	9,750,833	3.11
North Carolina	15,176	4.70	1,576	4.07	10,119	3.00			26,871	3.84
North Dakota	1,560,838	2.57	513,529	2.36	25,936	1.68			2,100,303	2.50
Ohio	72,577,291	2.20	5,530,333	2.56	1,385,645	2.10	3,032	2.35	79,496,301	2.22
Oklahoma	13,340,768	3.85	490,000	3.90	615,620	3.44	98,513	2.77	14,544,901	3.83
Oregon	30,504	2.79	19,134	6.17	14,156	3.00			63,794	3.40
Pennsylvania (bituminous)	297,881,306	2.47	12,767,711	2.48	7,531,194	2.28	47,250,293	2.19	365,430,504	2.42
South Dakota	1,762	3.92	43,840	2.84	105	3.75			45,707	3.17
Tennessee	13,147,213	2.77	338,980	2.64	376,720	2.57	585,255	3.02	14,448,168	2.77
Texas	4,445,105	2.73	16,463	4.20	66,072	1.41			4,527,640	2.69
Utah	12,308,119	3.04	286,046	2.83	166,448	2.04	(a)	(a)	12,760,613	2.76
Virginia	19,301,742	2.55	425,795	2.57	300,773	2.56	3,746,631	2.52	23,774,941	2.55
Washington	9,613,138	3.59	296,729	3.75	532,689	3.04	248,666	4.54	10,691,222	3.58
West Virginia	184,252,160	2.50	5,931,394	2.33	2,497,290	2.28	3,870,171	2.25	196,551,015	2.49
Wyoming	18,089,148	2.62	275,944	2.81	385,932	1.80			18,751,024	2.60
Total bituminous	1,026,833,434	2.51	47,336,514	2.62	25,274,521	2.28	61,171,544	2.22	1,160,616,013	2.49
Pennsylvania anthracite	345,201,682	4.53	8,388,546	3.55	11,336,722	1.18			364,926,950	4.14
Grand total	1,372,035,116	2.83	55,725,060	2.73	36,611,243	1.77	61,171,544	2.22	1,525,542,963	2.75

a Value of coal made into coke at the mines included in that of coal loaded at mines for shipment.

Value of coal produced in the United States in 1920.

State.	Loaded at mines for shipment.		Sold to local trade and used by employees.		Used at mine for steam and heat.		Made into coke at mines.		Total.	Average per ton.
	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.		
Alabama	$53,822,000	$3.65	$1,452,000	$4.12	$1,549,000	$3.22	$2,587,000	$3.68	$59,410,000	$3.65
Alaska	338,000	5.77	1,000	7.81	17,000	6.91			356,000	5.83
Arkansas	9,276,000	4.59	69,000	5.23	247,000	3.50			9,592,000	4.56
California and Idaho	1,000	4.81	11,000	4.33					12,000	4.36
Colorado	39,592,000	3.52	1,598,000	3.52	792,000	2.72	847,000	3.00	42,829,000	3.49
Georgia	81,000	5.07	3,000	3.79	14,000	3.89	153,000	5.13	251,000	5.00
Illinois	254,294,000	3.08	12,783,000	3.39	6,432,000	2.70			273,509,000	3.08
Indiana	87,521,000	3.17	3,353,000	3.35	1,993,000	2.72			92,867,000	3.16
Iowa	27,128,000	3.92	3,163,000	4.45	503,000	2.90			30,794,000	3.94
Kansas	21,636,000	3.87	674,000	3.94	613,000	3.64			22,923,000	3.87
Kentucky	139,174,000	4.16	3,750,000	3.47	2,245,000	3.22	1,407,000	3.15	146,576,000	4.11
Maryland	18,198,000	4.65	443,000	4.09	174,000	4.18			18,815,000	4.63
Michigan	6,922,000	4.99	92,000	5.94	332,000	3.79			7,346,000	4.93
Missouri	19,766,000	4.11	1,950,000	4.64	514,000	3.73			22,230,000	4.16
Montana	13,062,000	3.22	549,000	3.50	312,000	1.78			13,923,000	3.15
New Mexico	11,923,000	3.79	139,000	3.20	137,000	3.53	1,369,000	30.2	13,568,000	3.68
North Carolina	60,000	6.93			21,000	7.29			81,000	7.02
North Dakota	2,208,000	2.96	415,000	2.52	101,000	2.69			2,724,000	2.87
Ohio	162,218,000	3.84	10,313,000	3.69	2,548,000	3.08	2,000	2.61	175,081,000	3.82
Oklahoma	22,203,000	4.83	275,000	5.01	816,000	4.21			23,294,000	4.80
Oregon	63,000	4.85	7,000	4.35	23,000	3.75			93,000	4.49
Pennsylvania (bituminous)	535,365,000	3.89	22,124,000	3.51	11,159,000	3.18	73,982,000	3.08	642,630,000	3.76
South Dakota	1,000	4.31	45,000	3.58					46,000	3.60
Tennessee	24,616,000	4.06	481,000	3.52	555,000	3.48	1,126,000	3.63	26,778,000	4.02
Texas	5,959,000	3.78	25,000	4.53	78,000	2.31			6,062,000	3.75
Utah	18,916,000	3.47	190,000	3.28	244,000	2.33	(a)	(a)	19,350,000	3.22
Virginia	39,001,000	4.17	779,000	2.60	342,000	3.32	5,324,000	3.28	45,446,000	3.99
Washington	13,467,000	3.88	367,000	4.19	440,000	2.92	286,000	5.97	14,560,000	3.88
West Virginia	368,455,000	4.40	10,084,000	3.41	3,707,000	3.58	7,800,000	3.44	390,046,000	4.34
Wyoming	27,748,000	2.99	387,000	3.16	606,000	2.49			28,741,000	2.98
Total	1,923,014,000	3.80	75,522,000	3.55	36,514,000	3.07	94,883,000	3.10	2,129,933,000	3.75
Pennsylvania anthracite	409,840,000	5.33	11,480,000	3.96	12,932,000	1.31			434,252,000	4.85
Grand total	2,332,854,000	4.01	87,002,000	3.60	49,446,000	2.27	94,883,000	3.10	2,564,185,000	3.90

a Value of coal made into coke at the mines included in that of coal loaded at mines for shipment.

Value of coal produced in the United States in 1921.

[Exclusive of product of wagon mines.]

State.	Loaded at mines for shipment.		Sold to local trade and used by employees.		Used at mine for steam and heat.		Made into coke at mines.		Total.	Average per ton.
	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.		
Alabama	$36,642,000	$3.10	$830,000	$2.65	$813,000	$2.78	$428,000	$3.33	$38,713,000	$3.08
Alaska	464,000	6.44	20,000	6.66	12,000	6.62			496,000	6.46
Arkansas	5,100,000	4.34	138,000	7.08	122,000	3.62			5,360,000	4.37
California, Idaho, and Oregon	98,000	5.16	54,000	4.06	29,000	4.44			181,000	4.66
Colorado	30,164,000	3.59	1,253,000	3.13	765,000	3.01	195,000	3.22	32,377,000	3.55
Georgia	83,000	4.43	1,000	2.68	7,000	3.54	80,000	6.30	171,000	2.14
Illinois	174,843,000	2.72	10,823,000	3.21	5,320,000	2.59			190,986,000	2.74
Indiana	49,203,000	2.57	1,675,000	2.74	1,391,000	2.35			52,269,000	2.57
Iowa	14,663,000	3.77	2,269,200	4.35	324,600	2.74			17,256,800	3.81
Kansas	12,540,000	3.86	399,000	3.58	394,300	3.76			13,333,300	3.85
Kentucky	81,266,000	2.70	2,070,000	2.58	1,303,600	2.47	453,000	2.80	85,092,600	2.69
Maryland	6,316,000	3.62	181,000	3.19	105,000	3.85			6,602,000	3.61
Michigan	5,225,000	4.93	60,000	5.28	270,000	3.77			5,555,000	4.87
Missouri	12,538,700	3.90	1,049,100	4.33	327,700	3.28			13,915,500	3.92
Montana	8,345,200	3.35	392,300	3.40	184,100	1.46			8,921,600	3.26
New Mexico	9,203,000	3.95	116,000	3.34	177,000	2.84	89,000	2.92	9,585,000	3.91
North Carolina	120,000	6.00			15,000	4.36			135,000	5.76
North Dakota	1,940,000	2.77	332,000	2.45	57,500	2.02			2,329,500	2.69
Ohio	78,864,000	2.65	4,303,600	2.76	1,518,500	2.56	400	2.14	84,686,500	2.65
Oklahoma	14,919,300	4.65	128,700	5.03	498,000	3.87			15,546,000	4.62
Pennsylvania (bituminous)	286,617,000	2.81	11,888,000	2.75	6,908,300	2.71	17,125,000	2.40	322,538,300	2.78
South Dakota	1,500	3.34	19,600	2.77	100	2.94			21,200	2.81
Tennessee	14,164,000	3.38	279,000	3.16	384,000	3.10	105,000	1.94	14,932,000	3.35
Texas	2,498,700	2.64	13,200	4.91	51,700	2.29			2,563,600	2.64
Utah	13,243,000	3.61	230,000	3.08	189,000	2.58	(a)	(a)	13,662,000	3.35
Virginia	21,102,500	3.09	391,200	2.56	253,000	2.56	1,201,000	2.84	22,947,700	3.06
Washington	9,277,000	4.07	241,000	4.04	236,000	2.66	33,000	5.25	9,787,000	4.03
West Virginia	195,003,400	2.84	8,699,600	2.91	2,183,300	2.70	775,200	2.28	206,661,500	2.84
Wyoming	22,410,400	3.26	325,000	3.14	623,100	2.81			23,358,500	3.24
Total bituminous	1,106,854,700	2.90	48,181,500	2.99	24,462,800	2.68	20,484,600	2.38	1,199,983,600	2.89
Pennsylvania anthracite	430,990,000	5.53	11,934,000	4.24	9,381,000	.96			452,305,000	5.00
Grand total	1,537,844,700	3.34	60,115,500	3.17	33,843,800	3.47	20,484,600	2.38	1,652,288,600	3.26

[a] Value of coal made into coke at the mines included in that of coal loaded at mines for shipment.

ESTIMATES OF VALUE INCLUDED IN THE STATISTICS.

If an operator who is known to have produced coal during the year will make no report of the value of his product to the Geological Survey an estimate of the value is included in the total in order to make it complete. In earlier years the number of estimates thus made necessary was so small that their inclusion could in no way impair the substantial accuracy of the total, but in 1920 a considerable number of operators were unwilling to disclose the amounts they had realized for their coal. If, after correspondence with each operator not reporting value, the Geological Survey was unable to obtain from him the amount, it was estimated by multiplying number of tons of output reported by the average spot price per ton in the district as given by the Coal Age for 1920. The same method was followed in estimating the value of coal produced by new mines from which the Survey heard indirectly through the railroads or through State mine inspectors, for the information obtained from these sources showed the output but not the value. The percentage of the total value of the product in each State in 1920 represented in this report by estimates is shown in the following table:

Percentage of total value of coal represented by estimates in 1920, by States.

Alabama	6.6	North Dakota	16.3
Arkansas	15.5	Ohio	9.1
Colorado	10.0	Oklahoma	14.0
Illinois	6.0	Pennsylvania	5.4
Indiana	8.2	Tennessee	17.1
Iowa	19.5	Texas	17.2
Kansas	9.7	Utah	4.5
Kentucky	14.8	Virginia	5.1
Maryland	15.5	Washington	23.7
Michigan	3.0	West Virginia	4.9
Missouri	15.4	Wyoming	9.3
Montana	3.4	Total of bituminous coal	7.5
New Mexico	.7		

Of the $2,129,000,000 given as the total value of bituminous coal at the mine in 1920, $158,000,000, or 7.5 per cent, represents estimates of value of the output of commercial mines. This total also includes an item of $24,900,000 for the value placed by the Survey on the product of about 4,500 wagon mines, the shipments from which were reported by the railroads. In all, therefore, estimates had to be made for 8.6 per cent of the output in 1920.

In the average for the country the proportion estimated was not large enough to introduce an appreciable error, but in the figures for some of the States the error may have been serious.

Average value per net ton of coal at the mines, 1908–1921.

State.	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	Increase or decrease in 1921.
Alabama	$1.26	$1.19	$1.26	$1.27	$1.29	$1.31	$1.34	$1.28	$1.37	$2.27	$2.85	$2.96	$3.65	$3.08	−$0.57
Alaska	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	4.00	4.92	5.45	5.66	5.83	6.46	+.63
Arkansas	1.68	1.48	1.56	1.61	1.71	1.76	1.72	1.79	1.92	2.56	3.67	3.70	4.56	4.37	−.19
California	b 3.19	b 2.21	b 2.74	b 2.00	b 2.33	b 3.54	c 2.85	c 2.54	c 2.12	c 2.30	c 2.70	c 3.38	c 4.36	c 4.66	+.30
Colorado	1.41	1.33	1.42	1.45	1.49	1.52	1.66	1.58	1.62	2.22	2.69	2.78	3.49	3.55	+.06
Georgia	1.38	1.41	1.46	d 1.49	d 1.49	1.41	e 1.44	1.72	1.79	2.53	3.59	3.71	5.00	2.14	−2.86
Idaho	4.02	4.27	3.92	f 2.68	f 3.14	2.43	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(c)	(a)
Illinois	1.05	1.05	1.14	1.11	1.17	1.14	1.12	1.10	1.25	1.88	2.32	2.30	3.08	2.74	−.34
Indiana	1.06	1.02	1.13	1.08	1.14	1.11	1.10	1.10	1.27	1.99	2.29	2.22	3.16	2.57	−.59
Iowa	1.63	1.65	1.75	1.73	1.80	1.79	1.79	1.78	1.86	2.35	3.02	3.09	3.94	3.81	−.13
Kansas	1.49	1.44	1.61	1.53	1.62	1.67	1.64	1.66	1.78	2.31	2.91	3.05	3.87	3.85	−.02
Kentucky	1.01	.94	.99	.99	1.02	1.05	1.02	1.01	1.19	2.17	2.55	2.46	4.11	2.69	−1.42
Maryland	1.17	1.11	1.12	1.11	1.18	1.24	1.27	1.28	1.56	2.46	2.77	2.73	4.63	3.61	−1.02
Michigan	1.81	1.79	1.91	1.78	1.99	1.99	1.99	2.05	2.25	3.22	3.83	3.88	4.93	4.87	−.06
Missouri	1.64	1.65	1.79	1.72	1.76	1.73	1.73	1.73	1.91	2.43	3.02	3.21	4.16	3.92	−.24
Montana	1.96	1.97	1.82	1.79	1.82	1.74	1.75	1.62	1.73	2.11	2.53	2.67	3.16	3.26	+.10
New Mexico	1.37	1.29	1.39	1.44	1.42	1.46	1.61	1.44	1.47	1.86	2.68	3.11	3.68	3.91	+.23
North Carolina											4.75	3.84	7.02	5.76	−1.26
North Dakota	1.63	1.56	1.49	1.43	1.53	1.52	1.52	1.45	1.49	1.80	2.45	2.50	2.87	2.69	−.18
Ohio	1.06	.99	1.05	1.03	1.07	1.10	1.13	1.08	1.33	2.48	2.58	2.22	3.82	2.65	−1.17
Oklahoma	2.03	2.00	2.22	2.05	2.14	2.05	2.06	2.01	2.09	2.81	3.64	3.83	4.80	4.62	−.18
Oregon	2.74	2.69	3.48	2.32	2.60	2.53	2.78	2.84	2.68	3.38	2.81	3.40	4.49	(a)	(a)
Pennsylvania (bituminous)	1.01	.94	1.02	1.01	1.05	1.11	1.07	1.06	1.30	2.44	2.59	2.42	3.76	2.78	−.99
South Dakota						1.96	1.73	1.55	2.03	2.90	2.80	3.17	3.60	2.81	−.79
Tennessee	1.15	1.09	1.11	1.12	1.14	1.14	1.14	1.13	1.23	2.19	2.83	2.77	4.02	3.35	−.67
Texas	1.80	1.72	1.67	1.66	1.67	1.77	1.69	1.65	1.56	1.77	2.63	2.69	3.75	2.64	−1.11
Utah	1.69	1.66	1.68	1.69	1.67	1.65	1.59	1.58	1.62	2.07	2.71	2.76	3.22	3.35	+.63
Virginia	.91	.89	.90	.91	.96	1.01	1.01	.98	1.06	2.00	2.51	2.55	3.99	3.06	−.93
Washington	2.21	2.54	2.50	2.29	2.39	2.38	2.20	2.17	2.27	2.68	3.46	3.58	3.88	4.03	+.15
West Virginia	.95	.86	.92	.90	.94	1.01	.99	.97	1.18	2.32	2.56	2.49	4.34	2.84	−1.50
Wyoming	1.62	1.55	1.55	1.56	1.58	1.56	1.55	1.46	1.55	1.93	2.39	2.60	2.98	3.24	+.26
Total bituminous	1.12	1.07	1.12	1.11	1.15	1.18	1.17	1.13	1.32	2.26	2.58	2.49	3.75	2.89	−.86
Pennsylvania anthracite g	1.90	1.84	1.90	1.94	2.11	2.13	2.07	2.07	2.30	2.85	3.40	4.14	4.85	5.00	+.15

a Included with California.
b Includes Alaska.
c California includes Alaska, Idaho, and Nevada in 1914 and 1915; Idaho in 1916, 1917, 1918, 1919, 1920; and Idaho and Oregon in 1921.
d Includes North Carolina.
e Average for total output, including refuse from washery. The average exclusive of refuse was $1.71.
f Includes Nevada.
g These values represent amounts per net ton, and include all coal produced.

Average value per net ton of coal at the mines in the United States, 1880–1921.

Year.	Anthracite.[a]	Bituminous.	Year.	Anthracite.[a]	Bituminous	Year.	Anthracite.[a]	Bituminous.
1880	$1.47	$1.25	1894	$1.51	$0.91	1908	$1.90	$1.12
1881	2.01	1.12	1895	1.41	.86	1909	1.84	1.07
1882	2.01	1.12	1896	1.50	.83	1910	1.90	1.12
1883	2.01	1.07	1897	1.51	.81	1911	1.94	1.11
1884	1.79	.94	1898	1.41	.80	1912	2.11	1.15
1885	2.00	1.13	1899	1.46	.87	1913	2.13	1.18
1886	1.95	1.05	1900	1.49	1.04	1914	2.07	1.17
1887	2.01	1.11	1901	1.67	1.05	1915	2.07	1.13
1888	1.91	1.00	1902	1.84	1.12	1916	2.30	1.32
1889	1.44	.99	1903	2.04	1.24	1917	2.85	2.26
1890	1.43	.99	1904	1.90	1.10	1918	3.40	2.58
1891	1.46	.99	1905	1.83	1.06	1919	4.14	2.49
1892	1.57	.99	1906	1.85	1.11	1920	4.85	3.75
1893	1.59	.96	1907	1.91	1.14	1921	5.00	2.89

[a] Averages for anthracite represent amounts per net ton and include all coal produced.

FLUCTUATION IN VALUES AND PRICES.

The average value of bituminous coal declined 9 cents per net ton in 1919, as compared with 1918, when prices were largely determined by the maxima fixed by the United States Fuel Administration, which applied to all coal other than that covered by contracts entered into prior to August 21, 1917. Prices other than the contract prices just mentioned were under Government control during the first month of 1919, and the Fuel Administration's maxima were reestablished on the eve of the general strike in the organized bituminous coal fields and continued in effect until March 31, 1920. In 1919 prices were lowest in Ohio and Indiana and highest in Alaska and Michigan.

In 1920, when the postwar industrial boom was in full swing, when export demand was at its peak, when the coal industry was recovering from the strike of 1919, and when railroad service was crippled at the beginning of the coal year (April 1) by the so-called "outlaw" switchmen's strike, the average value of bituminous coal touched a new figure, $3.75 per ton, which exceeded the average for 1918 by $1.17 per ton. The lowest price during the year was that in North Dakota, $2.87 per ton. Wyoming ranked second and Illinois third from the bottom.

The general market conditions in 1921 were almost the direct antithesis of those in 1920. Industry as a whole was depressed, export demand was smaller, and the coal business suffered acutely from world-wide economic maladjustment. Nevertheless the average value for bituminous coal receded only 86 cents a ton, and the average for the year, $2.89, was exceeded only by that for 1920. The lowest State average was that in Georgia, and the highest were those in Alaska and North Carolina.

The averages for the United States as a whole furnish an index to the rise and fall in the value of coal, but in comparing the averages for individual States with those for other States the relative output and the commercial development must be taken into account. Thus, although Alaska, North Carolina, and Georgia had the highest average value in 1919, their output was comparatively small, and the fluctuations in those States and in Alaska over a period of years are much less significant than those in the great coal-producing States, such as Pennsylvania, West Virginia, Illinois, Ohio, Kentucky, Indiana, and Alabama.

The average value of anthracite per ton increased in each of the three years. In 1919 the increase was 74 cents; in 1920 (a year when wages were again advanced) it was 71 cents, and in 1921 it was 15 cents.

BITUMINOUS COAL AND LIGNITE LOADED FOR SHIPMENT BY RAILROADS AND WATERWAYS.

According to the reports made to the Geological Survey by the coal operators, the quantity of bituminous coal and lignite loaded for shipment by railroads in 1919 amounted to 397,444,815 net tons. The quantity loaded at the mines for shipment by waterways in the same year was 11,703,939 tons, and the total quantity so loaded for shipment by rail and water was 409,148,754 tons. In 1920 the total quantity loaded for shipment by all routes rose to 504,873,060 tons, but in the following year it dropped to 382,063,736 tons.

The shipments by rail, which are summarized by railroads in the accompanying tables, include all coal loaded on cars at the mines. A small part of the coal shipped is carried only a short distance, perhaps only switched from the tipple to coke ovens or to some adjacent industrial plant, but the greater part is moved a considerable distance from the mines. As these statistics include coal used by railroads that serve the coal mines, not all the shipments furnished revenue to the railroads, as coal for "company use" is nonrevenue freight. The statistics of coal traffic published by the railroad companies usually show only revenue freight and include coal received from connecting lines as well as that originating at mines on the line. For that reason the figures given in the following table may differ from those compiled by the railroads.

The railroads listed are those reported by the operators, and only a few reports of loadings on subsidiary roads have been consolidated under the name of the parent road. The shipments by the Coal & Coke Co. have been included under the Baltimore & Ohio; and those by the Vandalia, the Pittsburgh, Cincinnati, Chicago & St. Louis, the Pennsylvania Co., the Ohio River & Western, and the Wheeling Terminal have been included under the Pennsylvania System.

The quantities shown in the following table as shipped by waterways do not all agree with the statistics on river traffic published by the United States Engineer Office. The shipments of coal on Monongahela River, according to the United States Engineer Office at Pittsburgh, amounted to 14,629,000 tons in 1919 and 20,717,000 tons in 1920. The records of the Engineer Office should be accepted as a correct measure of the river traffic, and the differences between them and the reports of the operators to the Geological Survey are due to various causes, chiefly to the fact that shipments of coal loaded in cars at the mines and later transferred to boats would be classed by the Survey as "rail" and by the Engineer Office as "river."

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons.

1919.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad.			
Alabama Central	Alabama	32,146	32,146
Alabama Great Southern	do	41,074	41,074
Andrews Run	Pennsylvania	7,825	7,825
Arkansas Central	Arkansas	48,727	48,727
Arkansas Western	do	12,163	12,163
Ashland Coal & Iron	Kentucky	77,847	77,847
Atchison, Topeka & Santa Fe	Colorado	968,946	4,913,841
	Illinois	247,674	
	Kansas	1,367,217	
	Missouri	493,248	
	New Mexico	1,712,251	
	Oklahoma	124,505	
Atlanta, Birmingham & Atlantic	Alabama	741,860	741,860
Baltimore & Ohio (including Coal & Coke)	Illinois	1,444,541	34,590,486
	Indiana	288,530	
	Kentucky	135,988	
	Maryland	34,883	
	Ohio	8,663,423	
	Pennsylvania	10,383,515	
	West Virginia	13,639,606	
Bessemer & Lake Erie	Pennsylvania	3,171,402	3,171,402
Bevier & Southern	Missouri	187,263	187,263
Big Sandy & Cumberland	Kentucky	10,040	10,040
Big Sandy & Kentucky River	do	16,262	16,262
Birmingham Southern	Alabama	2,487,270	2,487,270
Book Cliff	Colorado	6,760	6,760
Buffalo & Susquehanna	Pennsylvania	1,295,334	1,295,334
Buffalo Creek & Gauley	West Virginia	346,000	346,000
Buffalo, Rochester & Pittsburgh	Pennsylvania	5,316,455	5,316,455
Cambria & Indiana	do	1,994,416	1,994,416
Campbell's Creek	West Virginia	373,410	373,410
Carolina, Clinchfield & Ohio	Kentucky	133,940	2,150,372
	Virginia	2,016,432	
Caseyville	Illinois	15,029	15,029
Central Indiana	Indiana	53,347	53,347
Central of Georgia	Alabama	650,240	665,268
	Georgia	15,028	
Cheat Haven & Bruceton	West Virginia	61,287	61,287
Chesapeake & Ohio	Kentucky	2,275,161	24,118,646
	West Virginia	21,843,485	
Chicago & Alton	Illinois	2,559,267	2,745,081
	Missouri	185,814	
Chicago & Eastern Illinois	Illinois	4,092,872	9,411,300
	Indiana	5,318,428	
Chicago & Illinois Midland	Illinois	1,350,895	1,350,895
Chicago & Northwestern	do	3,072,377	4,703,201
	Iowa	1,396,659	
	Wyoming	234,165	
Chicago, Burlington & Quincy	Colorado	404,691	13,050,297
	Illinois	9,506,930	
	Iowa	595,863	
	Missouri	477,440	
	Wyoming	2,065,373	
Chicago Great Western	Iowa	57,669	57,669
Chicago, Indianapolis & Louisville	Indiana	556,871	556,871
Chicago, Milwaukee & St. Paul	Illinois	815,494	2,576,634
	Iowa	847,412	
	Montana	804,833	
	North Dakota	47,498	
	South Dakota	450	
	Washington	60,947	
Chicago, Peoria & St. Louis	Illinois	431,449	431,449
Chicago, Rock Island & Gulf	Texas	31,723	31,723
Chicago, Rock Island & Pacific	Arkansas	110,140	2,560,325
	Colorado	5,774	
	Illinois	119,058	
	Iowa	1,283,050	
	Missouri	74,364	
	Oklahoma	967,939	
Chicago, Terre Haute & Southeastern	Indiana	4,046,838	4,046,838
Cincinnati, Indianapolis & Western	Illinois	37,679	94,264
	Indiana	56,585	
Cincinnati, New Orleans & Texas Pacific	Kentucky	125,957	336,505
	Tennessee	210,548	
Cleveland, Cincinnati, Chicago & St. Louis	Illinois	5,159,844	6,550,982
	Indiana	1,391,138	

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1919—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Colfax Northern	Iowa	104,458	104,458
Colorado & Southeastern	Colorado	485,477	485,477
Colorado & Southern	do	2,844,094	2,844,094
Colorado & Wyoming	do	297,328	297,328
Colorado Midland	do	6,050	6,050
Colorado, Wyoming & Eastern	do	47,267	47,267
Crystal River	do	6,300	6,300
Cumberland	Kentucky	106,370	106,370
Cumberland & Manchester	do	54,865	54,865
Cumberland & Pennsylvania	Maryland	1,729,034	1,776,632
	Pennsylvania	47,598	
Dardanelle & Russellville	Arkansas	98,098	98,098
Dayton Coal & Iron Co.'s R. R	Tennessee	26,717	26,717
Denver & Intermountain	Colorado	120,903	120,903
Denver & Rio Grande	do	2,400,519	5,121,796
	New Mexico	9,283	
	Utah	2,711,994	
Denver & Salt Lake	Colorado	1,129,699	1,129,699
Detroit, Bay City & Western	Michigan	30,978	30,978
Detroit, Toledo & Ironton	Ohio	235,273	235,273
East Broad Top	Pennsylvania	503,902	503,902
East St. Louis & Suburban	Illinois	478,630	478,630
Eastern Kentucky	Kentucky	41,264	41,264
El Paso & Southwestern	New Mexico	623,454	623,454
Elgin, Joliet & Eastern	Illinois	166,645	166,645
Erie	Ohio	94,489	1,430,889
	Pennsylvania	1,336,400	
Evansville & Indianapolis	Indiana	756,053	756,053
Evansville Suburban & Newburgh	do	142,598	142,598
Federal Valley	Ohio	104,071	104,071
Fort Dodge, Des Moines & Southern	Iowa	105,219	105,219
Fort Smith & Western	Oklahoma	93,751	93,751
Galveston, Harrisburg & San Antonio	Texas	7,739	7,739
Great Northern	Montana	897,175	1,007,522
	North Dakota	93,784	
	Washington	16,563	
Gulf, Colorado & Santa Fe	Texas	1,542	1,542
Harriman & Northeastern	Tennessee	197,345	197,345
Hartland Colliery	West Virginia	4,285	4,285
Hocking-Sunday Creek Traction	Ohio	5,604	5,604
Hocking Valley	do	4,310,990	4,310,990
Houston & Texas Central	Texas	79,003	79,003
Houston East & West Texas	do	890	890
Huntingdon & Broad Top Mountain	Pennsylvania	777,591	777,591
Illinois Central	Alabama	78,964	16,146,867
	Illinois	11,920,566	
	Indiana	446,795	
	Kentucky	3,700,542	
Illinois Southern	Illinois	50,490	50,490
Illinois Traction	do	432,461	432,461
Indian Creek Valley	Pennsylvania	295,461	295,461
Indian Creek & Northern	West Virginia	61,964	61,964
Indiana County Street	Pennsylvania	8,372	8,372
International & Great Northern	Texas	277,129	277,129
Interstate	Virginia	1,158,318	1,158,318
Interurban	Iowa	89,592	89,592
Iowa Southern Utilities	do	47,506	47,506
Johnstown & Stony Creek	Pennsylvania	133,434	133,434
Joplin & Pittsburg	Kansas	35,673	35,673
Kanawha & Michigan	Ohio	299,972	2,108,691
	West Virginia	1,808,719	
Kanawha & West Virginia	do	144,654	144,654
Kanawha Central	do	8,348	8,348
Kanawha, Glen Jean & Eastern	do	330,733	330,733
Kansas City, Clinton & Springfield	Missouri	12,287	12,287
Kansas City, Oklahoma & Gulf	Oklahoma	445,785	445,785
Kansas City Southern	Kansas	413,514	614,997
	Missouri	200,967	
	Oklahoma	516	
Kellys Creek & Northwestern	West Virginia	448,381	448,381
Kentucky & Tennessee	Kentucky	467,334	467,334
Lake Erie, Franklin & Clarion	Pennsylvania	413,989	413,989
Ligonier Valley	do	1,185,715	1,185,715

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1919—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Litchfield & Madison	Illinois	844,820	844,820
Long Fork	Kentucky	365,422	365,422
Louisville & Nashville	Alabama	3,053,582	19,787,699
	Illinois	847,658	
	Kentucky	14,520,162	
	Tennessee	803,309	
	Virginia	562,988	
Louisville, Henderson & St. Louis	Kentucky	88,709	88,709
McKeesport Connecting	Pennsylvania	4,660	4,660
M. E. McNeals	do	124,000	124,000
Marion & Eastern	Illinois	99,085	99,085
Mary Lee	Alabama	137,667	137,667
Michigan Central	Michigan	474,151	474,151
Midland Valley	Arkansas	320,437	437,556
	Oklahoma	117,119	
Millers Creek	Kentucky	360,786	360,786
Minneapolis & St. Louis	Illinois	590,092	912,300
	Iowa	322,208	
Minneapolis, St. Paul & Sault Ste. Marie	North Dakota	232,825	232,825
Missouri, Kansas & Texas	Kansas	319,649	2,030,448
	Missouri	147,830	
	Oklahoma	1,118,574	
	Texas	444,395	
Missouri Pacific	Arkansas	417,649	5,456,658
	Illinois	3,015,146	
	Kansas	1,080,992	
	Missouri	942,871	
Mobile & Ohio	Alabama	478,538	1,471,913
	Illinois	993,375	
Monongahela	Pennsylvania	4,244,662	5,831,988
	West Virginia	1,587,326	
Montana, Wyoming & Southern	Montana	439,574	439,574
Montour	Pennsylvania	3,196,770	3,196,770
Morehead & North Fork	Kentucky	32,955	32,955
Morgan & Fentress	Tennessee	68,942	68,942
Morgantown & Kingwood	West Virginia	540,705	540,705
Morgantown & Wheeling	do	761,208	761,208
Nashville, Chattanooga & St. Louis	Alabama	3,000	973,607
	Tennessee	970,607	
New Castle & Ohio River	Ohio	9,680	9,680
New Haven & Dunbar	Pennsylvania	104,578	104,578
New Mexico Midland	New Mexico	78,949	78,949
New York Central	Michigan	10,630	8,612,427
	Ohio	1,976,725	
	Pennsylvania	6,625,072	
Norfolk & Western	Kentucky	1,713,221	24,843,047
	Ohio	20,603	
	Virginia	2,345,417	
	West Virginia	20,763,806	
Northern Alabama	Alabama	415,706	415,706
Northern Pacific	Montana	746,038	2,855,529
	North Dakota	233,527	
	Washington	1,875,964	
Norton & Northern	Virginia	75,681	75,681
Ohio & Kentucky	Kentucky	62,324	62,324
Ohio River Electric Ry. & Power Co	Ohio	25,081	25,081
Ohio Service Electric	do	7,850	7,850
Oneida & Western	Tennessee	25,313	25,313
Oregon Short Line	Idaho	1,500	1,001,679
	Wyoming	1,000,179	
Oregon-Washington R. R. & Navigation Co	Washington	209,969	209,969
Owensboro City	Kentucky	120	120
Owensboro & Nashville	do	70,734	70,734
Pacific Coast	Washington	414,466	414,466
Pennsylvania System: (Includes Pittsburgh, Cincinnati, Chicago & St. Louis, Ohio River & Western, and Wheeling Terminal)	Illinois	643,026	70,710,112
	Indiana	5,108,939	
	Ohio	8,675,460	
	Pennsylvania	55,349,142	
	West Virginia	933,545	
Peoria & Pekin Union	Illinois	339,255	339,255
Peoria, Hanna City & Western	do	36,500	36,500
Peoria Railway Terminal	do	28,790	28,790
Pere Marquette	Michigan	385,504	385,504

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1919—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Peru, La Salle & Deer Park	Illinois	29,402	29,402
Pittsburgh & Lake Erie	Pennsylvania	5,427,583	5,427,583
Pittsburg & Shawmut	do	1,966,843	1,966,843
Pittsburgh & Susquehanna	do	209,843	209,843
Pittsburgh & West Virginia	Ohio	623,801	1,623,785
	Pennsylvania	813,858	
	West Virginia	186,126	
Pittsburgh, Butler, Harriman & New Castle	Pennsylvania	4,020	4,020
Pittsburgh, Chartiers & Youghiogheny	do	831,259	831,259
Pittsburg County Electric	Oklahoma	13,426	13,426
Pittsburgh, Lisbon & Western	Ohio	21,499	98,416
	Pennsylvania	76,917	
Pittsburg, Shawmut & Northern	do	485,091	485,091
Poteau Valley	Oklahoma	51,720	51,720
Preston	Maryland	3,041	49,116
	West Virginia	46,075	
Puget Sound Electric	Washington	103,335	103,335
Quincy, Omaha & Kansas City	Missouri	9,141	9,141
Reynoldsville & Falls Creek	Pennsylvania	586,776	586,776
Rio Grande & Eagle Pass	Texas	71,175	71,175
Rio Grande & Southwestern	New Mexico	3,590	3,590
Rio Grande Southern	Colorado	82,201	82,201
Rockcastle River	Kentucky	1,703	1,703
Rock Island Southern	Illinois	140,335	140,335
St. Louis & Belleville Electric	do	348,444	348,444
St. Louis & Hannibal	Missouri	12,819	12,819
St. Louis & O'Fallon	Illinois	534,511	534,511
St. Louis-San Francisco	Alabama	2,088,701	4,910,574
	Arkansas	344,052	
	Kansas	1,689,685	
	Missouri	259,177	
	Oklahoma	528,959	
St. Louis Southwestern Ry. of Texas	Texas	102,960	102,960
St. Louis, Troy & Eastern	Illinois	1,022,544	1,022,544
San Antonio Southern	Texas	3,429	3,429
Sandy Valley & Elkhorn	Kentucky	1,557,439	1,557,439
Santa Fe, Raton & Eastern	New Mexico	155,520	155,520
Scootac	Pennsylvania	26,382	26,382
Seaboard Air Line	Alabama	7,537	7,537
Sewell Valley	West Virginia	124,179	124,179
Southeastern Ohio	Ohio	5,874	5,874
Southern	Alabama	3,097,104	8,833,564
	Illinois	1,111,211	
	Indiana	1,207,621	
	Kentucky	367,049	
	Tennessee	1,894,909	
	Virginia	1,155,670	
Southern Illinois Ry. & Power Co	Illinois	26,260	26,260
Southern Pacific	California	948	27,845
	Oregon	10,917	
	Texas	15,980	
Springfield Terminal	Illinois	223,879	223,879
Steubenville, East Liverpool & Beaver Valley	Pennsylvania	18,248	18,248
Strouds Creek & Muddlety	West Virginia	22,947	22,947
Susquehanna & New York	Pennsylvania	85	85
Tennessee	Tennessee	46,216	46,216
Tennessee Central	do	500,637	500,637
Texas & Pacific	Texas	515,043	515,043
Texas Short Line	do	78,787	78,787
Thomas & Sayreton	Alabama	331,893	331,893
Toledo & Ohio Central	Ohio	2,553,888	2,553,888
Toledo, Peoria & Western	Illinois	126,659	126,659
Toledo, St. Louis & Western	do	391,120	399,099
	Indiana	7,979	
Trinidad Electric	Colorado	15,027	15,027
Uintah	do	11,692	11,692
Union	Pennsylvania	156,627	156,627
Union Pacific	Colorado	605,392	4,303,029
	Kansas	12,924	
	Missouri	28,911	
	Utah	49,014	
	Wyoming	3,606,788	
Unity	Pennsylvania	413,876	413,876

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1919—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Ursina & North Fork	Pennsylvania	13,841	13,841
Utah	Utah	1,178,344	1,178,344
Virginian	Virginia	750	5,841,918
	West Virginia	5,841,168	
Wabash	Illinois	2,156,475	2,538,566
	Missouri	382,091	
Wabash, Chester & Western	Illinois	74,044	74,044
Washington Run	Pennsylvania	74,816	74,816
West Side Belt	do	1,615,975	1,615,975
West Virginia Midland	West Virginia	4,600	4,600
West Virginia Northern	do	330,510	330,510
Western Allegheny	Pennsylvania	205,898	205,898
Western Maryland	Maryland	1,127,982	4,392,592
	Pennsylvania	560,617	
	West Virginia	2,703,993	
Wheeling & Lake Erie	Ohio	3,457,807	3,457,807
Williamson & Pond Creek	Kentucky	1,250,757	1,250,757
Wingfield	Tennessee	2,898	2,898
Woodstock & Blocton	Alabama	143,634	143,634
Youngstown & Interurban	Ohio	2,850	2,850
Youngstown & Ohio River	do	196,308	196,308
Zanesville & Western	do	1,677,215	1,677,215
Unspecified	Alaska	54,550	760,190
	Indiana	36,958	
	Maryland	4,991	
	North Carolina	3,229	
	Utah	112,162	
	Virginia	243,251	
	Wyoming	87	
	Unspecified—private roads.	304,962	
Total railroad shipments		397,444,815	397,444,815
Waterway.			
Great Kanawha River	West Virginia	152,419	152,419
Green River	Kentucky	30,098	30,098
Kanawha River	West Virginia	258,301	258,301
Kentucky River	Kentucky	42,803	42,803
Monongahela River	Pennsylvania	10,681,532	10,681,532
Ohio River	Indiana	5,064	426,647
	Kentucky	297,921	
	Ohio	84,377	
	West Virginia	39,285	
Warrior River	Alabama	80,764	80,764
Miscellaneous	Alaska	3,126	3,126
	Illinois	15,519	15,519
	Ohio	1,263	1,263
	Pennsylvania	10,967	10,967
	West Virginia	500	500
Total waterway shipments		11,703,939	11,703,939
Grand total		409,148,754	409,148,754

1920.

Route.	State.	By States.	Total for route.
Railroad.			
Alabama, Birmingham & Atlantic	Alabama	115,031	115,031
Alabama Central	do	6,500	6,500
Alabama Great Southern	do	76,561	76,561
Altoona & Northern	Pennsylvania	7,877	7,877
Arkansas Central	Arkansas	65,147	65,147
Arkansas Western	do	23,240	23,240
Ashland Coal & Iron	Kentucky	134,926	134,926
Atchison, Topeka & Santa Fe	Colorado	1,275,450	5,772,714
	Illinois	294,129	
	Kansas	1,323,278	
	Missouri	675,188	
	New Mexico	2,042,691	
	Oklahoma	161,978	

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1920—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Baltimore & Ohio (including Coal & Coke)	Illinois	1,772,087	41,750,998
	Indiana	363,571	
	Kentucky	52,505	
	Maryland	99,546	
	Ohio	11,339,591	
	Pennsylvania	11,018,028	
	West Virginia	17,105,670	
Bellingham & Northern	Washington	101,927	101,927
Bessemer & Lake Erie	Pennsylvania	4,127,956	4,127,956
Bevier & Southern	Missouri	487,629	487,629
Big Sandy & Cumberland	Kentucky	11,711	11,711
Big Sandy & Kentucky River	do	19,603	19,603
Book Cliff	Colorado	11,061	11,061
Buffalo Creek & Gauley	West Virginia	295,878	295,878
Buffalo, Rochester & Pittsburgh	Pennsylvania	8,164,642	8,164,642
Buffalo & Susquehanna	do	1,906,522	1,906,522
Cambria & Indiana	do	2,292,730	2,292,730
Campbell's Creek	West Virginia	550,274	550,274
Carolina, Clinchfield & Ohio	Kentucky	152,095	2,544,890
	Virginia	2,392,795	
Caseyville	Illinois	41,327	41,327
Central Indiana	Indiana	112,385	112,385
Central of Georgia	Alabama	654,611	670,572
	Georgia	15,961	
Chattanooga & Mont Lake	Tennessee	29,227	29,227
Cheat Haven & Bruceton	West Virginia	143,976	143,976
Chesapeake & Ohio	Kentucky	2,789,067	27,398,599
	West Virginia	24,609,532	
Chicago & Alton	Illinois	3,814,357	4,035,964
	Missouri	221,607	
Chicago & Great Western	Iowa	25,654	25,654
Chicago & Illinois Midland	Illinois	1,930,500	1,930,500
Chicago & Northwestern	do	6,156,905	8,339,024
	Iowa	1,888,774	
	Wyoming	293,345	
Chicago & Eastern Illinois	Illinois	5,860,444	13,865,141
	Indiana	8,004,697	
Chicago, Burlington & Quincy	Colorado	443,713	17,972,648
	Illinois	13,210,740	
	Iowa	1,028,234	
	Missouri	642,272	
	Wyoming	2,647,689	
Chicago, Indianapolis & Louisville	Indiana	2,364,468	2,364,468
Chicago, Milwaukee & St. Paul	Illinois	834,973	3,262,789
	Iowa	1,217,990	
	Missouri	35,575	
	Montana	1,090,733	
	North Dakota	63,540	
	South Dakota	232	
	Washington	19,746	
Chicago, Peoria & St. Louis	Illinois	895,726	895,726
Chicago, Rock Island & Pacific	Arkansas	347,790	3,470,394
	Colorado	45,296	
	Illinois	188,342	
	Iowa	1,544,715	
	Missouri	60,194	
	Oklahoma	1,244,664	
	Texas	39,393	
Chicago, Terre Haute & Southeastern	Indiana	5,199,097	5,199,097
Cincinnati, Indiana & Western	Illinois	283,211	378,228
	Indiana	95,017	
Cincinnati, New Orleans & Texas Pacific	Kentucky	114,228	266,493
	Tennessee	152,265	
Cleveland, Cincinnati, Chicago & St. Louis	Illinois	7,623,611	8,746,235
	Indiana	1,122,624	
Colfax & Northern	Iowa	189,961	189,961
Colorado Midland	Colorado	377	377
Colorado & Southeastern	do	702,978	702,978
Colorado & Southern	do	3,411,124	3,411,124
Colorado & Wyoming	do	263,617	263,617
Colorado, Wyoming & Eastern	do	50,905	50,905
Cumberland	Kentucky	117,675	117,675
Cumberland & Manchester	do	123,593	123,593

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1920—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Cumberland & Pennsylvania	Maryland	2,323,610	2,394,208
	Pennsylvania	70,598	
Dardanelle & Russellville	Arkansas	92,404	92,404
Denver & Intermountain	Colorado	153,867	153,867
Denver & Rio Grande	Colorado	3,117,990	6,774,602
	New Mexico	14,136	
	Utah	3,642,476	
Denver & Salt Lake	Colorado	906,212	906,212
Detroit, Bay City & Western	Michigan	72,771	72,771
Detroit, Toledo & Ironton	Ohio	554,109	554,109
East Broad Top	Pennsylvania	611,182	611,182
East St. Louis Suburban	Illinois	895,216	895,216
Eastern Kentucky	Kentucky	57,778	57,778
Eastern Railway & Lumber Co	Washington	30,486	30,486
El Paso & Southwestern	New Mexico	816,607	816,607
Elgin, Joliet & Eastern	Illinois	199,310	199,310
Erie	Ohio	73,964	1,689,203
	Pennsylvania	1,615,239	
Evansville, Indiana & Terre Haute	Indiana	1,205,535	1,205,535
Evansville & Ohio	do	113,035	113,035
Evansville Suburban & Newburg	do	302,686	302,686
Federal Valley	Ohio	117,080	117,080
Fort Dodge, Des Moines & Western	Iowa	98,477	98,477
Fort Smith, Subiaco & Rock Island	Arkansas	14,560	14,560
Fort Smith & Western	Oklahoma	83,341	83,341
Galveston, Houston & San Antonio	Texas	31,919	31,919
Gauley	Washington	76,708	76,708
Great Northern	Montana	1,321,202	1,500,815
	North Dakota	167,782	
	Washington	11,831	
Gulf, Colorado & Santa Fe	Texas	3,600	3,600
Harmony Street	Pennsylvania	5,000	5,000
Harriman & Northeastern	Tennessee	246,918	246,918
Hartland Colliery	West Virginia	39,677	39,677
Hocking-Sunday Creek Traction	Ohio	3,372	3,372
Hocking Valley	do	6,317,352	6,317,352
Houston & Texas Central	Texas	95,474	95,474
Houston East & West Texas	do	19,050	19,050
Huntingdon & Broad Top Mountain	Pennsylvania	778,448	778,448
Illinois Central	Alabama	86,916	21,816,011
	Illinois	16,508,375	
	Indiana	490,857	
	Kentucky	4,729,863	
Illinois Southern	Illinois	3,105	3,105
Illinois Traction	do	987,200	987,200
Indiana County Street Railway	Pennsylvania	5,330	5,330
Indiana Creek Valley	do	242,163	242,163
International & Great Northern	Texas	356,289	356,289
Interstate	Virginia	1,911,767	1,911,767
Interurban	Iowa	325,373	325,373
Iowa Southern Utilities	do	134,296	134,296
Johnstown & Stony Creek	Pennsylvania	317,851	317,851
Joplin & Pittsburg	Kansas	55,223	55,223
Kanawha Central	West Virginia	11,000	11,000
Kanawha, Glen Jean & Eastern	do	348,094	348,094
Kanawha & Michigan	Ohio	1,089,879	3,806,453
	West Virginia	2,716,574	
Kanawha & West Virginia	do	251,390	251,390
Kansas City, Clinton & Springfield	Missouri	18,594	18,594
Kansas City Southern	Kansas	424,011	745,498
	Missouri	235,756	
	Oklahoma	85,731	
Kansas, Oklahoma & Gulf	do	620,393	620,393
Kentucky Midland	Kentucky	124,961	124,961
Kentucky, Rock Castle & Cumberland	do	7,000	7,000
Kentucky & Tennessee	do	633,500	633,500
Lake Erie & Western	Illinois	80	80
Lake Erie, Franklin & Clarion	Pennsylvania	461,297	461,297
Ligonier Valley	do	1,037,505	1,037,505
Litchfield & Madison	Illinois	1,344,912	1,344,912
Long Fork	Kentucky	645,000	645,000
Louisville, Henderson & St. Louis	do	153,804	153,804

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1920—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Louisville & Nashville	Alabama	3,152,857	23,445,893
	Illinois	1,358,522	
	Kentucky	17,817,115	
	Tennessee	931,135	
	Virginia	186,264	
M. E. McNeals	Pennsylvania	107,562	107,562
Manns Creek	West Virginia	56,758	56,758
Marion & Eastern	Illinois	230,010	230,010
Michigan Central	Michigan	667,762	667,762
Midland Valley	Arkansas	339,438	572,637
	Oklahoma	233,199	
Millers Creek	Kentucky	319,957	319,957
Minneapolis & St. Louis	Illinois	1,115,982	1,433,107
	Iowa	317,125	
Minneapolis, St. Paul & Sault Ste. Marie	North Dakota	232,913	232,913
Missouri, Kansas & Texas	Kansas	379,225	2,241,699
	Missouri	205,102	
	Oklahoma	1,274,531	
	Texas	382,841	
Missouri Pacific	Arkansas	613,522	6,703,818
	Illinois	3,503,193	
	Kansas	1,344,474	
	Missouri	1,239,629	
	Oklahoma	3,000	
Mobile & Ohio	Alabama	576,669	2,002,487
	Illinois	1,425,818	
Monongahela	Pennsylvania	4,506,286	6,740,851
	West Virginia	2,234,565	
Monongahela Valley Traction	Ohio	4,192	11,591
	West Virginia	7,399	
Montana, Wyoming & Southern	Montana	726,392	726,392
Montour	Pennsylvania	4,081,725	4,081,725
Morehead & North Fork	Kentucky	8,227	8,227
Morgan & Fentress	Tennessee	87,622	87,622
Morgan Run	Ohio	4,428	4,428
Morgantown & Kingwood	West Virginia	748,743	748,743
Morgantown & Wheeling	do	1,088,970	1,088,970
Nashville, Chattanooga & St. Louis	Alabama	6,000	1,432,923
	Tennessee	1,426,923	
New Castle & Ohio River	Ohio	9,053	9,053
New Haven & Dunbar	Pennsylvania	141,610	141,610
New Mexico Central	New Mexico	15,767	15,767
New Mexico Midland	do	80,407	80,407
New York Central	Michigan	16,500	11,196,971
	Ohio	2,705,387	
	Pennsylvania	8,475,084	
Norfolk & Western	Kentucky	2,414,975	25,382,406
	Ohio	42,970	
	Virginia	2,825,745	
	West Virginia	20,098,716	
Northern Alabama	Alabama	609,288	609,288
Northern Pacific	Montana	943,954	3,770,401
	North Dakota	282,054	
	Washington	2,544,393	
Norton & Northern	Virginia	31,369	31,369
Ohio & Kentucky	Kentucky	139,565	139,565
Ohio River Electric Ry. & Power Co	Ohio	58,224	58,224
Ohio Service Electric	do	21,608	21,608
Oneida & Western	Tennessee	21,006	21,006
Oregon Short Line	Wyoming	1,388,150	1,388,150
Oregon-Washington R. R. & Navigation Co	Washington	255,551	255,551
Pacific Coast	do	454,448	454,448
Pennsylvania System	Illinois	1,134,614	75,279,891
Includes Pittsburgh, Cincinnati, Chicago & St. Louis, Ohio River & Western, and Wheeling Terminal.	Indiana	6,210,643	
	Ohio	8,836,749	
	Pennsylvania	57,875,126	
	West Virginia	1,222,759	
Peoria & Pekin Union	Illinois	842,203	842,203
Peoria, Hanna City & Western	do	171,513	171,513
Peoria Railway Terminal	do	17,070	17,070
Pere Marquette	Michigan	629,653	629,653
Peru, La Salle & Deer Park	Illinois	40,981	40,981
Pittsburgh & Lake Erie	Pennsylvania	4,973,749	4,973,749
Pittsburg & Shawmut	do	2,604,660	2,604,660
Pittsburgh & Susquehanna	do	261,981	261,981

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1920—Continued.

Route.	State.	Quantity.	
		By States.	Total for route.
Railroad—Continued.			
Pittsburgh & West Virginia	Ohio	957,641	2,293,390
	Pennsylvania	1,105,068	
	West Virginia	230,681	
Pittsburgh, Chartiers & Youghiogheny	Pennsylvania	729,293	729,293
Pittsburgh, Lisbon & Western	Ohio	47,506	162,025
	Pennsylvania	114,519	
Pittsburg, Shawmut & Northern	do	747,620	747,620
Preston	Maryland	16,149	189,604
	West Virginia	173,455	
Puget Sound Electric	Washington	52,402	52,402
Quincy, Omaha & Kansas City	Missouri	12,167	12,167
Reynoldsville & Falls Creek	Pennsylvania	382,438	382,438
Rio Grande & Eagle Pass	Texas	69,586	69,586
Rio Grande & Southwestern	New Mexico	2,400	2,400
Rock Island Southern	Illinois	197,948	197,948
Rural Valley	Pennsylvania	837,446	837,446
St. Louis & Belleville Electric	Illinois	513,664	513,664
St. Louis & Hannibal	Missouri	9,713	9,713
St. Louis & Iron Mountain	Arkansas	38,927	38,927
St. Louis & O'Fallon	Illinois	984,895	984,895
St. Louis-San Francisco	Alabama	2,325,308	6,015,514
	Arkansas	484,888	
	Kansas	2,024,121	
	Missouri	291,597	
	Oklahoma	889,600	
St. Louis Southwestern	Texas	92,456	92,456
St. Louis, Troy & Eastern	Illinois	1,479,071	1,479,071
San Antonio & Aransas Pass	Texas	410	410
San Antonio Southern	do	26,518	26,518
Sandy Valley & Elkhorn	Kentucky	1,344,532	1,344,532
Santa Fe, Raton & Eastern	New Mexico	175,260	175,260
Scootac	Pennsylvania	36,987	36,987
Seaboard Air Line	Alabama	10,887	10,887
Sewell Valley	West Virginia	81,558	81,558
Southeastern & Ohio River	Ohio	3,012	3,012
Southern	Alabama	3,257,233	11,752,415
	Illinois	1,464,625	
	Indiana	2,024,157	
	Kentucky	797,529	
	Tennessee	2,210,339	
	Virginia	1,998,532	
Southern Illinois Ry. & Power Co	Illinois	28,260	28,260
Springfield Terminal	do	499,185	499,185
Strouds Creek & Muddlety	West Virginia	37,426	37,426
Susquehanna & New York	Pennsylvania	5,601	5,601
Tennessee	Tennessee	121,006	121,006
Tennessee Central	do	821,665	821,665
Tennessee Coal, Iron & R. R. Co	Alabama	2,383,529	2,383,529
Texas Pacific	Texas	347,132	347,132
Texas Short Line	do	76,432	76,432
Thomas & Sayreton	Alabama	435,923	435,923
Toledo & Ohio Central	Ohio	3,268,915	3,268,915
Toledo, Peoria & Western	Illinois	310,509	310,509
Toledo, St. Louis & Western	Illinois	725,632	730,582
	Indiana	4,950	
Trinidad Electric	Colorado	7,986	7,986
Uintah	do	265	265
Union	Pennsylvania	252,822	252,822
Union Pacific	Colorado	859,905	5,920,381
	Kansas	36,484	
	Missouri	29,006	
	Utah	60,159	
	Wyoming	4,934,827	
Unity	Pennsylvania	453,900	453,900
Ursina & North Fork	do	30,872	30,872
Utah	Utah	1,752,332	1,752,332
Virginian	Virginia	7,350	7,350
	West Virginia	6,814,188	6,814,188
Wabash	Illinois	3,462,436	4,268,620
	Iowa	158,615	
	Missouri	647,569	
Wabash, Chester & Western	Illinois	201,811	201,811
Washington Run	Pennsylvania	99,922	99,922
Western Allegheny	do	231,635	231,635

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1920—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Western Maryland	Maryland	1,476,028	5,908,692
	Pennsylvania	835,651	
	West Virginia	3,597,013	
West Virginia Midland	do	5,680	5,680
West Side Belt	Pennsylvania	1,682,037	1,682,037
West Virginia & Northern	West Virginia	504,500	504,500
Wheeling & Lake Erie	Ohio	4,680,673	4,680,673
Wichita Falls & Southern	Texas	34,609	34,609
Williamson & Pond Creek	Kentucky	353,105	353,105
Woodstock & Blocton	Alabama	189,072	189,072
Woodward Iron Co	do	774,817	774,817
Youngstown & Ohio River	Ohio	366,455	366,455
Youngstown & Suburban Electric	do	3,000	3,000
Zanesville & Western	do	1,690,773	1,690,773
Unspecified	Alaska	58,522	93,571
	California	208	
	North Carolina	8,660	
	Oklahoma	4,000	
	Oregon	11,854	
	Pennsylvania	6,441	
	West Virginia	3,072	
	Wyoming	814	
Total railroad shipments		490,122,556	490,122,556
Waterway.			
Allegheny River	Pennsylvania	189,906	189,906
Kanawha River	West Virginia	560,863	560,863
Kentucky River	Kentucky	68,394	68,394
Monongahela River	Pennsylvania	13,312,754	13,312,754
Ohio River	Indiana	1,846	463,072
	Kentucky	307,636	
	Ohio	56,704	
	West Virginia	96,886	
Warrior River	Alabama	95,941	95,941
Miscellaneous	Illinois	21,537	59,574
	Kentucky	26,817	
	Ohio	2,254	
	Oregon	1,126	
	Tennessee	7,840	
Total waterway shipments		14,750,504	14,750,504
Grand total		504,873,060	504,873,060

1921.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad.			
Akron, Canton & Youngstown	Ohio	1,100	1,100
Alabama Central	Alabama	24,258	24,258
Alabama Great Southern	do	53,661	53,661
Alaska Railroad	Alaska	70,699	70,699
Altoona & Northern	Pennsylvania	16,424	16,424
Arkansas Central	Arkansas	33,763	33,763
Ashland Coal & Iron	Kentucky	57,974	57,974
Atchison, Topeka & Santa Fe	Colorado	646,429	3,879,293
	Illinois	274,310	
	Kansas	981,238	
	Missouri	513,754	
	New Mexico	1,404,589	
	Oklahoma	58,973	
Atlanta, Birmingham & Atlantic	Alabama	13,592	13,592
Baltimore & Ohio (including Coal & Coke)	Illinois	1,091,749	30,141,885
	Indiana	327,074	
	Kentucky	50,762	
	Maryland	5,089	
	Ohio	8,555,117	
	Pennsylvania	8,555,631	
	West Virginia	11,556,463	
Bessemer & Lake Erie	Pennsylvania	2,541,271	2,541,271

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1921—Continued.

Route.	State.	Quantity.	
		By States.	Total for route.
Railroad—Continued.			
Bevier & Southern	Missouri	297,206	297,206
Big Sandy & Cumberland	Kentucky	7,200	7,200
Big Sandy & Kentucky River	do	8,067	8,067
Book Cliff	Colorado	8,144	8,144
Buffalo & Susquehanna	Pennsylvania	1,032,385	1,032,385
Buffalo Creek & Gauley	West Virginia	493,210	493,210
Buffalo, Rochester & Pittsburgh	Pennsylvania	3,391,693	3,391,693
Cambria & Indiana	do	1,720,385	1,720,385
Campbell's Creek	West Virginia	529,718	529,718
Carolina, Clinchfield & Ohio	Kentucky	29,017	1,844,929
	Virginia	1,815,912	
Caseyville	Illinois	25,146	25,146
Central Indiana	Indiana	2,930	2,930
Central of Georgia	Alabama	614,809	633,564
	Georgia	18,755	
Chaffee	Maryland	54,279	54,279
Chattanooga & Montlake	Tennessee	19,645	19,645
Cheat Haven & Bruceton	West Virginia	147,165	147,165
Chesapeake & Ohio	Kentucky	1,788,799	23,229,094
	West Virginia	21,440,295	
Cheswick & Harmar	Pennsylvania	239,539	239,539
Chicago & Alton	Illinois	3,376,432	3,537,513
	Missouri	161,081	
Chicago & Eastern Illinois	Illinois	4,542,644	9,686,293
	Indiana	5,143,649	
Chicago & Illinois Midland	Illinois	2,210,753	2,210,753
Chicago & Northwestern	Illinois	3,714,150	5,257,900
	Iowa	1,303,198	
	Wyoming	240,552	
Chicago, Burlington & Quincy	Colorado	418,620	14,225,652
	Illinois	11,535,435	
	Iowa	405,328	
	Missouri	449,210	
	Wyoming	1,417,059	
Chicago Great Western	Iowa	13,989	13,989
Chicago, Indianapolis & Louisville	Indiana	1,240,954	1,240,954
Chicago, Milwaukee & St. Paul	Illinois	556,765	6,179,829
	Indiana	4,157,073	
	Iowa	513,231	
	Missouri	50,250	
	Montana	641,931	
	North Dakota	87,999	
	South Dakota	450	
	Washington	172,130	
Chicago, Peoria & St. Louis	Illinois	352,101	352,101
Chicago, Rock Island & Pacific	Arkansas	86,718	1,894,871
	Colorado	27,574	
	Illinois	50,882	
	Iowa	736,552	
	Missouri	15,253	
	Oklahoma	926,775	
	Texas	51,117	
Chicago, Terre Haute & Southeastern	Indiana	86,229	86,229
Cincinnati, Indianapolis & Western	Illinois	136,124	178,321
	Indiana	42,197	
Cincinnati, New Orleans & Texas Pacific	Kentucky	11,412	185,561
	Tennessee	174,149	
Cleveland, Cincinnati, Chicago & St. Louis	Illinois	5,646,545	6,547,356
	Indiana	900,811	
Colfax Northern	Iowa	83,846	83,846
Colorado & Southern	Colorado	2,680,047	2,680,047
Colorado & Wyoming	do	349,939	349,939
Colorado, Wyoming & Eastern	do	42,092	42,092
Cumberland	Kentucky	137,752	137,752
Cumberland & Manchester	do	131,584	131,584
Cumberland & Pennsylvania	Maryland	1,169,600	1,176,920
	Pennsylvania	7,320	
Denver & Intermountain	Colorado	113,771	113,771
Denver & Rio Grande Western	do	2,386,111	5,021,977
	New Mexico	15,766	
	Utah	2,620,100	
Denver & Salt Lake	Colorado	826,207	826,207
Detroit, Bay City & Western	Michigan	28,615	28,615
Detroit, Toledo & Ironton	Ohio	74,637	74,637

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1921—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
East Broad Top	Pennsylvania	267,985	267,985
Eastern Kentucky	Kentucky	7,001	7,001
Eastern Ry. & Lumber Co	Washington	27,925	27,925
East St. Louis & Suburban	Illinois	429,198	429,198
Elgin, Joliet & Eastern	do	162,737	162,737
El Paso & Southwestern	New Mexico	661,904	661,904
Erie	Ohio	104,606	1,732,034
	Pennsylvania	1,627,428	
Evansville & Indianapolis	Indiana	42	42
Evansville, Indianapolis & Terre Haute	do	944,092	944,092
Evansville & Ohio Valley	do	13,395	13,395
Evansville Suburban & Newburgh	do	159,454	159,454
Federal Valley	Ohio	138,516	138,516
Fort Dodge, Des Moines & Southern	Iowa	52,713	52,713
Fort Smith & Western	Oklahoma	72,429	72,429
Fort Smith, Subiaco & Rock Island	Arkansas	3,800	3,800
Galveston, Harrisburg & San Antonio	Texas	27,057	27,057
Great Northern	Montana	661,309	842,258
	North Dakota	156,893	
	Washington	24,056	
Greenbrier & Eastern	West Virginia	57,271	57,271
Gulf, Colorado & Santa Fe	Texas	9,972	9,972
Harriman & Northeastern	Tennessee	155,812	155,812
Hartland Colliery	West Virginia	29,209	29,209
Hocking-Sunday Creek Traction	Ohio	1,636	1,636
Hocking Valley	do	2,768,459	2,768,459
Houston & Texas Central	Texas	104,134	104,134
Houston East & West Texas	do	53,715	53,715
Huntingdon & Broad Top Mountain	Pennsylvania	396,581	396,581
Illinois Central	Alabama	52,189	18,113,884
	Illinois	13,755,836	
	Indiana	445,430	
	Kentucky	3,860,429	
Illinois Traction	Illinois	712,820	712,820
Indiana County Street Railway	Pennsylvania	2,686	2,686
Indian Creek Valley	do	271,717	271,717
International & Great Northern	Texas	152,072	152,072
Interstate	Virginia	1,619,382	1,619,382
Interurban	Indiana	500	211,555
	Iowa	211,055	
Iowa & St. Louis	Missouri	48,247	48,247
Iowa Southern Utilities	Iowa	63,880	63,880
Johnstown & Stony Creek	Pennsylvania	371,666	371,666
Joplin & Pittsburg	Kansas	16,455	16,455
Kanawha & Michigan	Ohio	756,913	2,631,579
	West Virginia	1,874,666	
Kanawha & West Virginia	do	38,474	38,474
Kanawha Central	do	11,147	11,147
Kanawha, Glen Jean & Eastern	do	388,069	388,069
Kansas City, Clinton & Springfield	Missouri	14,106	14,106
Kansas City Northwestern	do	32,000	32,000
Kansas City Southern	Kansas	288,418	514,894
	Missouri	122,502	
	Oklahoma	103,974	
Kansas, Oklahoma & Gulf	do	305,534	305,534
Kelly's Creek	West Virginia	237,058	237,058
Kentucky & Tennessee	Kentucky	526,934	526,934
Kentucky Midland	do	79,938	79,938
Kentucky, Rockcastle & Cumberland	do	23,543	23,543
Lake Erie, Franklin & Clarion	Pennsylvania	404,713	404,713
Ligonier Valley	do	865,462	865,462
Litchfield & Madison	Illinois	718,205	718,205
Long Fork	Kentucky	357,753	357,753
Louisville & Nashville	Alabama	2,709,803	22,938,291
	Illinois	905,130	
	Kentucky	18,634,962	
	Tennessee	653,249	
	Virginia	35,147	
Louisville, Henderson & St. Louis	Kentucky	15,456	15,456
McKeesport Connecting	Pennsylvania	784	784
Mary Lee	Alabama	283,317	283,317
Madisonville, Hartford & Eastern	Kentucky	19,041	19,041
Michigan Central	Michigan	631,491	631,491
Midland Valley	Arkansas	244,689	399,478
	Oklahoma	154,789	

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1921—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Millers Creek	Kentucky	350,148	350,148
Minneapolis & St. Louis	Illinois	868,104	1,132,454
	Iowa	264,350	
Minneapolis, St. Paul & Sault Ste. Marie	North Dakota	197,059	197,059
Missouri-Illinois	Illinois	184,066	184,066
Missouri, Kansas & Texas	Kansas	143,277	1,315,531
	Missouri	105,073	
	Oklahoma	803,434	
	Texas	263,747	
Missouri Pacific	Arkansas	568,481	5,015,365
	Illinois	2,974,790	
	Kansas	714,231	
	Missouri	754,363	
	Oklahoma	3,500	
Mobile & Ohio	Alabama	202,780	1,698,551
	Illinois	1,495,771	
Monongahela	Pennsylvania	3,161,218	5,619,336
	West Virginia	2,458,118	
Monongahela Power & Ry	Ohio	995	995
Montana, Wyoming & Southern	Montana	429,309	429,309
Montour	Pennsylvania	3,142,784	3,142,784
Morehead & North Fork	Kentucky	7,948	7,948
Morgan & Fentress	Tennessee	83,427	83,427
Morgan Run	Ohio	1,372	1,372
Morgantown	West Virginia	11,480	11,480
Morgantown & Kingwood	do	133,667	133,667
Morgantown & Wheeling	do	1,385,948	1,385,948
Nashville, Chattanooga & St. Louis	Alabama	811	977,320
	Tennessee	976,509	
New Castle & Ohio River	Ohio	2,175	2,175
New Haven & Dunbar	Pennsylvania	74,791	74,791
New Mexico Central	New Mexico	12,707	12,707
New Mexico Midland	do	77,281	77,281
New York Central	Michigan	9,200	7,195,915
	Ohio	1,852,546	
	Pennsylvania	5,334,169	
Norfolk & Western	Kentucky	2,073,641	22,122,210
	Ohio	1,806	
	Virginia	2,060,967	
	West Virginia	17,985,796	
Norfolk Southern	North Carolina	20,000	20,000
Northern Alabama	Alabama	523,739	523,739
Northern Maryland & Tidewater	Maryland	5,942	5,942
Northern Pacific	Montana	759,795	2,591,631
	North Dakota	258,999	
	Washington	1,572,837	
Norton & Northern	Virginia	12,000	12,000
Ohio & Kentucky	Kentucky	21,882	21,882
Ohio River Electric Ry. & Power Co	Ohio	1,914	1,914
Oneida & Western	Tennessee	22,050	22,050
Oregon Short Line	Wyoming	1,224,188	1,224,188
Oregon-Washington R. R. & Navigation Co	Washington	254,694	254,694
Pacific Coast	do	160,146	160,146
Pennsylvania System: Includes Pittsburgh, Cincinnati, Chicago & St. Louis, Ohio River & Western, and Wheeling Terminal.	Illinois	981,192	62,262,427
	Indiana	4,447,463	
	Ohio	7,690,760	
	Pennsylvania	48,410.234	
	West Virginia	732,778	
Peoria & Pekin Union	Illinois	548,508	548,508
Peoria Railway Terminal	do	308,046	308,046
Pere Marquette	Michigan	389,483	389,483
Peru, La Salle & Deer Park	Illinois	18,646	18,646
Pine Run Road	Pennsylvania	1,975	1,975
Pittsburgh & Lake Erie	do	3,377,585	3,377,585
Pittsburg & Shawmut	do	1,515,880	1,515,880
Pittsburgh & Susquehanna	do	78,808	78,808
Pittsburgh & West Virginia	Ohio	136,216	1,688,030
	Pennsylvania	1,290,218	
	West Virginia	261,596	
Pittsburgh, Chartiers & Youghiogheny	Pennsylvania	759,392	759,392
Pittsburgh County	Oklahoma	20,490	20,490
Pittsburgh, Harmony, Butler & Newcastle St. (Elec.)	Pennsylvania	763	763
Pittsburgh, Lisbon & Western	Ohio	35,059	150,703
	Pennsylvania	115,644	

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1921—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
Pittsburg, Shawmut & Northern	Pennsylvania	344,200	344,200
Preston	West Virginia	1,582	1,582
Puget Sound Electric	Washington	62,414	62,414
Quincy, Omaha & Kansas City	Missouri	20,265	20,265
Reynoldsville & Falls Creek	Pennsylvania	4,921	4,921
Rio Grande & Eagle Pass	Texas	48,880	48,880
Rio Grande & Southwestern	New Mexico	4,200	4,200
Rio Grande Southern	Colorado	75,879	75,879
Rock Island Southern	Illinois	155,356	155,356
Rural Valley	Pennsylvania	507,682	507,682
St. Louis & Belleville Electric	Illinois	334,344	334,344
St. Louis & Hannibal	Missouri	11,069	11,069
St. Louis & O'Fallon	Illinois	928,367	928,367
St. Louis-San Francisco	Alabama	1,766,184	4,055,211
	Arkansas	237,133	
	Kansas	1,074,379	
	Missouri	219,032	
	Oklahoma	758,483	
St. Louis Southwestern	Texas	86,903	86,903
St. Louis, Troy & Eastern	Illinois	957,072	957,072
San Antonio & Aransas Pass	Texas	9,972	9,972
San Antonio Southern	do	29,070	29,070
Sandy Valley & Elkhorn	Kentucky	966,823	966,823
Santa Fe, Raton & Eastern	New Mexico	149,587	149,587
Seaboard Air Line	Alabama	21,873	21,873
Sewell Valley	West Virginia	76,441	76,441
Southern	Alabama	2,363,504	7,584,884
	Illinois	843,012	
	Indiana	1,198,235	
	Kentucky	499,106	
	Tennessee	1,422,145	
	Virginia	1,258,882	
Southern Illinois Ry. & Power Co	Illinois	25,000	25,000
Southern Pacific	California	2,127	19,015
	Oregon	16,888	
Springfield Terminal	Illinois	366,039	366,039
Stroud's Creek & Muddlety	West Virginia	200	200
Susquehanna & New York	Pennsylvania	9,197	9,197
Tennessee	Tennessee	121,009	121,009
Tennessee Central	do	562,244	562,244
Tennessee Coal & Iron	Alabama	2,132,137	2,132,137
Texas & Pacific	Texas	68,950	68,950
Texas Short Line Ry	do	42,000	42,000
Thomas & Sayreton	Alabama	213,143	213,143
Toledo & Ohio Central	Ohio	2,124,412	2,124,412
Toledo, Peoria & Western	Illinois	152,559	152,559
Toledo, St. Louis & Western	Illinois	418,811	420,311
	Indiana	1,500	
Trinidad Electric Transmission	Colorado	3,542	3,542
Uintah	do	6,962	6,962
Union	Pennsylvania	168,181	168,181
Union Pacific	Colorado	823,296	4,901,977
	Kansas	32,301	
	Utah	53,014	
	Wyoming	3,993,366	
Unity	Pennsylvania	298,439	298,439
Ursina & North Fork	do	23,727	23,727
Utah	Utah	995,547	995,547
Virginian	Virginia	15,888	5,790,790
	West Virginia	5,774,902	
Wabash	Illinois	2,157,522	2,796,833
	Iowa	243,226	
	Missouri	396,085	
Wabash, Chester & Western	Illinois	244,761	244,761
Washington Run	Pennsylvania	259,121	259,121
Western Allegheny	do	148,536	148,536
Western Maryland	Maryland	508,800	3,265,049
	Pennsylvania	437,505	
	West Virginia	2,318,744	
Westinghouse Electric & Manufacturing Co. (private road).	Pennsylvania	12,605	12,605
West Side Belt	do	1,063,098	1,063,098
West Virginia Midland	West Virginia	3,500	3,500

Bituminous coal loaded for shipment in the United States, by railroads and waterways, in net tons—Continued.

1921—Continued.

Route.	State.	Quantity. By States.	Quantity. Total for route.
Railroad—Continued.			
West Virginia Northern	West Virginia	191,261	191,261
Wheeling & Lake Erie	Ohio	4,291,329	4,291,329
Williamson & Pond Creek	Kentucky	64,354	64,354
Winifrede	West Virginia	53,852	53,852
Woodstock & Blocton	Alabama	144,539	144,539
Woodward Iron Co	do	653,092	653,092
Wyoming	Wyoming	119	119
Youngstown & Ohio River	Ohio	245,300	245,300
Zanesville & Western	do	953,247	953,247
Total railroad shipments		371,327,621	371,327,621
Waterway.			
Allegheny River	Pennsylvania	116,332	116,332
Green River	Kentucky	89,063	89,063
Illinois River	Illinois	15,184	15,184
Kanawha River	West Virginia	394,290	394,290
Monongahela River	Pennsylvania	9,654,665	9,654,665
Muskingum River	Ohio	1,576	1,576
Ohio River	Indiana	5,231	396,675
	Kentucky	274,446	
	Ohio	48,702	
	West Virginia	68,296	
Rough River	Kentucky	592	592
Trade Water River	do	1,135	1,135
Tennessee River	Tennessee	4,125	4,125
Warrior River	Alabama	61,178	61,178
Miscellaneous waterways	Alaska	1,300	1,300
Total waterway shipments		10,736,115	10,736,115
Grand total		382,063,736	382,063,736

EXPORTS AND IMPORTS OF COAL.

IMPORT TRADE OF THE UNITED STATES.

Coal is a commodity of low value per unit of weight, and its distribution in world trade is governed more by the cost of transportation than by tariff regulations. The exigencies of supply and trade make the United States both an importer and exporter of coal. Although the country as a whole has a large exportable surplus, there are areas in the Far Northwest that depend on supplies from Canada.

The imports fluctuate but little from month to month or from year to year and amount to about 1,300,000 tons annually. They consist almost entirely of bituminous coal from Vancouver Island and Alberta, received in Washington, Montana, and Idaho and of small quantities of coal brought to Pacific coast ports as ballast in vessels from Australia and Japan. At one time a considerable quantity of coal was imported into New England from Nova Scotia, but in 1919, 1920, and 1921 the imports from this source were negligible. A very little anthracite from Vancouver is imported into Washington.

Occasionally a great strike, such as the anthracite strike of 1902, creates a shortage of coal in the eastern United States great enough to stimulate imports from Europe.

EXPORTS.

General features.—The exports of coal from the United States far exceed the imports. The quantity of anthracite exported is relatively constant—about 5,000,000 net tons a year. The exports of bituminous coal in recent years have ranged from 20,100,000 net tons in 1919 to 38,500,000 tons in 1920.

In considering exports the trade with Canada must be distinguished from that with other countries. The trade with other countries is sea borne, except for small shipments to Mexico. It is relatively new, fluctuating, and speculative. The trade with Canada, on the contrary, is stable and of long standing.

Trade with Canada.—Although Canada is richly endowed with low-rank bituminous coal and lignite, her fields of high-rank coals are confined to Nova Scotia on the east and British Columbia on the west. A great stretch of central Canada is without coal and has for many years depended upon the mines of the United States, purchasing every year about 4,500,000 net tons of anthracite and from 12,000,000 to 18,000,000 tons of bituminous coal. In this market the only serious competitor of American coal is the product of the Canadian mines themselves. At those mines the wage rates are fixed by agreement with the United Mine Workers of America under contracts that are readjusted periodically according to the changes in the basic wage districts in the United States. The competition between coal mined in the United States and in Canada is therefore fairly constant in its relations. Probably no part of the coal trade of the United States proceeds more steadily than the export movement to Canada. The coal is mined year after year in the same fields and moves to the same consumers and generally over the same transportation routes and through the same wholesale channels. The fluctuations in the quantity shipped to Canada from one year to the next are no greater than those in the domestic consumption of the United States, for the business conditions in both countries are as a rule nearly alike.

For these reasons the needs of Canada must be considered in framing any emergency program for the production and distribution of coal. Thus the budget of the Fuel Administration permitted shipments to Canada in the same ratio to estimated requirements that was allotted to the several States, and the Canadian Government cooperated by imposing the same regulations upon consumers in Canada that were in force in the United States.

Sea-borne export trade.—In contrast to the trade with Canada, the sea-borne export trade of the United States is beset by many uncertainties. In pre-war years it averaged about 4,000,000 net tons a year. The war at first stimulated our exports but later curtailed them as the activity of the submarines cut deeply into the world's supply of shipping. In 1919 we shipped offshore 8,278,000 net tons of bituminous coal. In 1920 the export demand was unprecedented and the sea-borne exports reached the enormous total of 22,059,000 tons. The next year, in the face of a world-wide industrial depression, they dropped to 9,541,000 tons and would have dropped still lower but for the fact that for three months exports from England were shut off entirely by a strike in that country.

The accompanying tables show how sudden and extreme have been the fluctuations in sea-borne exports. It remains to be seen how much of the increase over pre-war trade American exporters will be able to retain in the face of the uncertainties of foreign exchange and ocean freight rates, the impaired buying power of foreign countries, and the competition of coal from Britain and the Ruhr.

Practically all of our offshore exports consist of bituminous coal rather than anthracite, and the trade is confined largely to Atlantic ports—Hampton Roads, Baltimore, Philadelphia, and Charleston.

Bituminous coal exported from the United States in 1919–1921, by countries, in net tons.[a]

Country.	1919	1920	1921
Europe:			
Austria	....	13,182	....
Austria-Hungary	237	....	....
Azores and Madeira Islands	36,799	53,360	90,278
Belgium	224	307,524	26,554
Czechoslovakia	....	....	7,529
Denmark	99,571	1,082,647	171,307
Finland	....	31,229	920
France	586,032	4,083,911	680,435
Germany	9,565	86,006	43,292
Gibraltar	22,726	92,222	141,420
Greece	53,894	259,096	107,659
Hungary	....	5,817	8,292
Iceland and Faroe Islands	....	8,010	15,551
Italy	1,828,954	2,674,262	1,735,395
Malta, Gozo, etc	....	....	7,000
Netherlands	808,854	2,404,581	374,180
Norway	179,024	824,623	47,582
Poland and Danzig	....	7,573	....
Portugal	50,599	184,144	112,200
Rumania	....	9,238	2
Russia in Europe	....	69,119	97,819
Spain	20,858	73,789	65,504
Sweden	283,238	1,396,730	75,107
Switzerland	592,004	909,812	9,810
Turkey in Europe	4,710	105,728	21,456
United Kingdom—			
England	7,379	36,133	1,138,474
Scotland	....	22,100	83,324
Ireland	....	....	454,317
	4,584,668	14,740,836	5,515,407
North America:			
Bermuda	21,771	54,939	36,738
British Honduras	673	493	780
Canada	11,949,829	16,230,202	13,396,774
Costa Rica	1,923	15,352	3,613
Guatemala	4,360	1,181	2,940
Honduras	9,360	14,619	15,837
Nicaragua	2,269	1,029	2,045
Panama	80,748	173,647	249,568
Salvador	2,512	3,502	44
Greenland	1,363	1,178	795
Mexico	113,880	227,598	192,876
Newfoundland and Labrador	4,712	28,445	5,466
West Indies—			
Barbados	120,551	82,276	22,135
Jamaica	37,059	92,338	65,690
Trinidad and Tobago	46,277	31,849	22,785
Other British West Indies	31,403	53,477	8,698
Cuba	1,087,967	1,492,548	587,521
Dominican Republic	15,333	12,611	9,456
Dutch West Indies	27,657	45,222	13,665
French West Indies	26,806	50,916	62,520
Haiti	....	1	80
Virgin Islands of the United States	17,188	47,456	26,566
	13,603,641	18,660,879	14,726,592

[a] Compiled from the records of the Bureau of Foreign and Domestic Commerce. Amounts stated do not include fuel or bunker coal laden on vessels engaged in the foreign trade, which aggregated in 1919 8,223,862 tons; in 1920 10,485,639 tons; and in 1921 8,453,220 tons.

Bituminous coal exported from the United States in 1919–1921, by countries, in net tons—Continued.

Country.	1919	1920	1921
South America:			
Argentina	541,396	1,924,712	842,952
Brazil	710,202	1,080,821	590,492
Chile	104,852	553,416	168,945
Colombia	13,255	7,076	12,867
Ecuador	3,302	4,733	4,729
Falkland Islands	17,033	3,442	
Guiana—			
British	4,196	20,086	3,861
Dutch	1,121	3,244	2,757
Paraguay		7,778	
Peru	51,317	39,628	31,530
Uruguay	218,397	299,944	98,997
Venezuela	556	3,164	1,724
	1,665,627	3,948,044	1,758,854
Asia:			
Aden		17,773	
China		11	7,343
Dutch East Indies	14,808	1,235	14,445
Palestine and Syria			[b] 7,595
Russia in Asia	3	6	45
Turkey in Asia		13,156	19,182
	14,811	32,181	48,610
Oceania:			
New Zealand	56,038	39,918	67,011
Other British Oceania	6	4	11
Philippine Islands			9,559
Other Oceania	1		
	56,045	39,922	76,581
Africa:			
British Africa—			
West	4,658	3,979	7,439
South		728	
East	6,915	11,090	
Canary Islands	21,937	67,502	192,973
Egypt	42,048	701,716	533,344
French Africa	58,241	266,735	204,746
German Africa		7,164	
Italian Africa	5,786		
Morocco			336
Portuguese Africa	49,159	36,308	66,284
	188,744	1,095,222	1,005,122
Grand total	20,113,536	38,517,084	23,131,166

[b] Figures cover period July to December, 1921.

Bituminous coal exported from the United States in 1919–1921, by districts, in net tons.[a]

District.	1919	1920	1921
Georgia	36,901	189,185	10,258
Maine and New Hampshire	13,304	338	244
Maryland	1,923,423	4,933,385	1,644,217
Massachusetts	2,788	45	3,472
New York	32,790	283,414	69,038
Philadelphia	1,135,943	2,756,491	687,391
South Carolina	175,247	741,633	336,567
Virginia	4,681,488	12,755,689	6,740,444
Florida	45,434	268,432	129,446
Galveston	....	217	12
Mobile	6,971	108,310	19,028
New Orleans	17,716	47,153	19,776
Sabine	19	159	56
Arizona	43,505	38,254	26,992
El Paso	46,542	137,257	123,530
San Antonio	15,094	18,207	15,804
Alaska	987	17	50
Hawaii	6	48	11
Los Angeles	....	49	7
Oregon	2,421	392	....
San Diego	....	174	180
San Francisco	124	1,185	587
Southern California	277	....	....
Washington	4,738	11,693	16,228
Buffalo	2,457,114	3,605,285	3,277,863
Montana and Idaho	....	....	7,426
Dakota	38,152	23,715	58,517
Duluth-Superior	48,873	90,836	119,120
Michigan	1,134,576	1,782,437	1,340,509
Ohio	5,892,189	7,160,774	5,835,505
Rochester	546,735	1,006,625	468,800
St. Lawrence	1,763,756	2,481,550	2,149,468
Vermont	45,694	72,894	30,407
Porto Rico	729	1,241	213
	20,113,536	38,517,084	23,131,166

[a] Compiled from the records of the Bureau of Foreign and Domestic Commerce of the Department of Commerce. Amounts stated do not include fuel or bunker coal. (See table on p. 552.)

Anthracite exported from the United States in 1919–1921, by countries, in net tons.[a]

Country.	1919	1920	1921
Europe:			
Austria-Hungary	207	....	....
Azores and Madeira Islands	....	....	30
Belgium	....	8,453	....
Denmark	....	35,463	3,920
Finland	....	822	....
France	2,833	73,362	1,594
Germany	22	352	....
Greece	....	10,662	....
Italy	10,478	5,468	174
Netherlands	2	48,746	1,278
Norway	2	20,595	....
Portugal	50	1,590	....
Spain	762	....	4,767
Sweden	112	44,111	....
Switzerland	....	30,754	....
Turkey in Europe	225	5,154	....
England	....	2	368
	14,693	285,534	12,131
North America:			
Bermuda	3,322	2,119	3,716
British Honduras	1	....	690
Canada	4,865,912	4,968,282	4,519,216
Costa Rica	....	2	....
Guatemala	57	655	110
Honduras	1,116	1,397	....
Nicaragua	172	225	....
Panama	....	949	1,795
Salvador	....	4	6
Mexico	4,993	18,266	49,820
Miquelon	412	100	293
Newfoundland and Labrador	13,681	16,947	17,245

[a] Compiled from the records of the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

Anthracite exported from the United States in 1919–1921, by countries, in net tons—Con.

Country.	1919	1920	1921
North America—Continued.			
West Indies—			
Barbados	340	685	291
Jamaica	6	109	2
Trinidad and Tobago	2	22	
Other British West Indies	440	364	2,776
Cuba	58,079	58,410	53,648
Dominican Republic	9,554	7,773	10,531
Dutch West Indies		336	444
French West Indies		13,940	
Haiti	2	4	1
	4,958,089	5,090,589	4,660,584
South America:			
Argentina	28	5,127	1,959
Bolivia		504	
Brazil	1,894	9,966	22
Chile	259	1,832	596
Colombia	810	289	80
Ecuador		964	
Guiana—			
British	34		
Dutch			34
Peru	448	3,759	
Uruguay		90	
Venezuela	2	6	11
	3,475	22,537	2,702
Asia:			
Russia in Asia			448
Turkey in Asia	113	1,228	101
	113	1,228	549
Oceania:			
Philippine Islands	228		
Africa:			
British West Africa			136
Canary Islands		1,105	1,266
Egypt		2,747	
Portuguese Africa		9	
		3,861	1,402
Grand total	4,976,598	5,403,749	4,677,368

Anthracite exported from the United States in 1919–1921, by districts, in net tons.[a]

District.	1919	1920	1921
Georgia	2		
Maine and New Hampshire	1,469	843	866
Maryland	2,733	939	4,087
Massachusetts	2,907	1,177	983
New York	79,502	245,529	147,700
Philadelphia	66,483	176,021	72,844
South Carolina	1,633		
Virginia	7,476	19,777	5,464
Florida	1,475	6,980	30
New Orleans	2,027	9,513	
Sabine	1	34	35
Arizona	55	644	8,840
El Paso	988	2,465	496
San Antonio	3,149	14,254	40,153
Oregon	1	6,441	
Los Angeles		17	5
Southern California	169		
San Diego		62	54
San Francisco		132	66
Washington	392	1,197	1,206
Buffalo	2,622,023	2,622,543	2,532,752
Dakota	5,311	7,763	26,582
Duluth-Superior	18,630	7,497	9,025
Michigan	594	1,569	3,230
Ohio	63,016	27,896	24,687
Rochester	576,595	616,258	427,467
St. Lawrence	1,496,211	1,610,429	1,350,470
Vermont	23,616	23,685	20,326
Porto Rico	140	84	
	4,976,598	5,403,749	4,677,368

[a] Compiled from the records of the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

Anthracite and bituminous coal exported from the United States to Canada, Mexico, and all other countries, 1919–1921, in net tons.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1919.													
Anthracite:													
Canada	405,740	230,408	117,704	316,083	444,170	528,444	542,349	557,303	529,666	476,572	337,986	379,487	4,865,912
Mexico	306	170	462	664	113	382	229	396	1,130	495	178	468	4,993
Other countries	6,953	11,362	13,776	2,666	2,369	2,407	3,593	8,146	17,761	8,724	21,041	6,895	105,693
	412,999	241,940	131,942	319,413	446,652	531,233	546,171	565,845	548,557	485,791	359,205	386,850	4,976,598
Bituminous:													
Canada	861,023	500,000	395,229	562,173	1,218,589	1,602,430	1,498,681	1,498,208	1,581,407	1,622,438	375,918	233,734	11,949,830
Mexico	11,026	5,759	6,080	6,944	7,733	16,029	6,523	12,267	12,199	9,808	10,004	9,508	113,880
Other countries	480,501	259,995	219,212	339,346	374,949	822,246	765,267	1,128,297	1,453,295	1,654,602	413,366	138,750	8,049,826
	1,352,550	765,754	620,521	908,463	1,601,271	2,440,705	2,270,471	2,638,772	3,046,901	3,286,848	799,288	381,992	20,113,536
1920.													
Anthracite:													
Canada	326,527	285,553	430,139	371,300	304,039	544,704	665,218	521,890	332,712	456,239	339,180	390,781	4,968,282
Mexico	594	380	961	956	158	461	290	429	479	438	4,570	8,550	18,266
Other countries	15,676	19,119	38,944	17,142	6,264	28,220	72,678	99,736	31,071	41,041	29,507	17,803	417,201
	342,797	305,052	470,044	389,398	310,461	573,385	738,186	622,055	364,262	497,718	373,257	417,134	5,403,749
Bituminous:													
Canada	514,073	606,222	716,391	940,460	802,426	1,337,019	1,886,888	2,091,047	1,974,836	2,234,213	1,634,498	1,492,129	16,230,202
Mexico	6,941	12,615	17,580	19,093	7,976	7,842	18,686	20,153	17,748	23,023	24,128	51,812	227,597
Other countries	878,053	690,226	946,634	1,763,883	1,878,517	2,163,262	2,078,044	2,490,636	2,500,211	2,872,553	2,336,566	1,460,700	22,059,285
	1,399,067	1,309,063	1,680,605	2,723,436	2,688,919	3,508,123	3,983,618	4,601,836	4,492,795	5,129,789	3,995,192	3,004,641	38,517,084
1921.													
Anthracite:													
Canada	305,732	301,827	331,539	394,317	464,136	537,286	428,324	411,724	309,929	338,922	358,676	336,803	4,519,215
Mexico	9,012	8,508	4,536	6,792	5,602	2,502	1,320	3,066	2,849	2,342	744	2,546	49,819
Other countries	9,317	16,649	8,818	11,649	16,687	15,616	4,962	2,976	6,946	1,548	9,485	3,681	108,334
	324,061	326,984	344,893	412,758	486,425	555,404	434,606	417,766	319,724	342,812	368,905	343,030	4,677,368
Bituminous:													
Canada	1,319,219	704,323	662,544	813,224	1,259,155	1,581,997	1,466,050	1,477,378	1,158,994	1,259,684	997,574	696,632	13,396,774
Mexico	36,037	28,904	14,209	9,284	8,865	19,970	16,239	15,236	15,331	11,622	9,746	7,433	192,876
Other countries	1,163,006	676,483	613,308	793,754	1,532,399	2,110,287	1,485,699	405,887	182,678	218,634	200,943	158,438	9,541,516
	2,518,262	1,409,710	1,290,061	1,616,262	2,800,419	3,712,254	2,967,988	1,898,501	1,357,003	1,489,940	1,208,263	862,503	23,131,166

Bituminous coal imported into the United States in 1919–1921, by countries and districts, in net tons.[a]

Country of origin and district of entry.	1919	1920	1921
Country.			
Europe:			
Belgium	672	55	1
France		33	875
Germany		314	225
Greece		280	
Italy	448		1
Malta, Gozo, and Cyprus Islands	168		
Netherlands		84	
United Kingdom—			
England	2,110	8,287	27,608
Scotland			1,120
Ireland		4	
North America:			
Canada	924,138	1,123,903	1,092,132
Dutch West Indies			221
Mexico	33	48	115
Newfoundland and Labrador		1,240	
South America:			
Brazil		67	123
Chile	2		
Venezuela			2
Asia:			
China		3	1,667
Kwangtung, leased territory			8,760
Dutch East Indies		392	
Hongkong			56
Japan	7,411	28,408	50,191
Russia in Asia		17	
Oceania:			
Australia	75,603	76,422	73,976
New Zealand	207	3,193	14
Philippine Islands	552	2,240	201
Africa:			
Egypt			301
French Africa	206		
	1,011,550	1,244,990	1,257,589
District.			
Maine and New Hampshire	24,043	59,781	26,078
Maryland		448	3
Massachusetts	318	6,357	301
New York	1,878	16,215	1,939
Philadelphia	710		
Virginia	448	1,610	
Florida			28
New Orleans	336		347
San Antonio	33	48	87
Alaska	48,708	45,264	33,776
Hawaii	90,108	101,038	47,210
Oregon	76	4,595	4,205
San Francisco	31,362	18,567	86,902
Washington	289,527	275,824	348,034
Dakota	586	1,794	2,896
Duluth-Superior	1,603	5,357	272
Michigan	1,820	1,755	
Montana-Idaho	519,419	697,174	702,707
St. Lawrence	563	2,998	317
Buffalo		4,731	17
Vermont	12	1,193	9
Porto Rico			221
Pittsburgh		17	
Galveston		224	
San Diego			2,240
	1,011,550	1,244,990	1,257,589

[a] Compiled from the records of the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

Anthracite imported into the United States in 1919–1921, by countries and districts, in net tons.

Country of origin and district of entry.	1919	1920	1921
Country.			
France			10
England	336	369	11
Scotland	112		
Canada	81,205	30,853	6,654
Costa Rica		2	
Mexico	941	151	
Other British Indies		4	
Dutch West Indies	202	112	
Brazil			26
Chile			1
Peru		4	3
Kwangtung, leased territory			9
Chosen	22		
British India			6
Japan		238	2,174
Australia		14	
British South Africa		1	
	82,818	31,748	8,894
District.			
Maine and New Hampshire	1,691	777	1,259
New York	336	627	67
Vermont	3	221	30
St. Lawrence	65	17	35
Buffalo			46
San Francisco			
San Antonio	941	151	
Washington	79,326	28,407	4,967
Hawaii			2,173
Montana and Idaho		112	40
Dakota	69	439	
Duluth-Superior	73	880	238
Michigan			39
Porto Rico	314	117	
	82,818	31,748	8,894

PRODUCTION OF COAL BY STATES.

ALABAMA.

In 1919 Alabama produced 15,536,721 net tons of bituminous coal, a decrease of 3,648,241 tons, or 19 per cent, as compared with 1918. The total value of the output in 1919—$45,937,681—was only $8,814,648, or 16 per cent, less than that in the preceding year, and the average value per ton actually increased 11 cents, reaching $2.96. All the causes of nonoperation already considered of course reduced production, but the principal cause of the reduction was the decline in demand—the loss by "no market." A large part of the output of mines in Alabama is normally consumed by the steel and allied industries in the Birmingham district. At the end of the World War the stoppage of the demand for metallurgical products for military use caused a pronounced slump in the steel and allied industries. The amount of coal coked at the mines dropped from 2,225,194 tons in 1918 to 925,357 tons in 1919. The average number of days worked by the mines in Alabama fell from 278 in 1918 to 239 in 1919, though the total number of men employed showed a small but insignificant increase. The production per man per day (2.42 tons) and per year (578 tons) in 1919 fell below that in 1918, when the average per man per day was 2.63 tons and the average per year 732 tons. The reduction in the annual output was due in part to the decrease in the total number of days worked, but there was also a decrease of 0.21 ton per man per day. In 1919 every county showed losses in production as compared with 1918.

In 1920 the production amounted to 16,294,099 tons, an increase of only 757,378 tons, less than 5 per cent. The total value, $59,410,000 showed an increase of $13,472,319, or 29.3 per cent, and the average value per ton rose from $2.96 to $3.65, an increase of 23.3 per cent. The gains in output were shared by all counties except Bibb, Etowah, St. Clair, and Winston. No coal was coked at the mines in St. Clair County in 1920, and the quantity coked in other counties declined, so that the total coal used for making coke at the mines dropped to 703,033 tons. The average number of days worked increased from 239 to 247, but the number of men employed decreased 1,334. The greatest decline was in the number of surface employees, which decreased 1,029. Both the average daily and average yearly output per worker were greater than in 1919.

In 1921 Alabama produced 12,568,899 tons, valued at $38,713,000. As compared with the preceding year, this was a loss of 3,725,200 tons, or about 23 per cent, in quantity and $20,697,000, or 34.8 per cent, in value. The number of days worked dropped from 247 to 166, but the average daily production per man increased 0.37 ton. The number of men employed increased 269, but the number at work above ground decreased still further. The average value of the coal per ton dropped 57 cents. In spite of the falling off in production for the State as a whole, Blount County mined 17,006 tons more than in 1920. Every other producing county showed a loss. Jefferson County lost 1,855,435 tons and in Walker County 848,573 tons.

The strike of 1919 affected 13,431 men in Alabama, who stayed out an average of 20 days. In 1920 a protracted and bitterly contested strike occurred, during which 8,490 men stayed out for more than three months. Nor was peace restored entirely in 1921, for during that year 2,329 were reported on strike at one time or another, and in days lost per man on strike Alabama stood next to Washington and Kansas.

Coal produced in Alabama in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.										
Bibb	984,845	7,616	41,638	....	1,034,099	1,672		424	2,096	228
Blount	271,263	2,243	10,100	....	283,606	411		169	580	212
Etowah	87,664	1,140	2,593	....	91,397	153		55	208	253
Jefferson	6,547,911	84,073	284,662	631,921	7,548,567	9,578		2,574	12,152	254
St. Clair	635,067	7,122	21,809	4,306	668,304	657		373	1,030	260
Shelby	525,057	6,191	31,615	....	562,863	911		377	1,288	230
Tuscaloosa	588,322	4,548	24,227	255,681	872,778	1,308		433	1,741	259
Walker	4,065,593	83,166	108,090	33,449	4,290,298	5,703		1,645	7,348	212
Winston	58,921	2,035	4,050	....	65,006	82		55	137	184
Other counties[b]	105,037	1,988	12,365	....	119,390	185		109	294	252
Small mines	....	413	....	....	413	....		....	....	....
	c13,869,680	200,535	541,149	925,357	15,536,721	20,660		6,214	26,874	239
1920.										
Bibb	934,555	6,207	27,249	....	968,011	947	556	335	1,838	174
Blount	279,809	5,575	....	....	285,384	410	100	115	625	189
Etowah	73,755	1,104	1,709	....	76,568	102	26	39	167	223
Jefferson	6,851,632	148,003	270,198	450,077	7,719,910	5,742	3,458	2,177	11,377	264
St. Clair	629,936	7,289	24,984	....	662,209	334	184	112	630	192
Shelby	547,164	8,497	31,335	....	586,996	647	330	212	1,189	279
Tuscaloosa	671,628	5,336	14,926	222,293	914,183	937	377	418	1,732	272
Walker	4,470,876	167,825	99,093	30,663	4,768,457	4,320	1,611	1,718	7,649	238
Winston	35,629	816	50	....	36,495	53	23	15	91	211
Other counties[b]	108,159	1,544	12,183	....	121,886	155	43	44	242	221
Small mines	154,000	....	....	....	154,000	....	....	....	....	....
	c14,757,143	352,196	481,727	703,033	16,294,099	13,647	6,708	5,185	25,540	247
1921.[d]										
Bibb	616,709	6,112	21,171	....	643,992	1,009	426	280	1,715	150
Blount	298,712	1,878	1,800	....	302,390	437	62	136	635	177
Etowah	72,869	765	1,473	....	75,107	147	35	44	226	172
Jefferson	5,585,362	91,138	167,338	20,637	5,864,475	6,468	3,067	1,757	11,292	173
St. Clair	622,355	5,029	18,828	....	646,212	509	202	124	835	203
Shelby	429,614	7,670	23,212	....	460,496	681	227	181	1,089	192
Tuscaloosa	411,514	7,209	11,958	107,721	538,402	1,053	340	229	1,622	129
Walker	3,685,128	191,487	43,269	....	3,919,884	4,816	1,450	1,827	8,093	158
Winston	33,150	....	....	....	33,150	89	32	25	146	181
Other counties[b]	79,196	1,837	3,758	....	84,791	95	28	33	156	142
	c11,834,609	313,125	292,807	128,358	12,568,899	15,304	5,869	4,636	25,809	166

[a] Includes also loaders and shot firers.
[b] Cullman and Marion.
[c] Includes coal for by-product coke ovens transported over private railroads.
[d] Exclusive of product of wagon mines.

Value of coal produced in Alabama in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Bibb	$3,483,349	$23,420	$141,160	....	$3,647,929	$3.53
Blount	1,024,196	5,955	31,350	....	1,061,501	3.74
Etowah	282,190	3,840	8,362	....	294,392	3.22
Jefferson	18,151,203	192,719	753,564	$1,664,797	20,762,283	2.75
St. Clair	2,017,350	18,436	52,213	15,287	2,103,286	3.14
Shelby	2,050,464	23,698	100,392	....	2,174,554	4.70
Tuscaloosa	1,865,437	25,542	75,009	714,058	2,680,046	3.07
Walker	11,947,467	221,945	270,842	97,002	12,537,256	2.92
Winston	194,924	6,988	4,673	....	206,585	3.18
Other counties [a]	410,267	7,800	49,907	....	467,974	3.92
Small mines	....	1,875	....	....	1,875	4.52
	41,426,847	532,218	1,487,472	2,491,144	45,937,681	....
Average value per ton	2.99	2.65	2.75	2.69	2.96	2.96
1920.						
Bibb	3,622,000	24,000	96,000	....	3,742,000	3.87
Blount	1,274,000	21,000	....	....	1,295,000	4.54
Etowah	319,000	5,000	6,000	....	330,000	4.31
Jefferson	23,256,000	568,000	840,000	1,589,000	26,253,000	3.40
St. Clair	2,312,000	25,000	68,000	....	2,405,000	3.63
Shelby	2,766,000	42,000	118,000	....	2,926,000	4.98
Tuscaloosa	2,440,000	24,000	57,000	875,000	3,396,000	3.71
Walker	16,385,000	732,000	312,000	123,000	17,552,000	3.68
Winston	139,000	4,000	....	....	143,000	3.92
Other counties [a]	536,000	7,000	52,000	....	595,000	4.88
	53,049,000	1,452,000	1,549,000	2,587,000	58,637,000	3.63
Small mines	773,000	....	....	....	773,000	5.02
	53,822,000	1,452,000	1,549,000	2,587,000	59,410,000	....
Average value per ton	3.65	4.12	3.22	3.68	3.65	3.65
1921. [b]						
Bibb	2,189,000	22,000	66,000	....	2,277,000	3.54
Blount	1,061,000	6,000	6,000	....	1,073,000	3.55
Etowah	226,000	2,000	5,000	....	233,000	3.10
Jefferson	16,614,000	281,000	428,000	62,000	17,385,000	2.96
St. Clair	2,055,000	13,000	55,000	....	2,123,000	3.28
Shelby	1,784,000	26,000	93,000	....	1,903,000	4.13
Tuscaloosa	1,184,000	34,000	40,000	366,000	1,624,000	3.02
Walker	11,124,000	437,000	109,000	....	11,670,000	2.98
Winston	86,000	....	....	....	86,000	2.59
Other counties [a]	319,000	9,000	11,000	....	339,000	4.00
	36,642,000	830,000	813,000	428,000	38,713,000	....
Average value per ton	3.10	2.65	2.78	3.33	3.08	3.08

[a] Cullman and Marion. [b] Exclusive of product of wagon mines.

Coal produced in Alabama, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Bibb	1,624,623	1,374,548	1,034,099	968,011	643,992	−324,019
Blount	266,729	315,095	283,606	285,384	302,390	+17,006
Cullman, Jackson, and Marion	129,930	140,600	[a] 119,390	[a] 121,886	[a] 84,791	−[a] 37,095
Etowah	154,265	130,538	91,397	76,568	75,107	−1,461
Jefferson	10,453,093	9,379,957	7,548,567	7,719,910	**5,864,475**	**−1,855,435**
St. Clair	836,995	832,348	668,304	662,209	646,212	−15,997
Shelby	781,858	744,111	562,863	586,996	460,496	−126,500
Tuscaloosa	923,735	1,032,705	872,778	914,183	538,402	−375,781
Walker	4,844,480	5,156,269	4,290,298	4,768,457	3,919,884	−848,573
Winston	43,900	76,527	65,006	36,495	33,150	−3,345
Small mines	8,466	2,264	413	154,000	....	−154,000
	20,068,074	19,184,962	15,536,721	16,294,099	12,568,899	−3,725,200
Total value	$45,616,992	$54,752,329	$45,937,681	$59,410,000	$38,713,000	−$20,697,000

[a] Cullman and Marion only.

ALASKA.

The coal mined in Alaska in 1919 amounted to 60,674 tons, valued at $343,547, as compared with 75,606 tons, valued at $411,850, in 1918. In 1920 the output was 61,111 tons, valued at $356,000. In 1921 it was 76,817 tons, valued at $496,000, the largest in the history of the Alaskan coal-mining industry. The greater part of the coal mined continues to come from the Matanuska field, which produced about 58,000 tons in 1921. The principal producer in that field was the Eska mine, which was operated by the Alaskan Engineering Commission to supply coal for the railroad. The underground exploration work of the Navy Coal Commission was continued at Chickaloon and at Coal and Moose creeks with fairly encouraging results.

During 1921 coal was mined regularly at the Healy mine, in the Nenana lignite field. Some coal was mined also on Lignite Creek, in the same field, by the Broad Pass Development Co. in the winter of 1920–21. Small lignite mines were operated during 1921 at several widely scattered localities. The Evans-Jones mine, in the Matanuska field near the Eska, was further developed during the year, and a small washery was completed in the same field. Both the Evans-Jones and Healy mines have railroad connections and were developed by local enterprise.

The following table shows the production of coal in Alaska since 1888. The production given for 1888 to 1896 is estimated from the best data available but is only approximate. Most of the figures showing the production since 1897 were obtained from reports made by the operators. Nearly all the coal mined before 1916 was lignite. A little bituminous coal was produced in the west end of the Bering River field in 1906. The table does not include 855 tons of coal mined in the Bering River field in 1912 and 1,100 tons mined in the Matanuska field in 1913 for test by the United States Navy.

Coal produced in Alaska, 1888–1921.

Year.	Net tons.	Value.	Year.	Net tons.	Value.	Year.	Net tons.	Value.
1888–1896	6,000	$84,000	1905	3,774	$13,250	1914	....	....
1897	2,000	28,000	1906	5,541	17,974	1915	1,400	$3,300
1898	1,000	14,000	1907	10,139	53,600	1916	13,073	52,317
1899	1,200	16,800	1908	3,107	14,810	1917	53,955	265,317
1900	1,200	16,800	1909	2,800	12,300	1918	75,606	411,850
1901	1,300	15,600	1910	1,000	15,000	1919	60,674	343,547
1902	2,212	19,048	1911	900	9,300	1920	61,111	356,000
1903	1,447	9,782	1912	355	2,840	1921	76,817	496,000
1904	1,694	7,225	1913	2,300	13,800			

The following table shows the quantity of coal consumed in Alaska, including both local production and imports, since 1899. Most of the coal shipped to Alaska was bituminous, but a little was anthracite.

Coal consumed in Alaska, 1899–1921, in net tons.

Year.	Produced in Alaska, chiefly subbituminous and lignite.	Imported from States, chiefly bituminous from Washington.	Total foreign coal, chiefly bituminous from British Columbia.	Total coal consumed.
1899	1,200	10,000	a 50,120	61,320
1900	1,200	15,048	a 56,623	72,871
1901	1,300	24,000	a 77,674	102,974
1902	2,212	40,000	a 68,363	110,575
1903	1,447	64,626	a 60,605	126,678
1904	1,694	36,689	a 76,815	115,198
1905	3,774	67,713	a 72,612	144,099
1906	5,541	69,493	a 47,590	122,624
1907	10,139	46,246	a 93,262	149,647
1908	3,107	23,893	a 86,404	113,404
1909	2,800	33,112	69,046	104,958
1910	1,000	32,098	58,420	91,518
1911	900	32,255	61,845	95,000
1912	355	27,767	68,316	96,438
1913	2,300	69,066	56,430	127,796
1914	....	41,509	46,153	87,662
1915	1,400	46,329	29,457	77,186
1916	13,073	44,934	53,672	111,679
1917	53,955	58,116	56,589	168,660
1918	75,606	51,520	37,986	165,112
1919	60,674	57,166	48,708	166,548
1920	61,111	38,128	45,264	144,503
1921	76,817	24,278	33,776	134,871
	381,605	953,986	1,355,730	2,691,321

a Fiscal year ending June 30.

ARKANSAS.

The production of coal in Arkansas dropped from 2,227,369 tons, valued at $8,172,376, in 1918, to 1,429,020 tons, valued at $5,288,844, in 1919. The decline in output was 798,349 tons, or 35.8 per cent; the decline in value was $2,883,532, or 35.3 per cent. Indeed, the total output of the State in 1919 was less than that of Sebastian County alone in 1918: Nevertheless, in spite of the losses in quantity and in the total value, the average value per ton, $3.70, was 3 cents more than in 1918. The average number of days worked fell from 204 to 136. There was a slight decrease in the total number of men employed and a very small increase in the average tonnage per man per day, though the yearly average per man, of course, declined. Labor troubles caused an average loss of 44 days per striker and involved 3,681 men. During the war the Government control over the distribution of anthracite from Pennsylvania and of low-volatile or smokeless coal from West Virginia widened the market for the semianthracite and semibituminous coals of Arkansas, but the gains made were not held when the restrictions on the movement of eastern coals were removed.

Both production and value displayed a marked recovery in 1920. The quantity produced was 2,103,596 tons, an increase of 674,576 tons, or 47.2 per cent, over that produced in 1919, but it was still 123,773 tons less than the quantity produced in 1918, the largest output recorded. There was an increase of 40 in the average number of days worked but little change in the total number of men employed. The time lost through strikes, however, was materially reduced. Not only was the average time per striker cut to 29 days but the number of men involved fell from 3,681 to 956, bringing the total man-days lost from 161,069 in 1919 to 28,015 in 1920.

The average value per ton was the highest on record, $4.56. The total value in 1920, $9,592,000, was $4,303,156, or about 81 per cent, greater than the value in 1919. Every county shared in the increase.

The output in 1921 was only 1,227,777 tons, a decrease of 875,819 tons, or 41.6 per cent. The value in 1921 was $5,360,000, as compared with $9,592,000 in 1920, a decrease of $4,232,000, or 44.1 per cent. Although the average value per ton was 19 cents less than in 1920, it was, with that exception, the largest recorded for the State, exceeding the average of 1918, in war time, by 70 cents a ton. The number of days worked dropped to 112, but the average production per man per day rose to 3.03 tons—a new record for mining in Arkansas. Losses by strikes were substantially diminished; the average time lost per striker was only 10 days, but the number of men involved, 1,677, was greater than in 1920.

Coal produced in Arkansas in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
					Underground.				
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Miners.[a]	All others.	Surface.	Total.	
1919.									
Franklin	132,233	2,809	9,499	144,541	316		91	407	169
Johnson	198,445	1,209	11,382	211,036	579		211	790	87
Logan	37,600	3,215	2,122	42,937	136		25	161	132
Sebastian	870,927	3,794	28,693	903,414	1,738		347	2,085	139
Other counties[b]	112,061	2,926	3,074	118,061	327		44	371	185
Small mines	....	9,031	....	9,031	....		......	......	......
	1,351,266	22,984	54,770	1,429,020	3,096		718	3,814	136
1920.									
Franklin	262,736	1,846	13,868	278,450	290	122	60	472	205
Johnson	243,963	1,555	11,999	257,517	350	165	115	630	134
Logan	61,766	2,165	2,705	66,636	109	57	30	196	187
Sebastian	1,280,579	3,759	37,127	1,321,465	1,449	538	350	2,337	176
Other counties[c]	119,872	1,871	4,785	126,528	192	82	57	331	208
	1,968,916	11,196	70,484	2,050,596	2,390	964	612	3,966	176
Small mines	51,000	2,000	....	53,000	....	......	......	......	......
	2,019,916	13,196	70,484	2,103,596	....	......	......	......	......
1921.[d]									
Franklin	157,876	1,139	5,031	164,046	245	95	57	397	108
Johnson	57,576	318	898	58,792	250	96	82	428	48
Logan	64,495	9,429	1,038	74,962	185	68	29	282	139
Sebastian	801,506	2,218	23,097	826,821	1,470	485	217	2,172	117
Other counties[e]	93,131	6,373	3,652	103,156	165	104	68	337	149
	1,174,584	19,477	33,716	1,227,777	2,315	848	453	3,616	112

[a] Includes also loaders and shot firers.
[b] Pope and Scott.
[c] Pope, Scott, and Washington.
[d] Exclusive of product of wagon mines.
[e] Pope and Washington.

Value of coal produced in Arkansas in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Franklin	$511,910	$10,828	$29,996	$552,734	$3.82
Johnson	883,099	6,072	32,772	921,943	4.37
Logan	180,382	9,606	7,890	197,878	4.61
Sebastian	2,757,647	11,115	81,821	2,850,583	3.16
Other counties [a]	706,086	18,512	12,554	737,152	6.24
Small mines	....	28,554	....	28,554	3.16
	5,039,124	84,687	165,033	5,288,844	....
Average value per ton	3.73	3.69	3.01	3.70	3.70
1920.					
Franklin	1,203,000	7,000	51,000	1,261,000	4.53
Johnson	1,212,000	8,000	44,000	1,264,000	4.91
Logan	380,000	11,000	11,000	402,000	6.03
Sebastian	5,381,000	18,000	126,000	5,525,000	4.18
Other counties [b]	844,000	17,000	15,000	876,000	6.92
	9,020,000	61,000	247,000	9,328,000	4.55
Small mines	256,000	8,000	....	264,000	4.98
	9,276,000	69,000	247,000	9,592,000	....
Average value per ton	4.59	5.23	3.50	4.56	4.56
1921.[c]					
Franklin	587,000	5,000	18,000	610,000	3.72
Johnson	247,000	2,000	4,000	253,000	4.30
Logan	344,000	77,000	1,000	422,000	5.63
Sebastian	3,235,000	8,000	91,000	3,334,000	4.03
Other counties [d]	687,000	46,000	8,000	741,000	7.18
	5,100,000	138,000	122,000	5,360,000	....
Average value per ton	4.34	7.09	3.62	4.37	4.37

[a] Pope and Scott.
[b] Pope, Scott, and Washington.
[c] Exclusive of product of wagon mines.
[d] Pope and Washington.

Coal produced in Arkansas, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Franklin	210,152	240,149	144,541	278,450	164,046	−114,404
Johnson	306,948	371,704	211,036	257,517	58,792	−198,725
Logan	46,950	49,368	42,937	66,636	74,962	+8,326
Pope, Scott, and Washington	[a] 127,544	[a] 112,692	[a] 118,061	126,528	[a] 103,156	−23,372
Sebastian	1,433,355	1,447,268	903,414	1,321,465	826,821	−494,644
Small mines	18,630	6,188	9,031	53,000	....	−53,000
	2,143,579	2,227,369	1,429,020	2,103,596	1,227,777	−875,819
Total value	$5,492,777	$8,172,376	$5,288,844	$9,592,000	$5,360,000	−$4,232,000

[a] Includes Ouachita County in 1917; no production in Washington County in 1918 and 1919; no production in Scott County in 1921.

CALIFORNIA, IDAHO, NEVADA, AND OREGON.

In three States of the Far West—California, Idaho, and Nevada—the number of coal producers is so small that the statistics can not be shown separately without disclosing the operations of individual companies. The statistical record of the three States combined is shown in the following table. For 1921 it has been necessary to include figures for Oregon also. No production has been reported from Nevada since 1914.

The production of bituminous coal and lignite in California and Idaho in 1919 was 6,554 tons, as compared with 6,400 tons in 1918. In 1920, however, it dropped to 2,753 tons, when other States were reporting increased production. The inclusion of the figures for production in Oregon in 1921, of course, makes it impossible to compare the figures for 1921 with those for preceding years.

Coal produced in California in 1911–1913, in California, Idaho, and Nevada in 1914 and 1915, in California and Idaho in 1916–1920, and in California, Idaho, and Oregon in 1921.

Year.	Quantity (net tons).				Value.		Number of employees.	Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Total.	Average per ton.		
1911	4,981	5,266	500	10,747	$16,097	$1.50	45	254
1912	3,748	3,630	3,600	10,978	23,601	2.15	52	184
1913	14,864	1,808	8,167	24,839	84,073	3.38	35	332
1914	4,200	9,174	600	13,974	39,821	2.85	43	291
1915	2,488	9,715	300	12,503	32,054	2.56	36	285
1916	1,593	4,647	1,000	7,240	15,367	2.12	18	188
1917	2,800	3,383	240	6,423	14,791	2.30	17	173
1918	5,800	600	....	6,400	17,250	2.70	15	240
1919	2,448	3,591	515	6,554	22,174	3.38	77	59
1920	208	2,540	5	2,753	12,000	4.23	10	181
1921	19,015	13,305	6,525	38,845	181,000	4.66	141	149

COLORADO.

Colorado, which is the largest coal-producing State west of Mississippi River, made an output of 10,323,420 tons, valued at $28,748,534, in 1919, as compared with 12,407,571 tons, valued at $33,404,743, in 1918. A decrease in output was reported from every county except Delta, El Paso, and Routt. Garfield County showed the greatest loss, the output dropping from 92,655 to 20,539 tons. The heaviest actual losses were in Huerfano and Las Animas counties. For the State as a whole the decrease was 2,084,151 tons, or 16.7 per cent. The total value declined $4,656,209, or 13.9 per cent, but the average value per ton increased 9 cents.

The number of men employed decreased in 1919 but increased again in 1920. In 1918 the average number of men employed was 14,483; in 1919 it dropped to 11,829; and in 1920 it rose to 13,711. The decrease in 1919 was due in part to conditions produced by the strike of September, 1919, in the steel industry, which closed a number of large mines that produced coking coal. The decrease, however, was apparently exaggerated by the interpretation placed by operators on the statistical inquiry as to the number employed, for the reports of the State inspector of coal mines do not show so great a decrease. As the number of men employed was probably understated, the average production per man per day, 3.88 tons, was somewhat overstated.

The production in 1920 fell short of equaling the records made in 1917 and 1918. The total output was 12,278,225 tons, valued at $42,829,000. As compared with 1919 this was an increase of 1,954,805 tons, or 18.9 per cent, in output and of $14,080,466, or 48.9 per cent, in value. The average value per ton advanced from $2.78 to $3.49. Every county but Routt shared in the increase in output; in that county there was a loss of 216,990 tons. The average number of days worked was 255, the same as in 1918, and the average yearly output per man was higher; but the daily output was lower than in 1919. There was an increase of 2,074 in the number of men employed underground and a decrease of 192 in the number employed above ground. The losses by strikes were less. In 1919 strikes involved 6,186 men for an average of 14 days per striker; in 1920 they involved only 2,012 men for an average time of 9 days. The number of man-days lost therefore dropped from 89,392 to 18,240.

The total output in 1921 (9,122,760 tons) showed a decline compared with 1920 of 3,155,465 tons, or 25.7 per cent. Every county but Weld showed a loss in production; in Weld County the output rose from 920,073 tons in 1920 to 1,028,074 tons in 1921. The total value of the coal produced in the State declined from $42,829,000 to $32,377,000, a loss of $10,452,000, or 24.4 per cent. The average value per ton, however, increased 6 cents, rising to $3.55. There was an increase of 818 in the total number of men employed, but a decrease of 83 in the number of surface employees. As the number of days worked dropped to 164 the average tonnage per worker per year naturally declined, but the daily tonnage increased 0.32 ton over that in 1920. The losses by strikes were also heavier. During the year the man-day losses amounted to 72,830 days, involving 2,497 men for an average of 29 days per man.

Coal produced in Colorado in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground.		Surface.	Total.	
						Miners.[a]	All others.			
1919.										
Boulder	1,037,043	46,621	38,821		1,122,485	964		335	1,299	219
Delta	69,250	18,761	2,290		90,301	62		21	83	174
El Paso	201,937	91,513	12,589		306,039	116		194	310	240
Fremont	761,803	43,193	18,747		823,743	932		183	1,115	280
Garfield	11,692	8,247	600		20,539	23		12	35	274
Gunnison	447,950	4,313	25,411		477,674	399		178	577	247
Huerfano	1,778,216	39,568	40,877		1,858,661	1,786		560	2,346	230
La Plata	85,747	19,057	1,058	5,471	111,333	124		23	147	184
Las Animas	3,024,879	38,376	61,071	179,644	3,303,970	2,981		758	3,739	231
Mesa	95,334	14,527	6,460		116,321	114		71	185	194
Routt	1,129,699	7,106	44,527		1,181,332	783		297	1,080	169
Weld	605,392	28,687	25,581		659,660	501		196	697	182
Other counties[b]	189,178	26,791	9,167		225,136	146		70	216	227
Small mines		26,226			26,226					
	9,438,120	412,986	287,199	185,115	10,323,420	8,931		2,898	11,829	225
1920.										
Boulder	1,109,699	52,861	55,944		1,218,504	704	322	182	1,208	245
Delta	102,936	17,638	325		120,899	59	22	25	106	237
El Paso	242,089	130,867	11,021		383,977	206	74	54	334	237
Fremont	808,627	54,808	8,097		871,532	645	340	228	1,213	287
Garfield	265	27,511	600		28,376	20	8	6	34	256
Gunnison	582,305	6,488	30,101		618,894	317	152	208	677	255
Huerfano	2,320,882	41,700	32,679		2,395,261	1,476	762	653	2,891	268
Jackson and Jefferson	215,222	2,395	11,204		228,821	157	56	60	273	246
La Plata	108,252	6,482	1,232	11,766	127,732	87	41	28	156	245
Las Animas	3,841,568	41,956	65,340	270,222	4,219,086	2,641	1,095	808	4,544	289
Mesa	152,034	18,222			170,256	161	65	35	261	190
Moffat and Rio Blanco		6,472			6,472	3	4	2	9	284
Routt	905,962	11,626	46,754		964,342	621	307	279	1,207	119
Weld	859,905	31,943	28,225		920,073	446	214	138	798	206
	11,249,746	450,969	291,522	281,988	12,274,225	7,543	3,462	2,706	13,711	255
Small mines	1,000	3,000			4,000					
	11,250,746	453,969	291,522	281,988	12,278,225					
1921.[c]										
Boulder	758,370	46,610	46,706		851,686	615	325	178	1,118	166
Delta	69,735	20,200			89,935	58	14	25	97	147
Elbert, Jackson, and Jefferson	167,897	4,829	8,301		181,027	136	57	42	235	177
El Paso	159,950	122,232	6,349		288,531	192	68	67	327	155
Fremont	535,898	47,991	6,932		590,821	803	302	201	1,306	165
Garfield	6,962	9,833			16,795	14	3	3	20	188
Gunnison	445,993	4,704	28,310		479,007	378	170	174	722	154
Huerfano	1,718,620	16,331	20,799		1,755,750	1,634	725	629	2,988	192
La Plata	75,879	12,568	704	10,502	99,653	99	43	28	170	157
Las Animas	2,593,320	35,342	48,940	50,111	2,727,713	3,050	1,166	796	5,012	157
Mesa	96,461	14,700	2,600		113,761	110	39	41	190	158
Moffat, Montezuma, Ouray, Pitkin, and Rio Blanco		10,992			10,992	18	4	3	25	182
Routt	826,207	8,968	53,840		889,015	728	233	260	1,221	104
Weld	953,321	44,516	30,237		1,028,074	621	301	176	1,098	184
	8,408,613	[d]399,816	253,718	60,613	[d]9,122,760	8,456	3,450	2,623	14,529	164

[a] Includes also loaders and shot firers.
[b] Jackson, Jefferson, Moffat, Pitkin, and Rio Blanco.
[c] Exclusive of product of wagon mines.
[d] In addition to this total, 14,869 tons was produced by small mines and sold to local trade. The total production of the State was therefore 9,137,629 tons, and the total sold to local trade and used by employees was 414,685 tons.

Value of coal produced in Colorado in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Boulder	$2,723,925	$132,025	$85,980		$2,941,930	$2.62
Delta	192,115	52,952	5,000		250,067	2.77
El Paso	404,380	209,828	19,847		634,055	2.07
Fremont	2,524,395	136,230	37,792		2,698,417	3.28
Garfield	21,981	27,415	1,743		51,139	2.49
Gunnison	1,325,844	10,390	59,563		1,395,797	2.92
Huerfano	6,126,639	78,771	100,338		6,305,748	3.39
La Plata	220,868	56,933	3,196	$16,413	297,410	2.67
I as Animas	7,642,904	84,212	128,561	414,909	8,270,586	2.50
Mesa	241,318	39,665	16,200		297,183	2.55
Routt	3,477,492	23,473	101,548		3,602,513	3.05
Weld	1,303,368	89,492	48,950		1,441,810	2.18
Other counties [a]	396,778	62,008	14,448		473,234	2.10
Small mines		88,645			88,645	3.38
	26,602,007	1,092,039	623,166	431,322	28,748,534	
Average value per ton	2.82	2.64	2.17	2.33	2.78	2.78
1920.						
Boulder	3,807,000	228,000	147,000		4,182,000	3.43
Delta	329,000	52,000			381,000	3.15
El Paso	789,000	386,000	27,000		1,202,000	3.13
Fremont	3,379,000	216,000	30,000		3,625,000	4.16
Garfield	1,000	112,000	1,000		114,000	4.02
Gunnison	2,040,000	24,000	82,000		2,146,000	3.47
Huerfano	9,083,000	158,000	105,000		9,346,000	3.90
Jackson and Jefferson	637,000	11,000	29,000		677,000	2.96
La Plata	413,000	21,000	3,000	37,000	474,000	3.71
Las Animas	12,253,000	139,000	159,000	810,000	13,361,000	3.17
Mesa	520,000	70,000			590,000	3.47
Moffat and Rio Blanco		25,000			25,000	3.87
Routt	3,660,000	38,000	138,000		3,836,000	3.98
Weld	2,676,000	111,000	71,000		2,858,000	3.11
	39,587,000	1,591,000	792,000	847,000	42,817,000	3.49
Small mines	5,000	7,000			12,000	3.00
	39,592,000	1,598,000	792,000	847,000	42,829,000	
Average value per ton	3.52	3.52	2.71	3.00	3.49	3.49
1921. [b]						
Boulder	2,290,000	131,000	152,000		2,573,000	3.02
Delta	209,000	50,000			259,000	2.88
Elbert, Jackson, and Jefferson	526,000	19,000	18,000		563,000	5.11
El Paso	471,000	363,000	13,000		847,000	2.93
Fremont	2,507,000	165,000	23,000		2,695,000	4.56
Garfield	30,000	38,000			68,000	4.05
Gunnison	1,625,000	14,000	89,000		1,728,000	3.61
Huerfano	7,050,000	54,000	70,000		7,174,000	4.09
La Plata	234,000	42,000	1,000	39,000	316,000	3.17
Las Animas	8,780,000	104,000	139,000	156,000	9,179,000	3.36
Mesa	351,000	47,000	9,000		407,000	3.58
Moffat, Montezuma, Ouray, Pitkin, and Rio Blanco		42,000			42,000	3.82
Routt	3,502,000	31,000	185,000		3,718,000	4.18
Weld	2,589,000	153,000	66,000		2,808,000	2.73
	30,164,000	1,253,000	765,000	195,000	32,377,000	
Average value per ton	3.58	3.13	3.02	3.22	3.55	3.55

[a] Jackson, Jefferson, Moffat, Pitkin, and Rio Blanco.
[b] Exclusive of product of wagon mines.

Coal produced in Colorado, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Boulder	1,277,663	1,360,261	1,122,485	1,218,504	851,686	− 366,818
Delta	94,569	89,476	90,301	120,899	89,935	− 30,964
El Paso	371,166	301,647	306,039	383,977	288,531	− 95,446
Fremont	871,846	871,326	823,743	871,532	590,821	− 280,711
Garfield	104,463	92,655	20,539	28,376	16,795	− 11,581
Gunnison	655,584	652,770	477,674	618,894	479,007	− 139,887
Huerfano	2,411,440	2,586,911	1,858,661	2,395,261	1,755,750	− 639,511
Jackson and Jefferson	217,486	[a] 224,408	210,388	228,821	[a] 181,027	− 47,794
La Plata	139,478	138,963	111,333	127,732	99,653	− 28,079
Las Animas	4,359,844	4,250,291	3,303,970	4,219,086	2,727,713	− 1,491,373
Mesa	179,222	191,043	116,321	170,256	113,761	− 56,495
Pitkin and Rio Blanco	26,693	(a)	[b] 14,748	[b] 6,472	[b] 10,992	+ 4,520
Routt	1,074,103	941,355	1,181,332	964,342	889,015	− 75,327
Weld	654,977	687,609	659,660	920,073	1,028,074	+ 108,001
Small mines	[c] 44,802	[c] 18,856	26,226	4,000	....	− 4,000
	12,483,336	12,407,571	10,323,420	12,278,225	9,122,760	− 3,155,465
Total value	$27,669,129	$33,404,743	$28,748,534	$42,829,000	$32,377,000	−$10,452,000

[a] Jackson and Jefferson include Pitkin and Rio Blanco in 1918; Elbert County in 1921.
[b] Moffat, Pitkin, and Rio Blanco in 1919; Moffat and Rio Blanco in 1920; and Moffat, Montezuma, Ouray, Pitkin, and Rio Blanco in 1921.
[c] Includes Montrose and Ouray.

GEORGIA.

Commercial coal operations in Georgia are now confined to one mine. There were two in 1917 and 1918. There was a decline in output from year to year in each of the five years covered by the following table, large in 1918 and 1921 and very small in 1920. In Georgia, as in other States, the high mark in the average value per ton was reached in 1920, but the fall in value in 1921, unlike that in many other States, carried the average for the year below that of the four years preceding.

Coal produced in Georgia, 1917–1921.

Year.	Quantity (net tons).					Value.		Number of employees.	Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Total.	Average per ton.		
1917	37,855	1,284	7,200	72,689	119,028	$301,391	$2.53	281	269
1918	21,725	888	6,250	37,853	66,716	239,377	3.59	190	258
1919	15,028	679	4,600	33,030	53,337	198,033	3.71	168	284
1920	15,961	791	3,600	29,804	50,156	251,000	5.00	148	294
1921	18,755	373	1,979	12,708	33,815	171,000	2.14	136	183

ILLINOIS.

Illinois, which had brought its coal-mining facilities up to high speed in 1917 and 1918 to meet the increased industrial demand in its ordinary sales territory and to supply the deficit created by the wartime exclusion of eastern coals from western markets by the zoning system, suffered heavily in the postwar drop in the demand for coal, in 1919. The production fell from 89,291,105 tons, valued at $206,860,291, in 1918, to 60,862,608 tons, valued at $140,075,969, in 1919. The decrease in quantity therefore was 28,428,497 tons, or 31.9 per cent; the decrease in value was $66,784,322, or 32.2 per cent. The average value per ton in 1919 was $2.30, or 2 cents less than that in the preceding year. Although 47 counties report production to the Geological Survey, the largest part of the output in 1918, 79,019,041 tons, was made by 15 counties. These same counties in 1919 reported an output of 53,292,001 tons, which represented a loss of 25,727,040 tons out of the total loss of 28,428,497 tons. The output in the three principal counties in the southern Illinois field—Franklin, Saline, and Williamson—fell off 7,037,565 tons in 1919 as compared with that in 1918, when they produced 29,396,512 tons. The Central, Fulton-Peoria, Danville, and Belleville fields also lost heavily. Some of the smaller producing counties, however, showed an increase.

The loss in production in 1919 was evidently due primarily to market conditions and to the strike of November and December. The total number of men employed in 1919 was 85,020, a decrease of only 945 from the number employed in 1918. The average number of days the mines worked, however, fell from 238 to 160 and the average yearly output per man from 1,039 to 716 tons. The average daily output per man, however, increased from 4.37 to 4.48 tons. The loss by strikes was small except during the general bituminous strike in November and December, which involved 81,600 men, entailed a total loss of 3,558,094 man-days, and ran the average number of days lost per man up to 44.

In 1920, when Illinois again had to supply exceptional demands, production rose to 88,724,893 tons, an increase of 27,862,285 tons, or 45.7 per cent. Every county except Bureau, Jackson, and Stark shared in the increase, and in Franklin, Fulton, Macoupin, Peoria, Sangamon, and Tazewell counties the production exceeded that in 1918. The total value of the coal produced in 1920 was $273,509,000, an increase of $133,433,031, or 95.3 per cent, as compared with 1919. The average value per ton rose from $2.30 to $3.08, reaching by far the highest average value ever reported for the State. The increase in output involved more men, more days, and a greater output per man per day. The increase in the number of men employed was 2,064, of whom only 84 were employed above ground. The average number of days was 213, as against 160 days in 1919, and the average daily output per man was 0.3 ton greater. The losses by strikes were also materially reduced. The chief labor disturbance was a brief suspension late in July and early in August, which was caused by the dissatisfaction of the day and monthly men with the increases given to them by the Bituminous Coal Commission. The outcome of the strike was an advance in the day rate from $6 to $7.50. During the year 68,481 workers in Illinois went on strike, with an average loss per man of 14 days and a total loss of man-days of 948,408.

In 1921 production dropped back to 69,602,763 tons, a decrease of 19,122,130 tons, or 21.6 per cent, from that in 1920. The total value of the coal mined was $190,986,000, a decrease of $82,523,000, or 30.2 per cent. The average value per ton declined from $3.08 to $2.74. Six counties out of the total reporting showed an increase in output over 1920; Henry County increased from 24,809 tons to 26,029 tons; Jackson, from 1,037,844 to 1,113,612; Knox, from 24,089 to 31,206; Randolph, from 1,595,723 to 1,810,157; Stark, from 6,185 to 8,460; and Washington, from 769,697 tons to 908,797 tons. In the big three counties in southern Illinois, however, production declined 3,169,683 tons. Although the mines averaged only 152 days during the year, the labor employed, as measured in terms of average daily tonnage, established a new high record, the output being 4.8 tons per man per day. This daily average was surpassed in only three States—Utah, 6.10 tons; Wyoming, 5.08 tons; and Indiana, 4.86 tons. The losses by strikes were the smallest since 1918. The average number of days idle per man striking was 13; 18,088 men were involved in strikes; and 226,112 man-days were thus lost. The year was also notable for the marked increase in the number of men employed at the mines.

Coal produced in Illinois in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground.		Surface.	Total.	
					Miners.[a]	All others.			
1919.									
Bond and White	224,206	16,879	8,241	249,326	363		39	402	194
Bureau	783,314	102,224	42,077	927,615	1,795		179	1,974	193
Christian	2,040,286	156,420	56,475	2,253,181	2,667		312	2,979	147
Clinton	1,044,350	95,356	37,130	1,176,836	1,265		172	1,437	162
Franklin	9,304,512	160,876	333,933	9,799,321	9,926		1,856	11,782	159
Fulton	1,317,637	165,664	39,617	1,522,918	2,482		283	2,765	151
Gallatin and Johnson	175,365	7,606	2,710	185,681	362		39	401	147
Greene, Macon, and Moultrie	145,658	168,389	18,369	332,416	515		51	566	209
Grundy	165,353	11,102	15,419	191,874	363		64	427	145
Hancock, Scott, and Warren	....	4,612	4	4,616	18		3	21	150
Henry	....	22,731	1,906	24,637	43		5	48	231
Jackson	920,937	93,344	40,631	1,054,912	1,177		192	1,369	191
Knox	....	10,310	600	10,910	27		6	33	199
La Salle	415,854	301,521	32,329	749,704	1,219		198	1,417	203
Livingston	18,850	80,331	4,466	103,647	139		38	177	252
Logan, McLean, Putman, Will, and Woodford	705,496	161,787	61,055	928,338	1,619		309	1,928	198
Macoupin	4,522,360	72,205	135,811	4,730,376	5,661		528	6,189	149
Madison	2,993,377	119,064	104,670	3,217,111	3,786		375	4,161	151
Marion	716,682	21,618	30,652	768,952	893		100	993	185
Marshall	194,113	41,972	22,834	258,919	623		68	691	233
Menard	87,929	44,823	5,539	138,291	198		32	230	169
Mercer	143,144	15,165	9,208	167,517	243		86	329	162
Montgomery	1,912,133	37,001	58,285	2,007,419	3,086		338	3,424	115
Peoria	655,182	86,303	10,687	752,172	1,099		139	1,238	169
Perry	2,151,483	87,699	108,942	2,348,124	2,502		378	2,880	158
Randolph	1,038,518	24,576	26,904	1,089,998	1,257		119	1,376	158
Rock Island	7,437	20,918	942	29,297	56		12	68	174
St. Clair	3,812,417	242,635	149,756	4,204,808	5,767		701	6,468	132
Saline	3,752,158	75,702	124,925	3,952,785	5,493		662	6,155	156
Sangamon	4,730,847	363,271	124,463	5,218,581	6,728		685	7,413	160
Schuyler	....	7,394	20	7,414	22		2	24	149
Shelby	149,789	39,019	11,870	200,678	314		48	362	224
Stark	....	12,364	350	12,714	28		6	34	215
Tazewell	362,979	65,500	6,477	434,956	706		87	793	160
Vermilion	2,302,599	226,626	44,688	2,573,913	2,871		500	3,371	182
Washington	489,573	49,320	23,515	562,408	689		69	758	179
Williamson	8,255,513	98,690	252,638	8,606,841	9,011		1,326	10,337	161
Small mines	....	63,402	....	63,402	....		......	......	......
	55,540,051	3,374,419	1,948,138	60,862,608	75,013		10,007	85,020	160

[a] Includes also loaders and shot firers.

Coal produced in Illinois in 1919–1921—Continued.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground.		Surface.	Total.	
					Miners.[a]	All others.			
1920.									
Bond and White	351,478	19,398	10,710	381,586	218	107	37	362	257
Bureau	755,126	66,268	37,893	859,287	960	415	160	1,535	249
Christian	3,152,128	175,315	65,104	3,392,547	1,893	768	294	2,955	197
Clinton	1,171,727	93,362	46,661	1,311,750	914	304	158	1,376	175
Franklin	12,268,420	126,272	443,301	12,837,993	6,499	3,685	1,753	11,937	199
Fulton	2,593,807	62,643	56,148	2,712,598	1,875	813	305	2,993	240
Gallatin and Johnson	182,857	4,641	10,710	198,208	157	86	29	272	144
Greene, Moultrie, and Shelby	205,791	36,227	16,976	258,994	190	65	44	299	211
Grundy	205,161	22,620	18,173	245,954	263	102	47	412	278
Hancock, Schuyler, and Warren	....	7,798	....	7,798	14	5	5	24	217
Henry	....	23,397	1,412	24,809	32	11	8	51	266
Jackson	926,139	70,417	41,288	1,037,844	759	396	178	1,333	173
Knox	800	22,764	525	24,089	35	8	8	51	198
La Salle	528,058	314,817	31,487	874,362	839	266	176	1,281	253
Livingson	18,640	88,853	4,956	112,449	110	48	37	195	228
Logan, McLean, Putnam, Will, and Woodford	896,795	191,882	61,279	1,149,956	1,079	350	164	1,593	261
Macon	70,320	207,204	13,375	290,899	290	151	32	473	247
Macoupin	8,428,943	125,517	192,651	8,747,111	4,067	2,142	565	6,774	234
Madison	4,518,455	157,590	138,882	4,814,927	2,499	1,049	393	3,941	213
Marion	925,646	26,793	36,334	988,773	602	207	103	912	224
Marshall	201,035	74,434	24,604	300,073	431	132	66	629	266
Menard	147,076	53,519	5,283	205,878	192	70	27	289	236
Mercer	197,948	13,356	9,922	221,226	153	94	32	279	248
Montgomery	3,847,112	52,376	74,154	3,973,642	2,194	1,242	369	3,805	218
Peoria	1,234,386	119,400	13,030	1,366,816	960	312	152	1,424	266
Perry	2,578,304	110,979	113,311	2,802,594	1,968	769	396	3,133	180
Randolph	1,526,691	32,954	36,078	1,595,723	1,015	446	144	1,605	190
Rock Island	11,577	81,200	800	93,577	63	28	12	103	225
St. Clair	6,730,980	342,945	178,944	7,252,869	4,944	1,444	626	7,014	184
Saline	5,152,603	85,003	147,306	5,384,912	3,479	1,852	705	6,036	196
Sangamon	8,032,474	381,084	153,456	8,567,014	5,008	1,950	873	7,831	246
Stark	....	5,965	220	6,185	11	3	3	17	203
Tazewell	770,394	148,008	7,225	925,627	641	242	99	982	269
Vermilion	3,673,993	227,013	65,500	3,966,506	2,041	1,032	535	3,608	267
Washington	680,253	61,710	27,734	769,697	462	213	74	749	233
Williamson	10,524,912	102,809	298,899	10,926,620	6,506	2,823	1,482	10,811	180
	82,510,029	3,736,533	2,384,331	88,630,893	53,363	23,630	10,091	87,084	213
Small mines	64,000	30,000	....	94,000	....	....	....	....	....
	82,574,029	3,766,533	2,384,331	88,724,893	....	....	....	....	....

[a] Includes also loaders and shot firers.

Coal produced in Illinois in 1919–1921—Continued.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground.		Surface.	Total.	
					Miners.[a]	All others.			
1921.[b]									
Bond, Johnson, and White	344,165	12,066	9,433	365,664	293	131	52	476	160
Bureau	473,452	49,323	33,896	556,671	1,226	389	162	1,777	126
Cass, Moultrie, Scott, and Warren	148,938	13,857	12,155	174,950	159	42	20	221	187
Christian	2,748,238	146,690	55,982	2,950,910	1,762	892	401	3,055	152
Clinton	690,233	73,646	38,349	802,228	933	309	124	1,366	98
Franklin	11,422,369	109,955	415,215	11,947,539	7,873	4,358	1,689	13,920	169
Fulton	1,313,078	129,875	28,184	1,471,137	2,313	771	312	3,396	107
Gallatin	131,804	6,538	7,276	145,618	220	85	59	364	85
Greene	....	6,959	....	6,959	23	......	......	23	108
Grundy	171,189	17,095	14,642	202,926	314	96	44	454	193
Hancock	....	6,546	....	6,546	17	2	2	21	185
Henry	....	24,083	1,946	26,029	63	5	7	75	185
Jackson	998,544	67,034	48,034	1,113,612	944	445	173	1,562	161
Knox	....	30,752	454	31,206	61	6	6	73	158
La Salle	187,804	182,016	14,993	384,813	828	223	140	1,191	125
Livingston	12,805	82,407	2,698	97,910	166	37	40	243	155
Logan, McLean, Putnam, Will, and Woodford	553,991	143,898	53,617	751,506	1,149	389	168	1,706	169
McDonough	....	7,534	....	7,534	43	2	2	47	131
Macon	56,430	154,725	15,579	226,734	291	115	35	441	174
Macoupin	5,927,455	133,781	169,717	6,230,953	4,460	2,546	626	7,632	165
Madison	2,988,600	176,429	113,553	3,278,582	2,939	1,267	417	4,623	124
Marion	662,675	18,621	24,438	705,734	648	301	100	1,049	154
Marshall	157,396	60,405	12,106	229,907	469	123	57	649	177
Menard	71,703	44,524	7,114	123,341	173	43	25	241	148
Mercer	155,356	21,470	8,516	185,342	198	76	31	305	165
Montgomery	2,180,590	44,706	54,197	2,279,493	2,220	851	298	3,369	122
Peoria	934,305	151,122	16,575	1,102,002	1,229	357	170	1,756	164
Perry	2,222,319	84,270	96,882	2,403,471	2,199	849	319	3,367	151
Randolph	1,709,154	60,221	40,783	1,810,158	1,173	606	151	1,930	178
Rock Island	7,882	57,184	850	65,916	72	22	13	107	188
St. Clair	4,694,093	377,864	123,645	5,195,602	4,945	1,600	632	7,177	127
Saline	4,345,134	63,332	124,009	4,532,475	4,064	1,775	705	6,544	138
Sangamon	5,535,060	288,711	132,984	5,956,755	6,301	2,077	802	9,180	153
Schuyler	....	7,611	....	7,611	21	......	......	21	151
Shelby	43,225	28,007	5,088	76,320	106	35	14	155	124
Stark	....	8,460	....	8,460	25	3	2	30	170
Tazewell	577,151	105,256	8,952	691,359	674	318	90	1,082	158
Vermilion	2,766,752	225,006	48,407	3,040,165	2,320	1,000	599	3,919	174
Washington	838,457	45,338	25,002	908,797	519	272	65	856	248
Williamson	9,103,765	104,165	291,898	9,499,828	7,033	2,625	1,370	11,028	160
	64,174,112	3,371,482	2,057,169	69,602,763	60,466	25,043	9,922	95,431	152

[a] Includes also loaders and shot firers.
[b] Exclusive of prodnct of wagon mines.

Value of coal produced in Illinois in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Bond and White	$467,828	$39,900	$16,510	$524,238	$2.10
Bureau	2,329,786	309,813	107,181	2,746,780	2.96
Christian	4,259,468	418,459	136,413	4,814,340	2.13
Clinton	2,127,000	229,075	70,835	2,426,910	2.06
Franklin	22,898,853	282,838	746,483	23,928,174	2.44
Fulton	3,369,187	447,853	90,863	3,907,903	2.57
Gallatin and Johnson	373,107	18,113	5,612	396,832	2.14
Greene, Macon, and Moultrie	336,248	514,346	40,839	891,433	2.68
Grundey	529,077	36,884	47,574	613,535	3.20
Hancock, Scott, and Warren	....	17,072	18	17,090	3.70
Henry	....	86,065	3,491	89,556	3.64
Jackson	2,207,699	237,347	85,005	2,530,051	2.40
Knox	....	32,901	525	33,426	3.06
La Salle	1,284,894	1,002,466	83,478	2,370,838	3.16
Livingston	51,835	256,192	11,694	319,721	3.08
Logan, McLean, Putnam, Will, and Woodford	1,899,266	536,548	162,563	2,598,377	2.80
Macoupin	9,381,761	191,264	236,034	9,809,059	2.07
Madison	6,758,990	263,862	211,565	7,234,417	2.25
Marion	1,465,048	51,819	60,917	1,577,784	2.05
Marshall	708,603	179,258	85,449	973,310	3.76
Menard	193,542	127,483	9,373	330,398	2.39
Mercer	425,879	46,964	27,807	500,650	2.99
Montgomery	4,337,319	104,041	131,767	4,573,127	2.28
Peoria	1,661,112	236,623	24,782	1,922,517	2.56
Perry	4,765,368	213,190	220,878	5,199,436	2.21
Randolph	2,286,229	56,344	47,590	2,390,163	2.19
Rock Island	16,498	62,754	2,926	82,178	2.80
St. Clair	7,376,549	545,853	276,840	8,199,242	1.95
Saline	9,159,228	201,261	246,037	9,606,526	2.43
Sangamon	10,261,142	972,319	246,206	11,479,667	2.20
Schuyler	....	21,905	60	21,965	2.96
Shelby	330,158	118,688	27,454	476,300	2.37
Stark	....	36,750	450	37,200	2.92
Tazewell	954,794	161,823	14,133	1,130,750	2.60
Vermilion	4,940,552	523,476	83,076	5,547,104	2.15
Washington	1,100,108	121,689	44,701	1,266,498	2.25
Williamson	18,604,710	219,272	511,847	19,335,829	2.25
Small mines	....	172,645	....	172,645	2.72
	126,861,838	9,095,155	4,118,976	140,075,969	....
Average value per ton	2.28	2.70	2.11	2.30	2.30
1920.					
Bond and White	1,028,000	69,000	30,000	1,127,000	2.95
Bureau	2,892,000	249,000	122,000	3,263,000	3.80
Christian	7,628,000	565,000	147,000	8,340,000	2.46
Clinton	3,277,000	269,000	126,000	3,672,000	2.80
Franklin	42,709,000	423,000	1,362,000	44,494,000	3.47
Fulton	8,358,000	218,000	175,000	8,751,000	3.23
Gallatin and Johnson	739,000	13,000	24,000	776,000	3.91
Greene, Moultrie, and Shelby	707,000	157,000	42,000	906,000	3.50
Grundy	847,000	97,000	65,000	1,009,000	4.10
Hancock, Schuyler, and Warren	....	29,000	....	29,000	3.72
Henry	....	97,000	3,000	100,000	4.03
Jackson	3,319,000	238,000	127,000	3,684,000	3.55
Knox	5,000	74,000	1,000	80,000	3.32
La Salle	2,227,000	1,110,000	100,000	3,437,000	3.93
Livingston	74,000	442,000	14,000	530,000	4.71
Logan, McLean, Putnam, Will, and Woodford	3,113,000	790,000	196,000	4,099,000	3.56
Macon	293,000	856,000	55,000	1,204,000	4.14
Macoupin	22,938,000	371,000	442,000	23,751,000	2.72
Madison	13,003,000	472,000	355,000	13,830,000	2.87
Marion	2,786,000	85,000	94,000	2,965,000	3.00
Marshall	888,000	376,000	101,000	1,365,000	4.54
Menard	478,000	183,000	18,000	679,000	3.30
Mercer	705,000	61,000	33,000	799,000	3.61
Montgomery	11,805,000	159,000	190,000	12,154,000	3.06
Peoria	4,160,000	347,000	35,000	4,542,000	3.32
Perry	8,837,000	352,000	270,000	9,459,000	3.38
Randolph	4,524,000	108,000	89,000	4,721,000	2.96
Rock Island	47,000	295,000	2,000	344,000	3.68
St. Clair	19,444,000	1,090,000	451,000	20,985,000	2.89
Saline	16,362,000	261,000	361,000	16,984,000	3.15

Value of coal produced in Illinois in 1919–1921—Continued.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1920.					
Sangamon	$23,217,000	$1,119,000	$356,000	$24,692,000	$2.88
Stark	....	20,000	....	20,000	3.23
Tazewell	3,112,000	548,000	22,000	3,682,000	3.98
Vermilion	9,937,000	607,000	145,000	10,689,000	2.69
Washington	2,227,000	197,000	68,000	2,492,000	3.24
Williamson	32,341,000	334,000	811,000	33,486,000	3.06
	254,027,000	12,681,000	6,432,000	273,140,000	3.08
Small mines	267,000	102,000	....	369,000	3.93
	254,294,000	12,783,000	6,432,000	273,509,000	....
Average value per ton	3.08	3.39	2.70	3.08	3.08
1921.[a]					
Bond, Johnson, and White	803,000	46,000	23,000	872,000	2.38
Bureau	1,800,000	187,000	114,000	2,101,000	3.78
Cass, Moultrie, Scott, and Warren	393,000	49,000	26,000	468,000	2.67
Christian	5,644,000	494,000	167,000	6,305,000	2.14
Clinton	1,732,000	194,000	80,000	2,006,000	2.50
Franklin	35,246,000	382,000	1,214,000	36,842,000	3.08
Fulton	3,786,000	392,000	69,000	4,247,000	2.89
Gallatin	314,000	16,000	17,000	347,000	2.38
Greene	....	25,000	....	25,000	3.59
Grundy	686,000	79,000	61,000	826,000	4.07
Hancock	....	33,000	....	33,000	5.04
Henry	....	99,000	3,000	102,000	3.92
Jackson	2,992,000	194,000	109,000	3,295,000	2.96
Knox	....	93,000	1,000	94,000	3.01
La Salle	738,000	794,000	53,000	1,585,000	4.12
Livingston	48,000	347,000	8,000	403,000	4.12
Logan, McLean, Putnam, Will, and Woodford	1,787,000	514,000	146,000	2,447,000	3.26
McDonough	....	22,000	....	22,000	2.92
Macon	244,000	663,000	48,000	955,000	4.21
Macoupin	15,774,000	396,000	379,000	16,549,000	2.66
Madison	7,884,000	484,000	238,000	8,606,000	2.62
Marion	1,776,000	61,000	57,000	1,894,000	2.68
Marshall	682,000	275,000	45,000	1,002,000	4.36
Menard	179,000	148,000	14,000	341,000	2.76
Mercer	525,000	72,000	28,000	625,000	3.37
Montgomery	5,934,000	154,000	134,000	6,222,000	2.73
Peoria	2,559,000	429,000	47,000	3,035,000	2.75
Perry	5,926,000	265,000	250,000	6,441,000	2.68
Randolph	4,508,000	188,000	96,000	4,792,000	2.65
Rock Island	23,000	184,000	2,000	209,000	3.17
St. Clair	10,181,000	975,000	266,000	11,422,000	2.20
Saline	12,220,000	189,000	329,000	12,738,000	2.81
Sangamon	14,231,000	939,000	318,000	15,488,000	2.60
Schuyler	....	21,000	....	21,000	2.76
Shelby	120,000	108,000	10,000	238,000	3.12
Stark	....	24,000	....	24,000	2.84
Tazewell	1,650,000	229,000	27,000	1,906,000	2.76
Vermilion	7,012,000	602,000	114,000	7,728,000	2.54
Washington	2,738,000	142,000	73,000	2,953,000	3.25
Williamson	24,708,000	315,000	754,000	25,777,000	2.71
	174,843,000	10,823,000	5,320,000	190,986,000	....
Average value per ton	2.72	3.21	2.58	2.74	2.74

[a] Exclusive of product of wagon mines.

Coal produced in Illinois, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Bond and White	291,903	380,869	249,326	381,586	*a* 365,664	− *a* 15,922
Bureau	1,363,362	1,181,197	927,615	859,287	556,671	−302,616
Christian	3,133,360	3,340,377	2,253,181	3,392,547	2,950,910	−441,637
Clinton	1,464,722	1,533,702	1,176,836	1,311,750	802,228	−509,522
Franklin	11,455,238	12,373,356	9,799,321	12,837,993	11,947,539	−890,454
Fulton	2,820,495	2,552,105	1,522,918	2,712,598	1,471,137	−1,241,461
Gallatin	*a* 74,737	*a* 227,444	*a* 185,681	*a* 198,208	145,618	−52,590
Greene	*b* 268,006	*b* 228,237	*b* 332,416	*b* 258,994	6,959	− *b* 175,715
Grundy	418,033	317,801	191,874	245,954	202,926	−43,028
Hancock, Schuyler, Scott, and Warren	*c* 17,470	*c* 9,917	*c* 12,030	*c* 7,798	*c* 189,107	+ *c* 181,309
Henry	50,032	41,332	24,637	24,809	26,029	+1,220
Jackson	807,160	1,055,225	1,054,912	1,037,844	1,113,612	+75,768
Knox	14,050	7,669	10,910	24,089	31,206	+7,117
La Salle	1,151,156	1,083,879	749,704	874,362	384,813	−489,549
Livingston	125,363	105,341	103,647	112,449	97,910	−14,539
Logan	599,744	(*d*)	(*d*)	(*d*)	(*d*)	(*d*)
McDonough	(*b*)	(*b*)	....	....	7,534	+7,534
McLean, Putnam, Will, and Woodford	1,089,417	*d* 1,309,736	*d* 928,338	*d* 1,149,956	*d* 751,506	*d* −398,450
Macon	308,053	347,400	(*b*)	290,899	226,734	−64,165
Macoupin	7,070,146	7,381,165	4,730,376	8,747,111	6,230,953	−2,516,158
Madison	5,364,251	5,074,383	3,217,111	4,814,927	3,278,582	−1,536,345
Marion	1,120,426	1,119,206	768,952	988,773	705,734	−283,039
Marshall	437,087	310,784	258,919	300,073	229,907	−70,166
Menard	213,478	203,477	138,291	205,878	123,341	−82,537
Mercer	268,791	287,443	167,517	221,226	185,342	−35,884
Montgomery	4,204,722	4,231,122	2,007,419	3,973,642	2,279,493	−1,694,149
Peoria	1,547,916	1,295,460	752,172	1,366,816	1,102,002	−264,814
Perry	2,739,914	2,917,590	2,348,124	2,802,594	2,403,471	−399,123
Randolph	1,397,629	1,627,414	1,089,998	1,595,723	1,810,158	+214,435
Rock Island	55,082	36,068	29,297	93,577	65,916	−27,661
St. Clair	6,955,766	7,810,186	4,204,808	7,252,869	5,195,602	−2,057,267
Saline	5,188,777	5,684,594	3,952,785	5,384,912	4,532,475	−852,437
Sangamon	8,062,735	8,331,764	5,218,581	8,567,014	5,956,755	−2,610,259
Shelby	132,591	193,346	200,678	(*b*)	*b* 76,320	(*b*)
Stark	....	(*b*)	12,714	6,185	8,460	+2,275
Tazewell	508,215	484,681	434,956	925,627	691,359	−234,268
Vermilion	3,886,480	3,973,478	2,573,913	3,966,506	3,040,165	−926,341
Washington	812,563	821,357	562,408	769,697	908,797	+139,100
Williamson	10,645,697	11,338,562	8,606,841	10,926,620	9,499,828	−1,426,792
Small mines	134,820	73,438	63,402	94,000	....	−94,000
	86,199,387	89,291,105	60,862,608	88,724,893	69,602,763	−19,122,130
Total value	$162,281,822	$206,860,291	$140,075,969	$273,509,000	$190,986,000	−$82,523,000

a Johnson County included with Gallatin in 1917, 1918, 1919, and 1920; with Bond and White in 1921.
b Greene includes McDonough, Moultrie, and Stark counties in 1917 and 1918; Macon and Moultrie in 1919; and Moultrie and Shelby in 1920; Moultrie included with Hancock, etc., in 1921.
c No production in Schuyler County, 1917; no production in Scott County in 1920; includes Cass and Moultrie in 1921.
d McLean, etc., includes Logan County in 1918, 1919, 1920, and 1921.

INDIANA.

Indiana, like Illinois, pushed production ahead in 1917 and 1918 and felt the full force of the general depression in 1919. The production was 20,912,288 tons in 1919, as against 30,678,634 tons in 1918, a decline of 9,766,346 tons, or 31.8 per cent. The value of the output in 1919 was $46,345,750, which was $24,038,851, or 34.2 per cent, less than in 1918. The average value per ton dropped 7 cents, or to $2.22. The greatest losses in production were in Greene, Knox, Sullivan, Vermilion, and Vigo counties and aggregated 8,006,388 tons. Increases were reported in the output in Daviess and Spencer counties. The number of men employed decreased from 30,376 in 1918 to 29,987 in 1919, but the number employed underground increased from 23,979 to 25,316. The number of days the mines worked fell from 227 to 148. The general strike of November and December, 1919, of course, caused part of this decrease, but the unfavorable market made the running time short. The strikes during the year involved 28,431 men, and the average time lost by them per man was 40 days. The average output per man per day increased from 4.45 to 4.72 tons, but the output per year dropped from 1,010 to 698 tons.

In 1920 the production was 29,350,585 tons, valued at $92,867,000. As compared with the preceding year, this was an increase in quantity of 8,438,297 tons, or 40.4 per cent, and an increase in value of $46,521,250, or 100.4 per cent. The average value per ton went to $3.16. With the exception of Fountain and Warren counties, all fields in the State enjoyed a portion of the increased business. Greene County increased its output about 40 per cent and Sullivan 50 per cent. Substantial gains were also made by Knox, Vermilion, and Vigo counties. There was a small increase in the number of men employed, and a reduction of about 9 per cent in the number of surface employees. The strike of the day men in 1920 for an increase over the rates awarded by the Bituminous Coal Commission also reduced the output in Indiana, but the average number of days lost per man striking was reduced from 40 in 1919 to 22 in 1920. During the year strikes involved 19,068 men and caused a loss of 411,991 man-days. The average number of days the mines were in operation increased to 192 and the average yearly output per man from 698 to 934 tons. The average daily output per man was 0.14 ton greater, bringing the amount up to 4.86 tons.

The production in 1921 was 20,319,509 tons, valued at $52,269,000, a decrease, as compared with the preceding year, of 9,031,076 tons, or 30.8 per cent, in quantity and of $40,598,000, or 43.7 per cent, in value. The average value per ton was $2.57, a decline of 59 cents. With the exception of Crawford and Dubois counties, which made a combined output of 9,144 tons, every county showed substantial losses in production as compared with 1920. Nevertheless the total number of men employed increased from 31,155 to 32,687, though the number of outside men decreased more than 10 per cent. The mines in Indiana averaged only 128 days, primarily because of the poor market. The average daily output per man, however, 4.86 tons, was very high and was exceeded only in Utah and Wyoming. The losses by strikes declined; the total loss in man-days was 321,593, involving 17,634 workers an average of 18 days, as compared with 23 days for the bituminous mines of the country as a whole.

Coal produced in Indiana in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.									
Clay	931,288	22,996	52,496	1,006,780	1,164		430	1,594	142
Daviess	266,222	44,820	9,207	320,249	325		81	406	191
Dubois and Perry	....	25,250	250	25,500	41		4	45	260
Fountain and Warren	7,979	5,263	75	13,317	11		22	33	129
Gibson	437,432	22,911	16,270	476,613	747		101	848	147
Greene	1,878,771	59,752	83,345	2,021,868	2,677		612	3,289	126
Knox	2,825,543	63,869	76,246	2,965,658	2,790		550	3,340	155
Owen	81,801	4,764	10,550	97,115	30		131	161	125
Parke	57,422	31,426	4,064	92,912	188		32	220	179
Pike	972,166	26,221	26,586	1,024,973	1,267		259	1,526	140
Spencer	15,900	9,620	200	25,720	32		6	38	223
Sullivan	2,946,703	48,132	101,224	3,096,059	3,755		687	4,442	147
Vanderberg	94,610	160,139	10,011	264,760	294		163	457	197
Vermilion	2,714,467	23,375	107,003	2,844,845	3,704		464	4,168	154
Vigo	5,484,445	160,016	157,783	5,802,244	7,285		915	8,200	146
Warrick	708,995	43,712	28,610	781,317	1,006		214	1,220	161
Small mines	....	52,358	....	52,358	....		......	......	......
	19,423,744	804,624	683,920	20,912,288	25,316		4,671	29,987	148
1920.									
Clay	1,256,139	81,162	33,101	1,370,402	799	382	452	1,633	180
Crawford and Dubois	....	7,475	200	7,675	8	4	3	15	223
Daviess	288,024	45,915	9,633	343,572	267	115	73	455	187
Fountain and Warren	....	2,571	....	2,571	7	2	3	12	184
Gibson	762,571	40,306	20,180	823,057	710	261	85	1,056	211
Greene	2,730,374	71,861	76,633	2,878,868	1,891	797	590	3,278	170
Knox	3,556,583	64,807	84,321	3,705,711	2,272	1,049	337	3,658	158
Owen	106,619	11,294	4,015	121,928	30	12	89	131	197
Parke	76,251	25,203	3,800	105,254	115	68	28	211	245
Perry	....	15,997	....	15,997	24	9	6	39	280
Pike	1,370,595	30,566	20,852	1,422,013	1,039	466	283	1,788	164
Spencer	25,344	7,209	160	32,713	27	12	12	51	228
Sullivan	4,350,353	65,374	107,579	4,523,306	2,739	1,403	779	4,921	194
Vanderberg	157,728	202,845	10,420	370,993	345	111	43	499	272
Vermilion	3,408,670	22,749	119,768	3,551,187	2,070	1,031	421	3,522	215
Vigo	7,778,174	231,852	222,080	8,232,106	5,277	2,275	751	8,303	202
Warrick	1,500,143	61,782	21,307	1,583,232	973	332	278	1,583	210
	27,367,568	988,968	734,049	29,090,585	18,593	8,329	4,233	31,155	192
Small mines	248,000	12,000	....	260,000	....	......	......	......	......
	27,615,568	1,000,968	734,049	29,350,585	....	......	......	......	......
1921.[b]									
Clay	503,721	12,227	31,532	547,480	685	317	382	1,384	84
Crawford and Dubois	....	8,936	208	9,144	10	3	3	16	222
Daviess	234,917	27,578	8,609	271,104	284	103	50	437	140
Fountain and Warren	....	2,527	....	2,527	11	......	......	11	145
Gibson	607,824	32,984	17,319	658,127	591	331	112	1,034	147
Greene	1,799,263	23,839	62,377	1,885,479	1,828	764	475	3,067	109
Knox	2,624,994	42,445	68,672	2,736,111	2,430	877	391	3,698	135
Owen	67,132	2,063	8,150	77,345	12	......	82	94	121
Parke	8,006	19,548	695	28,249	85	43	17	145	71
Perry	....	8,064	....	8,064	21	4	2	27	150
Pike	1,001,270	21,986	12,213	1,035,469	1,069	468	270	1,807	102
Spencer	4,811	2,661	....	7,472	18	4	6	28	111
Sullivan	3,291,929	31,984	94,522	3,418,435	2,973	1,560	584	5,117	135
Vanderberg	80,764	134,846	9,055	224,665	297	79	28	404	185
Vermilion	2,055,566	40,199	90,121	2,185,886	2,528	1,099	380	4,007	116
Vigo	6,027,304	163,339	173,602	6,364,245	6,552	2,514	709	9,775	140
Warrick	808,758	35,394	15,555	859,707	1,078	294	264	1,636	118
	19,116,259	610,620	592,630	20,319,509	20,472	8,460	3,755	32,687	128

[a] Includes also loaders and shot firers.
[b] Exclusive of product of wagon mines.

Value of coal produced in Indiana in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Clay	$2,099,246	$71,410	$102,365	$2,273,021	$2.26
Daviess	577,484	104,748	21,402	703,634	2.20
Dubois and Perry	....	66,270	750	67,020	2.63
Fountain and Warren	19,789	15,976	125	35,890	2.70
Gibson	926,255	54,235	33,221	1,013,711	2.13
Greene	4,073,021	129,440	177,054	4,379,515	2.17
Knox	6,071,618	146,228	150,651	6,368,497	2.15
Owen	195,700	12,865	21,562	230,127	2.37
Parke	194,414	83,641	11,213	289,268	3.11
Pike	2,179,586	51,264	51,693	2,282,543	2.23
Spencer	35,590	23,203	450	59,243	2.30
Sullivan	6,309,424	108,547	216,764	6,634,735	2.14
Vanderburg	227,436	501,177	16,214	744,827	2.81
Vermilion	5,944,621	53,150	214,391	6,212,162	2.18
Vigo	12,426,830	413,637	318,359	13,158,826	2.27
Warrick	1,603,096	103,685	60,281	1,767,062	2.26
Small mines	....	125,669	....	125,669	2.40
	42,884,110	2,065,145	1,396,495	46,345,750	....
Average value per ton	2.21	2.57	2.04	2.22	2.22
1920.					
Clay	4,623,000	280,000	89,000	4,992,000	3.64
Crawford and Dubois	....	31,000	1,000	32,000	4.17
Daviess	825,000	158,000	30,000	1,013,000	2.95
Fountain and Warren	....	12,000	....	12,000	4.67
Gibson	2,495,000	129,000	58,000	2,682,000	3.26
Greene	9,327,000	265,000	240,000	9,832,000	3.42
Knox	10,364,000	228,000	209,000	10,801,000	2.91
Owen	482,000	51,000	14,000	547,000	4.49
Parke	365,000	99,000	15,000	479,000	4.55
Perry	....	55,000	....	55,000	3.44
Pike	4,509,000	83,000	58,000	4,650,000	3.27
Spencer	81,000	33,000	1,000	115,000	3.52
Sullivan	14,148,000	204,000	305,000	14,657,000	3.24
Vanderburg	601,000	645,000	29,000	1,275,000	3.44
Vermilion	9,975,000	67,000	323,000	10,365,000	2.92
Vigo	23,541,000	787,000	563,000	24,891,000	3.02
Warrick	5,139,000	189,000	58,000	5,386,000	3.40
	86,475,000	3,316,000	1,993,000	91,784,000	3.16
Small mines	1,046,000	37,000	....	1,083,000	4.17
	87,521,000	3,353,000	1,993,000	92,867,000	....
Average value per ton	3.17	3.35	2.72	3.16	3.16
1921.[a]					
Clay	1,178,000	33,000	64,000	1,275,000	2.33
Crawford and Dubois	....	25,000	1,000	26,000	2.84
Daviess	517,000	78,000	19,000	614,000	2.26
Fountain and Warren	....	8,000	....	8,000	3.16
Gibson	1,577,000	91,000	48,000	1,716,000	2.61
Greene	4,431,000	55,000	146,000	4,632,000	2.46
Knox	6,792,000	107,000	184,000	7,083,000	2.59
Owen	179,000	5,000	22,000	206,000	2.66
Parke	22,000	52,000	2,000	76,000	2.69
Perry	....	27,000	....	27,000	3.35
Pike	2,780,000	53,000	25,000	2,858,000	2.76
Spencer	11,000	7,000	....	18,000	2.41
Sullivan	8,157,000	94,000	229,000	8,480,000	2.48
Vanderburg	208,000	374,000	22,000	604,000	2.69
Vermilion	5,252,000	116,000	196,000	5,564,000	2.55
Vigo	15,952,000	447,000	395,000	16,794,000	2.64
Warrick	2,147,000	103,000	38,000	2,288,000	2.66
	49,203,000	1,675,000	1,391,000	52,269,000	....
Average value per ton	2.57	2.74	2.35	2.57	2.57

[a] Exclusive of product of wagon mines.

Coal produced in Indiana, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Clay	1,141,029	1,572,582	1,006,780	1,370,402	547,480	−822,922
Daviess	147,224	215,808	320,249	343,572	271,104	−72,468
Dubois	....	....	[a] 25,500	[a] 7,675	[a] 9,144	+1,469
Fountain and Warren	20,910	15,280	13,317	2,571	2,527	−44
Gibson	471,575	609,693	476,613	823,057	658,127	−164,930
Greene	3,498,038	3,426,168	2,021,868	2,878,868	1,885,479	−993,389
Knox	3,119,922	3,822,853	2,965,658	3,705,711	2,736,111	−969,600
Owen	62,869	[b] 266,520	97,115	121,928	77,345	−44,583
Parke	387,055	313,996	92,912	105,254	28,249	−77,005
Perry	24,509	([b])	([a])	15,997	8,064	−7,933
Pike	983,974	1,139,412	1,024,973	1,422,013	1,035,469	−386,544
Spencer	5,081	8,456	25,720	32,713	7,472	−25,241
Sullivan	3,528,902	4,346,857	3,096,059	4,523,306	3,418,435	−1,104,871
Vanderburg	384,199	347,440	264,760	370,993	224,665	−146,328
Vermilion	4,212,638	4,205,808	2,844,845	3,551,187	2,185,886	−1,365,301
Vigo	7,303,343	8,935,376	5,802,244	8,232,106	6,364,245	−1,867,861
Warrick	1,169,386	1,399,746	781,317	1,583,232	859,707	−723,525
Small mines	78,675	52,639	52,358	260,000	....	−260,000
	26,539,329	30,678,634	20,912,288	29,350,585	20,319,509	−9,031,076
Total value	$52,940,106	$70,384,601	$46,345,750	$92,867,000	$52,269,000	−$40,598,000

[a] Dubois includes Perry County in 1919, and Crawford County in 1920 and 1921.
[b] Owen includes Perry County in 1918.

IOWA.

The production of coal in Iowa in 1919, which totaled 5,624,692 tons, decreased 2,567,503 tons, or 31.3 per cent, as compared with 1918. The coal produced was valued at $17,352,620, a decrease of $7,350,617, or 29.8 per cent. The average value per ton was $3.09, an increase of 7 cents over the average for 1918. With the exception of Adams County, which made a total output of 7,418 tons, decreases were registered in every county, and the losses were especially heavy in Appanoose, Dallas, Mahaska, Monroe, and Wapello counties. The number of men employed was 12,366, or 962 less than in 1918, but the number of outside men was reduced only 61. Strikes cost 11,350 workers an average of 38 days each, or 433,884 man-days; the greater part of this loss was due to the general bituminous strike in November and December. The average number of days in which the mines in Iowa were in operation during the year dropped to 176, or 69 less than in 1918. The quantity produced per year per man declined 160 tons, but the average per man per day increased 0.08 ton.

Mahaska and Wapello counties were the only large producing areas in Iowa that did not contribute to the increased tonnage in 1920, when the output reached 7,813,916 tons, an increase of 2,189,224 tons, or 38.9 per cent, over the total in 1919. The total value was $30,794,000, an increase of $13,441,380, or 77.5 per cent, as compared with 1919. The average value per ton went up 85 cents, or to $3.94. There was a decrease of 461 in the number of men employed, of which 345 was in the workers above ground. There was a slight increase (0.02 ton) in the average output per man per day, but the increase in the number of days worked from 176 to 250 was chiefly responsible for raising the average tonnage per year to 653, or 38 tons more than in 1918. Strike losses in Iowa were the smallest for any State in which such losses were reported. The average number of days lost per man striking was 5, and the total number of workers involved 4,966; the total loss in man-days was 24,366.

Production in 1921 was the lowest for the State since 1896. The total output was only 4,531,392 tons, a decrease of 3,282,524 tons, or 42 per cent. The value was $17,256,800, a decrease of $13,537,200, or 44 per cent. The average value per ton, however, was only 13 cents less than the average for the preceding year. Every large producing county showed heavy losses. The number of men employed was reduced 519. Strike losses dropped to 1,840 man-days and involved 897 workers, an average of 2 days. The mines were in operation an average of 148 days, but the average output per man per day increased from 2.61 to 2.69 tons.

Coal produced in Iowa in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.									
Adams	....	7,368	50	7,418	45		5	50	187
Appanoose	882,327	78,064	27,834	988,225	2,923		321	3,244	167
Boone	212,852	22,580	6,577	242,009	539		71	610	193
Dallas	270,815	6,117	2,712	279,644	579		61	640	168
Greene, Guthrie, Lucas, and Warren	440,442	17,343	21,330	479,115	549		216	765	192
Jasper	104,458	26,187	7,526	138,171	255		29	284	167
Jefferson and Keokuk	....	7,982	90	8,072	13		4	17	162
Mahaska	52,376	19,768	1,265	73,409	156		23	179	147
Marion	450,451	37,982	20,334	508,767	897		106	1,003	184
Monroe	1,644,542	35,046	55,045	1,734,633	2,805		415	3,220	167
Page and Taylor	2,570	10,300	3	12,873	51		6	57	161
Polk	679,269	248,930	16,914	945,113	1,645		179	1,824	200
Van Buren	545	6,069	53	6,667	15		3	18	233
Wapello	108,463	56,903	4,134	169,500	361		45	406	155
Wayne	526	9,810	252	10,588	40		9	49	200
Small mines	....	20,488	....	20,488	....		......	......	....
	4,849,636	610,937	164,119	5,624,692	10,873		1,493	12,366	176
1920.									
Adams	....	8,409	10	8,419	23	11	6	40	168
Appanoose	1,411,232	75,921	24,446	1,511,599	2,210	630	330	3,170	242
Boone	254,913	60,404	7,200	322,517	365	175	51	591	239
Dallas	428,629	9,864	6,177	444,670	406	183	60	649	272
Greene, Guthrie, Jasper, and Warren	272,219	39,942	16,054	328,215	290	146	73	509	228
Jefferson and Keokuk	....	1,726	....	1,726	7	2	2	11	124
Lucas	370,150	12,592	14,940	397,682	370	211	48	629	237
Mahaska	48,511	14,981	938	64,430	57	23	16	96	223
Marion	756,483	30,630	18,610	805,723	609	294	92	995	267
Monroe	2,409,358	39,568	54,350	2,503,276	1,995	811	258	3,064	259
Page and Taylor	4,745	18,161	....	22,906	45	8	5	58	251
Polk	864,452	292,538	26,832	1,183,822	1,047	521	157	1,725	255
Van Buren	1,292	7,538	15	8,845	9	5	5	19	274
Wapello	66,325	75,498	1,970	143,793	176	45	38	259	221
Wayne	10,905	14,415	1,973	27,293	68	15	7	90	225
	6,899,214	702,187	173,515	7,774,916	7,677	3,080	1,148	11,905	250
Small mines	30,000	9,000	....	39,000	....	......	......	......	....
	6,929,214	711,187	173,515	7,813,916	....	......	......	......	....
1921.[b]									
Adams, Page, and Taylor	2,200	23,621	....	25,821	60	8	6	74	193
Appanoose	540,191	57,003	12,203	609,397	2,335	590	273	3,198	92
Boone	152,968	43,179	2,591	198,738	371	131	46	548	159
Dallas	299,324	6,618	3,946	309,888	412	188	55	655	179
Greene, Guthrie, and Warren	45,988	9,037	3,067	58,092	106	39	20	165	163
Jasper	83,846	16,555	8,009	108,410	163	113	41	317	124
Jefferson, Keokuk, and Van Buren	2,492	9,078	20	11,590	15	7	4	26	201
Lucas	223,420	2,592	10,811	236,823	269	125	45	439	211
Mahaska	36,781	9,879	1,091	47,751	74	14	10	98	139
Marion	527,561	37,159	18,468	583,188	699	273	96	1,068	149
Monroe	1,447,902	31,546	39,843	1,519,291	1,919	783	217	2,919	172
Polk	519,549	213,044	17,758	750,351	1,017	497	141	1,655	179
Wapello	2,000	47,799	700	50,499	66	19	10	95	175
Wayne	7,146	14,355	52	21,553	91	28	10	129	127
	3,891,368	521,465	118,559	4,531,392	7,597	2,815	974	11,386	148

[a] Includes also loaders and shot firers.

[b] Exclusive of product of wagon mines.

Value of coal produced in Iowa in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Adams	....	$38,782	$261	$39,043	$5.26
Appanoose	$2,994,517	240,609	55,543	3,290,759	3.33
Boone	666,919	121,417	13,159	801,495	3.31
Dallas	809,946	24,061	8,434	842,441	3.01
Greene, Guthrie, Lucas, and Warren	1,340,279	57,134	50,370	1,447,783	3.02
Jasper	328,199	99,079	21,182	448,460	3.24
Jefferson and Keokuk	....	31,381	180	31,561	3.91
Mahaska	155,155	59,089	2,126	216,370	2.95
Marion	1,325,635	108,761	55,663	1,490,059	2.93
Monroe	4,680,434	95,681	116,307	4,892,422	2.82
Page and Taylor	11,565	60,556	15	72,136	5.60
Polk	2,017,580	1,049,040	48,699	3,115,319	3.30
Van Buren	1,204	22,791	356	24,351	3.65
Wapello	339,351	170,740	11,868	521,959	3.08
Wayne	2,104	36,225	1,008	39,337	3.71
Small mines	....	79,125	....	79,125	3.86
	14,672,888	2,204,561	385,171	17,352,620	....
Average value per ton	3.03	3.76	2.35	3.09	3.09
1920.					
Adams	....	39,000	....	39,000	4.63
Appanoose	6,386,000	341,000	72,000	6,799,000	4.50
Boone	935,000	323,000	18,000	1,276,000	3.96
Dallas	1,611,000	48,000	18,000	1,677,000	3.77
Greene, Guthrie, Jasper, and Warren	1,022,000	192,000	54,000	1,268,000	3.86
Jefferson and Keokuk	....	6,000	....	6,000	3.48
Lucas	1,149,000	38,000	46,000	1,233,000	3.10
Mahaska	169,000	48,000	3,000	220,000	3.41
Marion	2,617,000	113,000	60,000	2,790,000	3.46
Monroe	9,468,000	157,000	144,000	9,769,000	3.90
Page and Taylor	24,000	91,000	....	115,000	5.02
Polk	3,307,000	1,305,000	77,000	4,689,000	3.96
Van Buren	3,000	34,000	....	37,000	4.18
Wapello	236,000	323,000	5,000	564,000	3.92
Wayne	51,000	67,000	6,000	124,000	4.54
	26,978,000	3,125,000	503,000	30,606,000	3.94
Small mines	150,000	38,000	....	188,000	4.82
	27,128,000	3,163,000	503,000	30,794,000	....
Average value per ton	3.92	4.45	2.90	3.94	3.94
1921.[a]					
Adams, Page, and Taylor	8,000	94,000	....	102,000	3.95
Appanoose	2,057,000	217,000	27,000	2,301,000	3.81
Boone	727,000	249,000	6,000	982,000	4.94
Dallas	1,150,000	30,000	15,000	1,195,000	3.86
Greene, Guthrie, and Warren	161,000	42,200	9,300	212,500	3.66
Jasper	342,000	65,000	24,000	431,000	3.98
Jefferson, Keokuk, and Van Buren	5,000	34,000	100	39,100	3.37
Lucas	800,000	47,000	40,000	887,000	3.78
Mahaska	136,000	31,000	4,000	171,000	3.58
Marion	1,939,000	136,000	65,000	2,140,000	3.67
Monroe	5,302,000	118,000	81,000	5,501,000	3.62
Polk	2,001,000	1,017,000	52,000	3,070,000	4.09
Wapello	3,000	131,000	1,000	135,000	2.67
Wayne	32,000	58,000	200	90,200	4.19
	14,663,000	2,269,200	324,600	17,256,800	....
Average value per ton	3.77	4.35	2.74	3.81	3.81

[a] Exclusive of product of wagon mines.

Coal produced in Iowa in 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Adams	4,016	5,418	7,418	8,419	[a] 25,821	[a] −5,504
Appanoose	1,663,454	1,559,253	988,225	1,511,599	609,397	−902,202
Boone	244,721	277,619	242,009	322,517	198,738	−123,779
Dallas	588,477	527,478	279,644	444,670	309,888	−134,782
Greene and Warren	[b] 776,320	[b] 650,393	[b] 479,115	[b] 328,215	[b] 58,092	[b] −270,123
Guthrie	[c] 29,679	[c] 30,726	(b)	(b)	(b)	(b)
Jasper	304,212	248,951	138,171	(b)	108,410	+108,410
Jefferson and Keokuk	(d)	....	8,072	1,726	[d] 11,590	[d] +1,019
Lucas	(b)	(b)	(b)	397,682	236,823	−160,859
Mahaska	145,820	221,860	73,409	64,430	47,751	−16,679
Marion	504,999	609,266	508,767	805,723	583,188	−222,535
Monroe	2,446,670	2,317,929	1,734,633	2,503,276	1,519,291	−983,985
Page and Taylor	17,943	16,202	12,873	22,906	(a)	(a)
Polk	1,845,839	1,434,433	945,113	1,183,822	750,351	−433,471
Van Buren	6,431	13,195	6,667	8,845	(d)	(d)
Wapello	346,509	245,166	169,500	143,793	50,499	−93,294
Wayne	(b)	(b)	10,588	27,293	21,553	−5,740
Webster	(c)	(c)	....	....	....	....
Small mines	40,740	34,306	20,488	39,000	....	−39,000
	8,965,830	8,192,195	5,624,692	7,813,916	4,531,392	−3,282,524
Total value	$21,096,408	$24,703,237	$17,352,620	$30,794,000	$17,256,800	−$13,537,200

[a] Adams includes Page and Taylor counties in 1921.
[b] Greene, etc., includes Lucas and Wayne counties in 1917 and 1918 and Davis County in 1918, Guthrie and Lucas counties in 1919, Guthrie and Jasper counties in 1920, and Guthrie County in 1921.
[c] Guthrie includes Webster County in 1917 and 1918.
[d] No production in Keokuk County in 1917 and Jefferson County included with small mines. Includes Van Buren County in 1921.

KANSAS.

In Kansas the production of coal reached its peak in 1918, when 7,561,947 tons was mined. In the three following years the output decreased, and that in 1921 was the smallest made in the State since 1898. In common with other States Kansas made an increase in its output of coal in 1920, as compared with 1919, but the gain in 1920, unlike that in many other States, was not comparable with that in 1918. Although the production of bituminous coal for the entire country in 1920 was about 98 per cent of that in 1918, which was the largest on record, the production in Kansas in 1920 was only 78.3 per cent of that in 1918. The output in 1921, 3,466,641 tons, valued at $13,333,300, was 2,459,767 tons, or 41.5 per cent less in quantity than that in 1920 and $9,589,700, or 41.8 per cent, less in value. The average value per ton increased from $2.91 in 1918 to $3.05 in 1919 and to $3.87 in 1920 and was only 2 cents less in 1921.

Because of internal dissension and the opposition of the union to the Industrial Court law, the labor situation in the Kansas mines has been very much in the public eye during the three years under review. In 1919 the State was second in the average number of days lost per man striking, when 9,104 men lost an average of 58 days, a total man-day loss of 531,791. The average for the bituminous mines of the country as a whole that year was 37 days per striker. In 1920 there were 5,461 men on strike, who lost an average of 30 days each, as against an average for the country of 22 days. In that year Kansas ranked sixth in the average time lost per man. In 1921, however, when the average loss per striker was 74 days against a national average of 23 days, Kansas took second place. Although only 7,285 men were on a strike, the number of man-days lost, 538,811, was the largest reported for any State and represented 23.6

per cent of the total number of man-days lost through strikes in bituminous coal mines throughout the country.

During the three years considered there has been a steady decrease in the total number of men employed, and the heaviest proportionate reductions were made in the number employed above ground. In 1919 the total number of workers reported was 9,926; in 1920 it dropped to 8,984, and in 1921 to 8,207. The increased output in 1920 over that in 1919 was due to greater efficiency, as measured by daily average output, and an increase in the number of days worked. In 1921 there was not only a sharp decline in the number of days in operation but a lowering in the daily output per employee.

Coal produced in Kansas in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total	Underground.		Surface.	Total.	
					Miners.[a]	All others.			
1919.									
Cherokee	849,143	8,913	26,676	884,732	1,136		406	1,542	169
Crawford	3,952,836	63,732	131,604	4,148,172	6,235		1,223	7,458	185
Leavenworth	46,624	34,194	8,891	89,709	310		57	367	215
Linn	5,350	5,381	250	10,981	47		8	55	169
Osage	56,132	15,058	110	71,300	429		26	455	161
Small mines[b]	9,569	8,924	1,337	19,830	16		33	49	114
	4,919,654	136,202	168,868	5,224,724	8,173		1,753	9,926	182
1920.									
Bourbon and Linn	9,707	3,796	338	13,841	32	10	25	67	119
Cherokee	1,047,105	8,838	34,213	1,090,186	805	222	366	1,393	192
Crawford	4,287,967	99,138	121,6[illegible]2	4,508,747	4,547	1,425	943	6,915	206
Leavenworth	90,850	40,576	11,844	143,270	157	43	32	232	246
Osage	69,187	12,814	363	82,364	286	62	29	377	197
	5,504,816	165,162	168,430	5,838,408	5,827	1,762	1,395	8,984	204
Small mines	82,000	6,000	....	88,000	....	....	....	....	....
	5,586,816	171,162	168,430	5,926,408	....	....	....	....	....
1921.[c]									
Cherokee	547,447	9,732	13,422	570,601	533	198	364	1,095	122
Crawford	2,579,878	53,511	79,618	2,713,007	4,534	1,243	799	6,576	138
Leavenworth	80,817	41,530	11,557	133,904	161	45	29	235	205
Linn	4,754	2,605	100	7,459	17	9	3	29	118
Osage	37,403	4,070	197	41,670	208	43	21	272	133
	3,250,299	111,448	104,894	3,466,641	5,453	1,538	1,216	8,207	137

[a] Includes also loaders and shot firers.
[b] Includes Bourbon County.
[c] Exclusive of product of wagon mines.

Value of coal produced in Kansas in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Cherokee	$2,459,255	$20,528	$68,753	$2,548,536	$2.88
Crawford	12,041,965	157,326	371,280	12,570,571	3.03
Leavenworth	182,487	139,020	29,140	350,647	3.91
Linn	20,175	21,715	1,000	42,890	3.91
Osage	269,520	70,160	502	340,182	4.77
Small mines [a]	22,834	36,862	4,531	64,227	3.24
	14,996,236	445,611	475,206	15,917,053	....
Average value per ton	3.05	3.27	2.81	3.05	3.05
1920.					
Bourbon and Linn	49,000	17,000	1,000	67,000	4.84
Cherokee	4,062,000	32,000	123,000	4,217,000	3.87
Crawford	16,288,000	337,000	434,000	17,059,000	3.78
Leavenworth	443,000	190,000	53,000	686,000	4.79
Osage	406,000	67,000	2,000	475,000	5.77
	21,248,000	643,000	613,000	22,504,000	3.85
Small mines	388,000	31,000	....	419,000	4.76
	21,636,000	674,000	613,000	22,923,000	....
Average value per ton	3.87	3.94	3.64	3.87	3.87
1921. [b]					
Cherokee	1,967,000	35,000	45,000	2,047,000	3.59
Crawford	10,015,000	189,000	311,000	10,515,000	3.88
Leavenworth	354,000	145,000	37,000	536,000	4.00
Linn	19,000	9,000	300	28,300	3.79
Osage	185,000	21,000	1,000	207,000	4.97
	12,540,000	399,000	394,300	13,333,300	....
Average value per ton	3.86	3.58	3.76	3.85	3.85

[a] Includes Bourbon County.
[b] Exclusive of product of wagon mines.

Coal produced in Kansas, 1917–1921, in net tons.

	1917	1918	1919	1920	1921	Decrease, 1921.
Cherokee	1,396,395	1,311,230	884,732	1,090,186	570,601	519,585
Crawford	5,513,556	5,984,551	4,148,172	4,508,747	2,713,007	1,795,740
Leavenworth	158,709	134,710	89,709	143,270	133,904	9,366
Linn	12,492	8,739	10,981	[a] 13,841	7,459	6,382
Osage	93,043	106,623	71,300	82,364	41,670	40,694
Small mines	10,780	16,094	[a] 19,830	88,000	....	88,000
	7,184,975	7,561,947	5,224,724	5,926,408	3,466,641	2,459,767
Total value	$16,618,277	$22,028,142	$15,917,053	$22,923,000	$13,333,300	$9,589,700

[a] Includes Bourbon County.

KENTUCKY.

The production of coal in Kentucky in 1919 was 30,036,061 tons, valued at $73,891,049. As compared with production in 1918 this represents a decrease of 1,576,556 tons, or about 5 per cent, in quantity, and of $6,775,793, or 8.4 per cent, in value. The loss in quantity was all in the western part of the State. In eastern Kentucky the output in 1919 increased 569,559 tons over that in 1918, and the unclassified small mines produced 111,243 tons as compared with 90,904 tons. The number of men employed increased from 39,342 to 45,598, a gain of 6,256, but only 1,049 were added to the surface workers. The average number of days in operation decreased from 230 to 189. In the western district the average number fell from 228 to 170; in the eastern district from 231 to 196. There was a slight decrease in the average output per man per day. The losses by strikes averaged 31 days for the 22,598 men involved. The average value of coal per ton for the State as a whole fell 9 cents; the decrease in average prices in western Kentucky was 8 cents; in eastern Kentucky 13 cents.

The production of coal in 1920 was 35,690,762 tons, valued at $146,576,000, an increase over 1919 of 5,654,701 tons, or 18.8 per cent, in quantity and of $72,685,951, or 98.5 per cent, in value. In the eastern district the increase amounted to 3,199,922 tons; in the western to 2,404,022 tons. The number of men employed increased 3,854, to 49,452, but there was a reduction of 652 in the number employed above ground. The number of days of operation averaged 182, a decrease of 7. The greater output, then, was due to the augmented working forces and particularly to the increased efficiency per worker. The increase in the number of workers was about 8.4 per cent, but the increase in the daily average output was about 13 per cent. The increase in the number and in the percentage of underground workers to the total working force undoubtedly contributed largely toward pushing the average daily output per man up to 3.95 tons. The losses by strikes averaged 34 days per striker, but only 9,192 men were involved, making the total man-day loss 312,460.

In 1921 production in Kentucky fell to 31,588,270 tons, valued at $85,092,600, a decrease, as compared with 1920, of 4,102,492 tons, or 11.5 per cent, in quantity, and of $61,483,400, or 41.9 per cent, in value. The average value per ton declined from $4.11 to $2.69; the average per ton in the eastern district declined from $4.44 to $2.77 and in the western district from $3.37 to $2.48. The decline in output in the western district represented 58.9 per cent of the total decrease for the year. The average number of days the mines were in operation dropped to 152. In 1921, as compared with 1920, when both districts made an average of 182 days, the eastern district showed a loss of 22 in the total number of days of operation and the western district 51 days. The number of men employed increased 1,069, but the number employed above ground decreased 628. The average output per man per day made another rise, to 4.11 tons. Strikes during the year involved 1,789 men, who were out an average of 36 days, and caused a total loss of 64,448 man-days.

Coal produced in Kentucky in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground.		Surface.	Total.	
						Miners.[a]	All others.			
1919.										
Eastern district:										
Bell	1,919,761	22,279	30,407	....	1,972,447	3,030		806	3,836	165
Boyd	59,626	1,739	1,425	....	62,790	140		28	168	161
Breathitt	124,409	9,654	3,379	....	137,442	290		64	354	159
Carter	116,234	34,718	390	....	151,342	196		64	260	192
Clay	46,111	666	286	....	47,063	152		104	256	126
Floyd	1,227,044	14,382	18,714	....	1,260,140	1,592		569	2,161	185
Harlan	3,816,563	46,129	50,152	263,687	4,176,531	4,077		2,317	6,394	231
Johnson	782,049	12,460	29,720	....	824,229	969		188	1,157	196
Knox	557,918	12,987	12,223	....	583,128	1,130		290	1,420	148
Laurel	64,413	9,934	131	....	74,478	222		54	276	127
Lawrence	15,785	1,280	385	....	17,450	71		14	85	129
Lee	56,923	8,355	258	....	65,536	118		34	152	176
Letcher	2,979,431	35,510	38,745	....	3,053,686	2,844		558	3,402	211
McCreary	613,013	18,953	4,423	....	636,389	881		215	1,096	189
Martin, Owsley, Pulaski, and Wayne	35,086	1,060	....	....	36,146	50		43	93	218
Morgan	57,671	4,040	3,120	....	64,831	216		80	296	213
Perry	2,684,561	20,445	7,037	....	2,712,043	3,069		860	3,929	169
Pike	4,468,979	42,659	91,510	181,751	4,784,899	4,261		1,408	5,669	224
Whitley	588,128	19,425	24,459	....	632,012	1,390		327	1,717	169
	20,213,705	316,675	316,764	445,438	21,292,582	24,698		8,023	32,721	196
Western district:										
Christian and Hancock	136,696	11,801	10,966	....	159,463	206		17	223	222
Daviess	440	66,888	775	....	68,103	100		10	110	215
Henderson	194,565	64,247	14,444	....	273,256	442		68	510	181
Hopkins	2,120,009	201,381	114,854	26,766	2,463,010	2,444		488	2,932	181
McLean	72,490	10,624	1,374	....	84,488	177		25	202	103
Muhlenberg	2,442,370	97,602	86,393	....	2,626,365	3,750		596	4,346	142
Ohio	650,290	35,779	30,243	....	716,312	1,075		219	1,294	141
Union	792,695	43,141	56,868	....	892,704	1,082		377	1,459	234
Webster	1,284,513	19,476	44,546	....	1,348,535	1,556		245	1,801	183
	7,694,068	550,939	360,463	26,766	8,632,236	10,832		2,045	12,877	170
Small mines	....	111,243	....	....	111,243	....		....	....	....
Grand total	27,907,773	978,857	677,227	472,204	30,036,061	35,530		10,068	45,598	189
1920.										
Eastern district:										
Bell	2,397,215	65,340	39,791	200	2,502,546	2,432	1,014	633	4,079	185
Boyd	112,728	4,274	2,192	....	119,194	115	55	26	196	228
Breathitt	212,107	15,646	3,200	....	230,953	237	92	64	393	168
Carter	154,864	5,182	2,218	....	162,264	169	75	57	301	242
Clay	107,204	610	1,156	....	108,970	168	61	51	280	151
Floyd	1,642,632	54,326	19,546	....	1,716,504	1,233	574	367	2,174	178
Harlan	4,704,085	51,853	50,817	250,376	5,057,131	2,827	2,289	2,275	7,391	198
Johnson	749,000	15,999	32,241	....	797,240	599	377	182	1,158	159
Knox	526,851	10,274	17,644	....	554,769	634	352	212	1,198	156
Laurel	130,600	5,958	510	....	137,068	238	76	57	371	170
Lawrence	19,500	1,500	500	....	21,500	41	18	13	72	123
Lee	84,644	3,350	600	....	88,594	73	36	34	143	188
Letcher	3,231,255	50,096	47,645	....	3,328,996	2,090	1,306	593	3,989	156
McCreary	810,036	3,342	3,825	....	817,203	638	231	177	1,046	216
Morgan	70,252	4,167	1,623	....	76,042	182	37	30	249	245
Perry	3,104,959	20,107	5,455	438	3,130,959	2,199	1,058	807	4,064	163
Pike	4,567,144	71,074	91,460	195,957	4,925,635	2,883	1,871	1,575	6,329	192
Whitley	646,739	17,155	29,373	....	693,267	925	328	260	1,513	179
Other counties[b]	20,617	3,052	....	....	23,669	22	18	35	75	175
	23,292,432	403,305	349,796	446,971	24,492,504	17,705	9,868	7,448	35,021	182

[a] Includes also loaders and shot firers.

[b] Martin, Pulaski, and Wayne.

Coal produced in Kentucky in 1919-1921—Continued.

County.	Production (net tons). Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Number of employees. Underground. Miners.[a]	All others.	Surface.	Total.	Average number of days worked.
1920.										
Western district:										
Christian and McLean	238,474	9,980	12,460	....	260,914	204	88	54	346	197
Daviess	11,723	81,450	1,100	....	94,273	92	40	24	156	189
Hancock	8,400	5,730	....	....	14,130	24	11	7	42	166
Henderson	330,981	98,071	19,289	....	448,341	345	149	78	572	214
Hopkins	2,444,798	222,785	87,874	....	2,755,457	1,967	929	532	3,428	162
Muhlenberg	3,603,645	132,047	87,003	....	3,822,695	2,880	1,321	574	4,775	177
Ohio	914,365	32,406	45,265	....	992,036	887	485	242	1,614	157
Union	931,586	44,790	56,995	....	1,033,371	715	446	204	1,365	221
Webster	1,557,757	19,632	37,652	....	1,615,041	1,187	693	253	2,133	209
	10,041,729	646,891	347,638	....	11,036,258	8,301	4,162	1,968	14,431	182
	33,334,161	1,050,196	697,434	....	35,528,762	26,006	14,030	9,416	49,452	182
Small mines	131,000	31,000	....	....	162,000	....	....	....	....	....
Grand total	33,465,161	1,081,196	697,434	446,971	35,690,762	....	....	....	....	....
1921.[c]										
Eastern district:										
Bell	1,648,524	22,600	24,226	....	1,695,350	2,003	867	569	3,439	135
Boyd	39,506	2,261	963	....	42,730	121	45	49	215	85
Breathitt	143,059	5,878	700	....	149,637	203	81	58	342	142
Carter	65,506	2,353	322	....	68,181	164	47	45	256	125
Clay	150,944	900	1,095	....	152,939	145	53	36	234	159
Floyd	1,122,394	27,822	15,822	....	1,166,038	1,557	696	490	2,743	116
Harlan	6,773,233	42,000	34,294	45,992	6,895,519	4,900	1,784	1,955	8,639	217
Johnson	697,415	13,208	30,527	....	741,150	756	308	200	1,264	137
Knox	474,062	12,738	20,891	....	507,691	580	261	219	1,060	163
Laurel	88,058	1,970	200	....	90,228	251	26	29	306	188
Lee	31,083	1,760	70	....	32,913	76	37	32	145	88
Letcher	2,424,850	37,060	38,784	....	2,500,694	1,967	1,047	687	3,701	140
McCreary	603,440	7,965	441	....	611,846	829	338	143	1,310	126
Martin	63,039	956	1,720	....	65,715	64	46	47	157	132
Morgan	27,816	8,143	2,050	....	38,009	120	66	41	227	160
Perry	4,380,147	58,727	1,185	....	4,440,059	2,639	1,288	759	4,686	187
Pike	3,067,923	72,048	62,103	115,515	3,317,589	2,815	1,707	1,256	5,778	134
Whitley	388,583	10,479	25,077	....	424,139	721	259	169	1,149	116
Other counties[d]	30,487	1,500	....	....	31,987	70	49	28	147	85
	22,220,069	330,368	260,470	161,507	22,972,414	19,981	9,005	6,812	35,798	160
Western district:										
Christian and Crittenden	116,232	1,511	7,603	....	125,346	113	31	42	186	207
Daviess	13,160	78,093	1,768	....	93,021	117	38	18	173	202
Hancock	2,296	2,400	....	....	4,696	14	2	1	17	152
Henderson	256,013	69,763	14,944	....	340,720	337	171	63	571	156
Hopkins	1,822,115	136,269	39,225	....	1,997,609	1,806	888	548	3,242	122
McLean	87,168	938	3,200	....	91,306	143	46	22	211	71
Muhlenberg	2,996,142	133,761	94,049	....	3,223,952	3,455	1,461	640	5,556	133
Ohio	804,773	22,492	35,920	....	863,185	1,014	444	230	1,688	118
Union	757,965	20,249	43,086	....	821,300	728	386	188	1,302	150
Webster	1,020,829	6,900	26,992	....	1,054,721	1,029	524	224	1,777	125
	7,876,693	472,376	266,787	....	8,615,856	8,756	3,991	1,976	14,723	131
Grand total	30,096,762	802,744	527,257	161,507	31,588,270	28,737	12,996	8,788	50,521	152

[a] Includes also loaders and shot firers.
[c] Exclusive of product of wagon mines.
[d] Knott, Lawrence, and Wayne.

Value of coal produced in Kentucky in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Eastern district:						
Bell	$5,108,619	$58,128	$74,219		$5,240,966	$2.66
Boyd	183,306	4,091	3,372		190,769	3.04
Breathitt	303,550	20,269	8,898		332,717	2.42
Carter	257,078	69,049	653		326,780	2.16
Clay	141,625	1,981	680		144,286	3.07
Floyd	3,499,716	32,513	57,880		3,590,109	2.85
Harlan	9,379,550	102,430	117,250	$659,217	10,258,447	2.46
Johnson	2,208,805	30,615	76,241		2,315,661	2.81
Knox	1,518,025	30,757	30,692		1,579,474	2.71
Laurel	174,089	31,966	,00		206,355	2.77
Lawrence	40,326	2,560	1,001		43,887	2.52
Lee	144,197	24,800	678		169,675	2.59
Letcher	7,440,825	81,773	92,022		7,614,620	2.49
McCreary	1,638,605	48,450	11,523		1,698,578	2.67
Martin, Owsley, Pulaski, and Wayne	80,966	4,950			85,916	2.38
Morgan	209,469	9,868	3,349		222,686	3.43
Perry	7,046,189	37,668	16,742		7,100,599	2.62
Pike	11,188,558	87,657	214,072	425,974	11,916,261	2.49
Whitley	1,729,201	59,671	65,873		1,854,745	2.93
	52,292,699	739,196	775,445	1,085,191	54,892,531	
Average value per ton	2.59	2.33	2.45	2.44	2.58	2.58
Western district:						
Christian and Hancock	339,222	29,695	18,951		387,868	2.43
Daviess	820	165,523	1,557		167,900	2.46
Henderson	449,393	168,054	32,717		650,164	2.38
Hopkins	4,623,750	454,567	213,058	26,766	5,318,141	2.16
McLean	157,394	26,347	3,228		186,969	2.21
Muhlenberg	5,399,439	216,486	180,303		5,796,228	2.20
Ohio	1,435,726	86,121	55,171		1,577,018	2.20
Union	1,611,341	96,631	120,308		1,828,280	2.05
Webster	2,684,143	41,267	88,206		2,813,616	2.09
	16,701,228	1,284,691	713,499	26,766	18,726,184	
Average value per ton	2.17	2.33	1.98	1.00	2.17	2.17
Small mines		272,334			272,334	2.45
Grand total	68,993,927	2,296,221	1,488,944	1,111,957	73,891,049	
Average value per ton for the State	2.47	2.35	2.20	2.35	2.46	2.46
1920.						
Eastern district:						
Bell	11,606,000	295,000	167,000	1,000	12,069,000	4.82
Boyd	528,000	18,000	9,000		555,000	4.66
Breathitt	1,180,000	59,000	16,000		1,255,000	5.43
Carter	606,000	10,000	6,000		622,000	3.83
Clay	517,000	3,000	5,000		525,000	4.82
Floyd	7,720,000	161,000	72,000		7,953,000	4.63
Harlan	19,738,000	177,000	149,000	894,000	20,958,000	4.14
Johnson	3,733,000	61,000	134,000		3,928,000	4.93
Knox	2,681,000	44,000	52,000		2,777,000	5.01
Laurel	697,000	35,000	3,000		735,000	5.36
Lawrence	108,000	2,000	2,000		112,000	5.21
Lee	492,000	19,000	3,000		514,000	5.80
Letcher	13,705,000	194,000	171,000		14,070,000	4.23
McCreary	3,399,000	13,000	13,000		3,425,000	4.19
Morgan	424,000	23,000	6,000		453,000	5.96
Perry	14,606,000	59,000	29,000	1,000	14,695,000	4.69
Pike	19,408,000	236,000	327,000	511,000	20,482,000	4.16
Whitley	3,330,000	69,000	113,000		3,512,000	5.07
Other counties [a]	83,000	9,000			92,000	3.89
	104,561,000	1,487,000	1,277,000	1,407,000	108,732,000	
Average value per ton	4.49	3.68	3.65	3.15	4.44	4.44

[a] Martin, Pulaski, and Wayne.

Value of coal produced in Kentucky in 1919–1921—Continued.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1920.						
Western district:						
Christian and McLean	$945,000	$38,000	$34,000		$1,017,000	$3.90
Daviess	18,000	335,000	4,000		357,000	3.79
Hancock	44,000	24,000			68,000	4.81
Henderson	1,234,000	341,000	57,000		1,632,000	3.64
Hopkins	8,489,000	735,000	251,000		9,475,000	3.44
Muhlenberg	12,854,000	368,000	243,000		13,465,000	3.52
Ohio	2,846,000	103,000	128,000		3,077,000	3.10
Union	2,675,000	154,000	158,000		2,987,000	2.89
Webster	4,957,000	69,000	93,000		5,119,000	3.17
	34,062,000	2,167,000	968,000		37,197,000	
Average value per ton	1.02	2.06	1.39			3.37
Small mines	551,000	96,000			647,000	3.99
Grand total	139,174,000	3,750,000	2,245,000	$1,407,000	146,576,000	
Average value per ton for the State	4.16	3.47	3.22	3.15	4.11	4.11
1921.[b]						
Eastern district:						
Bell	4,940,000	61,000	67,000		5,068,000	2.99
Boyd	87,000	5,000	1,000		93,000	2.18
Breathitt	232,000	12,000	2,000		246,000	1.64
Carter	177,000	6,000	1,000		184,000	2.70
Clay	315,000	2,000	2,000		319,000	2.09
Floyd	2,820,000	59,000	43,000		2,922,000	2.51
Harlan	18,805,000	113,000	93,000	129,000	19,140,000	2.78
Johnson	2,293,000	46,000	90,000		2,429,000	3.28
Knox	1,252,000	31,000	46,000		1,329,000	2.62
Laurel	214,100	3,500	400		218,000	2.42
Lee	70,000	3,300	100		73,400	2.23
Letcher	7,326,000	104,000	104,000		7,534,000	3.01
McCreary	1,848,000	21,000	1,000		1,870,000	3.06
Martin	116,000	1,000	3,000		120,000	1.83
Morgan	133,000	39,000	6,000		178,000	4.68
Perry	11,245,000	138,000	3,000		11,386,000	2.56
Pike	8,542,000	202,000	170,000	324,000	9,238,000	2.78
Whitley	1,228,000	32,000	61,000		1,321,000	3.11
Other counties[c]	65,000	4,100			69,100	2.16
	61,708,100	882,900	693,500	453,000	63,737,500	
Average value per ton	2.78	2.67	2.66	2.80	2.77	2.77
Western district:						
Christian and Crittenden	283,900	5,100	20,100		309,100	2.47
Daviess	20,000	140,000	3,000		163,000	1.75
Hancock	5,000	5,000			10,000	2.13
Henderson	700,000	184,000	27,000		911,000	2.64
Hopkins	4,554,000	306,000	78,000		4,938,000	2.47
McLean	190,000	2,000	3,000		195,000	2.14
Muhlenberg	7,496,000	395,000	218,000		8,109,000	2.52
Ohio	1,947,000	55,000	95,000		2,097,000	2.43
Union	1,865,000	75,000	102,000		2,042,000	2.49
Webster	2,497,000	20,000	64,000		2,581,000	2.45
	19,557,900	1,187,100	610,100		21,355,100	
Average value per ton	2.48	2.51	2.29		2.48	2.48
Grand total	81,266,000	2,070,000	1,303,600	453,000	85,092,600	
Average value per ton for the State	2.70	2.58	2.47	2.80	2.69	2.69

[b] Exclusive of product of wagon mines.
[c] Knott, Lawrence, and Wayne.

Coal produced in Kentucky, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Eastern district:						
Bell	2,079,122	2,447,875	1,972,447	2,502,546	1,695,350	−807,196
Boyd	101,714	110,644	62,790	119,194	42,730	−76,464
Breathitt	55,881	179,136	137,442	230,953	149,637	−81,316
Carter	150,554	187,777	151,342	162,264	68,181	−94,083
Clay	....	3,740	47,063	108,970	152,939	+43,969
Floyd	845,863	1,326,956	1,260,140	1,716,504	1,166,038	−550,466
Harlan	2,167,741	3,201,733	4,176,531	5,057,131	6,895,519	+1,838,388
Johnson	869,802	791,241	824,229	797,240	741,150	−56,090
Knox	561,035	669,437	583,128	554,769	507,691	−47,078
Laurel	80,203	129,027	74,478	137,068	90,228	−46,840
Lawrence	38,631	47,066	17,450	21,500	(a)	(a)
Lee	30,997	57,705	65,536	88,594	32,913	−55,681
Letcher	3,470,779	3,279,715	3,053,686	3,328,996	2,500,694	−828,302
McCreary	692,933	734,894	636,389	817,203	611,846	−205,357
Morgan	[b] 69,680	63,332	64,831	76,042	38,009	−38,033
Perry	1,660,795	2,120,223	2,712,043	3,130,959	4,440,059	+1,309,100
Pike	3,846,651	4,473,442	4,784,899	4,925,635	3,317,589	−1,608,046
Whitley	762,146	842,989	632,012	693,267	424,139	−269,128
Other counties [a]	19,021	56,091	36,146	23,669	97,702	+52,533
	17,503,548	20,723,023	21,292,582	24,492,504	22,972,414	−1,520,090
Western district:						
Christian	57,921	[a] 85,259	[a] 159,463	[a] 260,914	[a] 125,346	−[a] 44,262
Daviess	74,663	86,552	68,103	94,273	93,021	−1,252
Hancock	(b)	12,280	(a)	14,130	4,696	−9,434
Henderson	292,447	394,062	273,256	448,341	340,720	−107,621
Hopkins	3,052,001	2,987,377	2,463,010	2,755,457	1,997,609	−757,848
McLean	113,468	154,871	84,488	(a)	91,306	(a)
Muhlenberg	3,411,816	3,650,473	2,626,365	3,822,695	3,223,952	−598,743
Ohio	895,819	951,829	716,312	992,036	863,185	−128,851
Union	915,358	992,973	892,704	1,033,371	821,300	−212,071
Webster	1,400,987	1,483,014	1,348,535	1,615,041	1,054,721	−560,320
	10,214,480	10,798,690	8,632,236	11,036,258	8,615,856	−2,420,402
Small mines	[b] 89,943	90,904	111,243	162,000	....	−162,000
Grand total	27,807,971	31,612,617	30,036,061	35,690,762	31,588,270	−4,102,492
Total value	$60,297,653	$80,666,842	$73,891,049	$146,576,000	$85,092,600	−$61,483,400

[a] Jackson and Pulaski in 1917; Jackson, Martin, and Pulaski in 1918; Martin, Owsley, Pulaski, and Wayne in 1919; Martin, Pulaski, and Wayne in 1920; Knott, Lawrence, Martin, and Wayne in 1921; Christian and Butler in 1918; Christian and Hancock in 1919; Christian and McLean in 1920; and Christian and Crittenden in 1921.

[b] Hancock County included in small mines.

MARYLAND.

In 1919 Maryland produced 3,021,686 tons of coal, valued at $8,255,984, a decrease, as compared with 1918, of 1,475,611 tons, or 32.8 per cent, in quantity, and of $4,210,205, or 33.8 per cent, in value. The State participated in the general recovery of 1920, but its output was not equal to that in 1918, although the value of the output in 1920 exceeded that of 1918 by over 50 per cent. In 1920 the output was 4,065,239 tons, an increase of 1,043,553 tons, or 34.5 per cent, over that in 1919. The value was $18,815,000, an increase of $10,559,016, or nearly 128 per cent, over that of 1919. In 1921 the output was only 1,827,740 tons, valued at $6,602,000, a decrease of 2,237,499 tons, or 55 per cent, in quantity, and $12,213,000, or 64.9 per cent, in value. This was the lowest output made by the State since 1882.

The number of workers increased slightly, from 5,394 in 1919 to 5,548 in 1920. In 1921, however, the number dropped to 4,668. The average output per man increased from 3.13 tons a day in 1919 to 3.50 tons a day in 1920 but declined to 3.27 tons in 1921. The average number of days in which the mines in Maryland were in operation dropped from 261 in 1918 to 179 in 1919, increased to 207 in 1920, and decreased to 120 in 1921. The man-days lost on account of strikes were 143,523 in 1919, 25,514 in 1920, and 4,463 in 1921.

Coal produced in Maryland in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground.		Surface.	Total.	
					Miners.[a]	All others.			
1919.									
Allegany	2,107,467	52,541	35,716	2,195,724	3,323		771	4,094	182
Garrett	792,464	15,435	10,665	818,564	1,099		201	1,300	168
Small mines	....	7,398	....	7,398	.....		......	......	....
	2,899,931	75,374	46,381	3,021,686	4,422		972	5,394	179
1920.									
Allegany	2,898,728	78,861	31,139	3,008,728	2,572	970	702	4,244	213
Garrett	988,605	22,450	10,456	1,021,511	711	377	216	1,304	189
	3,887,333	101,311	41,595	4,030,239	3,283	1,347	918	5,548	207
Small mines	28,000	7,000	....	35,000	....	....	....	....	....
	3,915,333	108,311	41,595	4,065,239	....	....	....	....	....
1921.[b]									
Allegany	1,426,793	47,736	22,548	1,497,077	2,265	735	552	3,552	136
Garrett	316,917	8,998	4,748	330,663	699	243	174	1,116	69
	1,743,710	56,734	27,296	1,827,740	2,964	978	726	4,668	120

[a] Includes also loaders and shot firers. [b] Exclusive of product of wagon mines.

Value of coal produced in Maryland in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Allegany	$5,893,279	$144,953	$104,783	$6,143,015	$2.80
Garrett	2,039,460	32,970	23903	2,096,333	2.56
Small mines	....	16,636	....	16,636	2.25
	7,932,739	194,559	128,686	8,255,984	....
Average value per ton	2.74	2.58	2.77	2.73	2.73
1920.					
Allegany	13,695,000	330,000	130,000	14,155,000	4.70
Garrett	4,318,000	90,000	44,000	4,452,000	4.36
Small mines	185,000	23,000	....	208,000	5.94
	18,198,000	443,000	174,000	18,815,000	....
Average value per ton	4.65	3.09	4.18	4.63	4.63
1921.[a]					
Allegany	5,281,000	157,000	88,000	5,526,000	3.69
Garrett	1,035,000	24,000	17,000	1,076,000	3.25
	6,316,000	181,000	105,000	6,602,000	....
Average value per ton	3.62	3.19	3.85	3.61	3.61

[a] Exclusive of product of wagon mines.

Coal produced in Maryland, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Decrease, 1921.
Allegany	3,727,609	3,490,326	2,195,724	3,008,728	1,497,077	1,511,651
Garrett	992,867	983,192	818,564	1,021,511	330,663	690,848
Small mines	25,448	23,779	7,398	35,000	....	35,000
	4,745,924	4,497,297	3,021,686	4,065,239	1,827,740	2,237,499
Total value	$11,667,852	$12,466,189	$8,255,984	$18,815,000	$6,602,000	$12,213,000

MICHIGAN.

The coal produced in Michigan in 1919 amounted to 996,545 tons, valued at $3,864,228, a decrease, as compared with 1918, of 468,273 tons, or 32 per cent, in quantity and $1,750,869, or 31.2 per cent, in value. Bay County was the heaviest loser in output. The average number of days on which the mines were in operation was cut from 237 to 179, and the number of men employed from 2,558 to 2,104. Strike losses during the year involved 2,087 workers for an average of 73 days. This was the highest average loss in time per striker reported for the country.

In 1920 the output was 1,489,765 tons, valued at $7,346,000, an increase, as compared with 1919, of 493,220 tons, or 49.5 per cent, in quantity and of $3,481,772, or 90.1 per cent, in value. There was an increase of 82 days in the average number worked during the year, but only a slight increase in the number of men employed and no change in the average daily output. The increase in the number of days of operation may be attributed, in part at least, to the export demand and to the car-service orders of the Interstate Commerce Commission on Great Lakes and New England business, which had the effect of diminishing for a time the quantity of eastern coal normally moving into Michigan. The average time lost on account of strikes dropped to 15 days per striker, and 1,659 men were involved.

In 1921 Michigan produced 1,141,715 tons of coal, valued at $5,555,000, a decrease, as compared with the preceding year, of 348,050 tons, or 23.4 per cent, in quantity and $1,791,000, or 24.4 per cent, in value. There was another small increase in the number of men employed, but the average number of days in which the mines were in operation for the year dropped to 196. The losses by strikes reduced production but little; a total of 780 men were idle for an average of four days per man. The trouble in Michigan was the same as that in other States capable of reaching a much wider market—the business depression.

Coal produced in Michigan in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.									
Bay	331,013	734	27,122	358,869	649		80	729	197
Saginaw	528,642	7,716	45,577	581,935	1,037		144	1,181	170
Tuscola[b]	41,608	2,462	11,125	55,195	165		29	194	163
Small mines		546		546					
	901,263	11,458	83,824	996,545	1,851		253	2,104	179
1920.									
Bay	425,687	2,260	21,740	449,687	460	229	82	771	264
Saginaw	871,728	8,092	55,228	935,048	755	299	119	1,173	261
Tuscola[b]	89,271	3,129	10,630	103,030	117	67	26	210	250
	1,386,686	13,481	87,598	1,487,765	1,332	595	227	2,154	261
Small mines		2,000		2,000					
	1,386,686	15,481	87,598	1,489,765					
1921.[c]									
Bay	330,955	2,910	14,630	348,495	445	208	86	739	193
Saginaw	690,019	6,699	49,519	746,237	807	343	129	1,279	210
Tuscola[b]	37,815	1,745	7,423	46,983	94	71	29	194	122
	1,058,789	11,354	71,572	1,141,715	1,346	622	244	2,212	196

[a] Includes also loaders and shot firers.
[b] Includes Calhoun County.
[c] Exclusive of product of wagon mines.

Value of coal produced in Michigan in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Bay	$1,330,278	$2,481	$84,538	$1,417,297	$3.95
Saginaw	2,010,460	36,719	144,956	2,192,135	3.77
Tuscola [a]	204,492	12,570	35,380	252,442	4.57
Small mines	....	2,354	....	2,354	4.31
	3,545,230	54,124	264,874	3,864,228	....
Average value per ton	3.93	4.72	3.16	3.88	3.88
1920.					
Bay	2,180,000	18,000	84,000	2,282,000	5.07
Saginaw	4,274,000	46,000	195,000	4,515,000	4.83
Tuscola [a]	468,000	19,000	53,000	540,000	5.24
	6,922,000	83,000	332,000	7,337,000	4.93
Small mines	....	9,000	....	9,000	4.50
	6,922,000	92,000	332,000	7,346,000	....
Average value per ton	4.99	5.94	3.79	4.93	4.93
1921. [b]					
Bay	1,653,000	19,000	57,000	1,729,000	4.96
Saginaw	3,372,000	31,000	184,000	3,587,000	4.81
Tuscola [a]	200,000	10,000	29,000	239,000	5.09
	5,225,000	60,000	270,000	5,555,000	....
Average value per ton	4.93	5.28	3.77	4.87	4.87

[a] Includes Calhoun County.
[b] Exclusive of product wagon mines.

Coal produced in Michigan, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Decrease, 1921.
Bay	688,037	638,688	358,869	449,687	348,495	101,192
Saginaw	598,480	691,810	581,935	935,048	746,237	188,811
Tuscola	[a] 87,060	[a] 133,532	[a] 55,195	[a] 103,030	[a] 46,983	[a] 56,047
Small mines	1,228	788	546	2,000	....	2,000
	1,374,805	1,464,818	996,545	1,489,765	1,141,715	348,050
Total value	$4,426,314	$5,615,097	$3,864,228	$7,346,000	$5,555,000	$1,791,000

[a] Tuscola County includes Calhoun, Genesee, and Shiawassee in 1917 and 1918; Calhoun in 1919, 1920, and 1921.

MISSOURI.

In 1919 Missouri produced 1,687,932 tons of coal, or 29.8 per cent less than in 1918. The total value decreased $4,360,132, or 25.4 per cent. The percentage of the decline in value was less than the percentage of the decline in quantity because the average value per ton rose from $3.02 to $3.21. The average number of days in which the mines were in operation during the year fell from 235 to 175, and the number of men employed from 9,590 to 9,314. The number of men above ground, however, was greater by 133 in 1919 than in 1918, and there was a loss of 0.07 ton in the daily average tonnage. The losses by strikes were considerable: 8,315 men lost 458,588 man-days, an average of 55 days per striker, The output for the State in 1920 was 5,369,565 tons, valued at $22,230,000, an increase, as compared with the preceding year, of 1,389,767 tons, or 34.9 per cent, in quantity, and of $9,463,634, or 74.1 per cent, in value. The average value per ton increased from $3.21 to $4.16. The average number of days worked was 233, or just 2 less than in 1918, but the number of men employed was about 5 per cent less than in 1919. The average output increased 0.12 ton per man per day. The losses by strikes were cut down to 36,015 man-days and involved 1,841 workers an average of 20 days.

In 1921 the State produced 3,551,621 tons, valued at $13,915,500, a decrease, as compared with 1920, of 1,817,944 tons, or 33.9 per cent, in quantity, and of $8,314,500, or 37.4 per cent, in value. The average value per ton declined to $3.92. The number of men employed was 8,555, as compared with 8,838 in 1920, and the average number of days worked was 166. The average output per man per day was slightly less than that in 1920. The losses by strikes rose; 2,089 men averaged 24 days on strike.

Coal produced in Missouri in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.									
Adair	502,084	7,136	8,690	517,910	1,051		157	1,208	168
Audrain	80	16,498	105	16,683	58		5	63	257
Barton	816,773	11,394	59,007	887,174	169		941	1,110	143
Bates	46,205	10,307	538	57,050	82		62	144	163
Boone	....	18,416	....	18,416	50		8	58	269
Caldwell, Clay, and Platte	49,620	16,158	2,341	68,119	261		39	300	173
Callaway	24,675	23,072	3,263	51,010	100		48	148	266
Chariton	....	2,826	82	2,908	7		......	7	212
Cooper, Howard, Moniteau, and Pettis	14,589	3,766	3,615	21,970	20		14	34	187
Dade	....	6,300	24	6,324	20		1	21	135
Grundy and Harrison	12,558	13,165	6,005	31,728	91		17	108	184
Henry	113,694	17,016	6,162	136,872	88		127	215	177
Johnson	62,475	14,037	1,446	77,958	114		14	128	161
Lafayette	583,076	43,323	24,794	651,193	1,722		183	1,905	195
Linn	70,306	28,830	855	99,991	249		72	321	213
Macon	337,693	39,824	7,329	384,846	1,162		98	1,260	122
Putnam	32,008	4,745	1,220	37,973	115		13	128	175
Randolph	284,633	29,565	6,637	320,835	704		67	771	187
Ray	357,526	43,521	7,101	408,148	1,097		93	1,190	196
Vernon	44,041	3,743	194	47,978	22		48	70	159
Other counties [b]	62,187	3,692	3,688	69,567	53		72	125	253
Small mines	....	65,145	....	65,145	....		......	......	......
	3,414,223	422,479	143,096	3,979,798	7,235		2,079	9,314	175

[a] Includes also loaders and shot firers.
[b] Franklin, Ralls, and St. Clair.

Coal produced in Missouri in 1919–1921—Continued.

County.	Production (net tons). Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Number of employees. Underground. Miners.[a]	All others.	Surface.	Total.	Average number of days worked.
1920.									
Adair	757,797	10,427	9,762	777,986	702	341	93	1,136	260
Audrain	....	18,496	130	18,626	34	9	6	49	255
Barton	908,717	11,690	45,350	965,757	122	20	845	987	147
Bates	100,329	14,765	527	115,621	107	34	50	191	199
Boone	....	18,950	....	18,950	49	8	8	65	272
Caldwell, Clay, and Platte	59,858	23,439	3,320	86,617	119	54	23	196	258
Callaway	26,302	29,898	2,262	58,462	91	19	40	150	226
Cooper, Howard, Moniteau, Morgan, and Pettis	21,140	3,060	5,100	29,300	16	5	15	36	169
Dade	....	6,342	....	6,342	10	5	4	19	164
Grundy and Harrison	6,705	13,996	2,379	23,080	65	14	6	85	180
Henry	179,131	17,959	6,110	203,200	77	23	135	235	191
Johnson	39,194	4,544	1,696	45,434	61	38	17	116	185
Lafayette	812,916	43,317	29,336	885,569	1,008	633	192	1,833	253
Linn	100,785	40,340	1,165	142,290	229	62	21	312	246
Macon	655,586	53,420	11,221	720,227	612	265	94	971	262
Putnam	26,583	3,204	1,080	30,867	51	16	13	80	207
Randolph	386,739	29,226	6,938	422,903	597	182	61	840	238
Ray	511,763	58,052	8,879	578,694	850	282	226	1,358	239
Vernon	69,324	3,053	2,394	74,771	25	7	55	87	219
Other counties[c]	59,729	2,140	....	61,869	17	6	69	92	214
	4,722,598	406,318	137,649	5,266,565	4,842	2,023	1,973	8,838	233
Small mines	89,000	14,000	....	103,000	....	....	....	....	....
	4,811,598	420,318	137,649	5,369,565	....	....	....	....	....
1921.[d]									
Adair	509,561	8,998	9,245	527,804	663	257	114	1,034	225
Audrain	2,341	8,076	121	10,538	34	7	4	45	226
Barton	680,698	6,447	39,202	726,347	106	22	778	906	107
Bates	37,350	1,120	1,220	39,690	51	16	71	138	74
Boone	2,000	14,128	....	16,128	41	11	5	57	179
Caldwell, Clay, Dade, and Platte	65,589	23,088	2,969	91,646	158	55	20	233	177
Callaway	10,776	19,882	1,533	32,191	64	18	34	116	128
Henry	88,025	6,354	900	95,279	33	7	95	135	163
Howard, Moniteau, and Pettis	2,314	1,630	570	4,514	5	1	12	18	66
Grundy and Harrison	3,170	8,177	307	11,654	52	5	5	62	159
Johnson	12,969	1,934	337	15,240	35	26	9	70	72
Lafayette	491,450	30,153	18,818	540,421	1,006	480	145	1,631	162
Linn	66,198	22,948	601	89,747	177	99	13	289	157
Macon	443,659	20,180	10,146	473,985	931	219	69	1,219	151
Putnam	11,703	1,138	1,080	13,921	55	13	8	76	84
Randolph	306,052	12,711	6,073	324,836	627	192	52	871	194
Ray	420,402	49,679	6,036	476,117	979	372	98	1,449	189
Vernon	39,182	2,073	771	42,026	94	24	29	147	101
Other counties[e]	16,057	3,420	60	19,537	30	6	23	59	147
	3,209,496	242,136	99,989	3,551,621	5,141	1,830	1,584	8,555	166

[a] Includes also loaders and shot firers.
[c] Chariton, Ralls, and St. Clair.
[d] Exclusive of product of wagon mines.
[e] Chariton, Franklin, Ralls, and St. Clair.

Value of coal produced in Missouri in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Adair	$1,350,252	$21,011	$23,324	$1,394,587	$2.69
Audrain	300	72,616	395	73,311	4.39
Barton	2,493,225	29,842	160,301	2,683,368	3.02
Bates	145,326	33,301	1,597	180,224	3.16
Boone		73,605		73,605	4.00
Caldwell, Clay, and Platte	188,378	79,252	5,511	273,141	4.01
Callaway	92,443	100,894	11,806	205,143	4.02
Chariton		9,696	207	9,903	3.41
Cooper, Howard, Moniteau, and Pettis	91,002	14,781	21,649	127,432	5.80
Dade		24,250	90	24,340	3.85
Grundy and Harrison	46,070	64,356	16,515	126,941	4.00
Henry	327,418	55,505	15,152	398,075	2.91
Johnson	188,950	48,547	4,379	241,876	3.10
Lafayette	2,144,052	164,999	70,724	2,379,775	3.65
Linn	256,052	134,602	3,201	393,855	3.94
Macon	942,139	122,698	19,713	1,084,550	2.82
Putnam	100,466	11,574	1,481	113,521	2.99
Randolph	815,329	87,599	19,340	922,268	2.87
Ray	1,307,132	146,778	23,429	1,477,339	3.62
Vernon	135,589	12,996	524	149,109	3.11
Other counties [a]	186,483	11,112	9,976	207,571	2.98
Small mines		226,432		226,432	3.48
	10,810,606	1,546,446	409,314	12,766,366	
Average value per ton	3.17	3.66	2.86	3.21	3.21
1920.					
Adair	3,045,000	45,000	29,000	3,119,000	4.01
Audrain		88,000	1,000	89,000	4.77
Barton	3,771,000	34,000	178,000	3,983,000	4.12
Bates	432,000	69,000	1,000	502,000	4.34
Boone		84,000		84,000	4.43
Caldwell, Clay, and Platte	308,000	117,000	17,000	442,000	5.10
Callaway	104,000	156,000	9,000	269,000	4.60
Cooper, Howard, Moniteau, Morgan, and Pettis	100,000	12,000	20,000	132,000	4.51
Dade		28,000		28,000	4.42
Grundy and Harrison	29,000	68,000	9,000	106,000	4.59
Henry	674,000	83,000	21,000	778,000	3.83
Johnson	142,000	21,000	6,000	169,000	3.72
Lafayette	3,725,000	206,000	109,000	4,040,000	4.56
Linn	418,000	205,000	5,000	628,000	4.35
Macon	2,256,000	252,000	35,000	2,543,000	3.53
Putnam	112,000	14,000	2,000	128,000	4.15
Randolph	1,472,000	129,000	26,000	1,627,000	3.85
Ray	2,236,000	259,000	37,000	2,532,000	4.38
Vernon	281,000	13,000	9,000	303,000	4.05
Other counties [b]	236,000	9,000		245,000	3.96
	19,341,000	1,892,000	514,000	21,747,000	4.13
Small mines	425,000	58,000		483,000	4.69
	19,766,000	1,950,000	514,000	22,230,000	
Average value per ton	4.11	4.64	3.73	4.16	4.16
1921. [c]					
Adair	1,614,000	27,000	18,000	1,659,000	3.14
Audrain	8,200	37,000	300	45,500	4.32
Barton	2,791,000	16,000	127,000	2,934,000	4.04
Bates	119,000	3,000	3,000	125,000	3.15
Boone	12,000	33,000		45,000	2.79
Caldwell, Clay, Dade, and Platte	262,000	99,000	11,000	372,000	4.06
Callaway	44,000	81,000	5,000	130,000	4.04
Henry	301,000	23,000	3,000	327,000	3.43
Howard, Moniteau, and Pettis	9,100	6,100	2,200	17,400	3.85
Grundy and Harrison	12,000	55,000	1,000	68,000	5.83
Johnson	40,000	9,000	1,000	50,000	3.28
Lafayette	2,106,000	142,000	68,000	2,316,000	4.29
Linn	305,000	120,000	3,000	428,000	4.77
Macon	1,657,000	93,000	34,000	1,784,000	3.76
Putnam	46,000	5,000	1,000	52,000	3.74
Randolph	1,194,000	57,000	23,000	1,274,000	3.92
Ray	1,808,000	225,000	25,000	2,058,000	4.32
Vernon	158,000	6,000	2,000	166,000	3.95
Other counties [d]	52,400	12,000	200	64,600	3.31
	12,538,700	1,049,100	327,700	13,915,500	
Average value per ton	3.91	4.33	3.28	3.92	3.92

[a] Franklin, Ralls, and St. Clair.
[b] Chariton, Ralls, and St. Clair.
[c] Exclusive of product of wagon mines.
[d] Chariton, Franklin, Ralls, and St. Clair.

Coal produced in Missouri, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Decrease, 1921.
Adair	693,084	755,604	517,910	777,986	527,804	250,182
Audrain	11,735	11,747	16,683	18,626	10,538	8,088
Barton	1,056,291	1,146,043	887,174	965,757	726,347	239,410
Bates	89,832	105,078	57,050	115,621	39,690	75,931
Boone	16,410	16,129	18,416	18,950	16,128	2,822
Caldwell, Clay, and Platte	[a] 195,221	94,090	68,119	86,617	[a] 91,646	1,313
Callaway	60,881	48,139	51,010	58,462	32,191	26,271
Cooper, etc. [b]	4,575	4,302	21,970	29,300	4,514	24,786
Dade	(a)	5,327	6,324	6,342	(a)	(a)
Grundy and Harrison	[c] 92,085	[c] 79,999	31,728	23,080	11,654	11,426
Henry	110,557	79,290	136,872	203,200	95,279	107,921
Johnson	(a)	150,844	77,958	45,434	15,240	30,194
Lafayette	961,739	1,009,554	651,193	885,569	540,421	345,148
Linn	128,512	148,266	99,991	142,290	89,747	52,543
Macon	924,667	812,677	384,846	720,227	473,985	246,242
Putnam	21,651	45,549	37,973	30,867	13,921	16,946
Randolph	598,245	463,587	320,835	422,903	324,836	98,067
Ray	516,285	493,980	408,148	578,694	476,117	102,577
Vernon	(d)	(d)	47,978	74,771	42,026	32,745
Other counties	[d] 57,375	[d] 129,896	72,475	61,869	19,537	42,332
Small mines	131,404	67,629	65,145	103,000	....	103,000
	5,670,549	5,667,730	3,979,798	5,369,565	3,551,621	1,817,944
Total value	$13,755,864	$17,126,498	$12,766,366	$22,230,000	$13,915,500	$8,314,500

[a] No production in Caldwell County but includes Dade and Johnson in 1917; includes Dade County in 1921.
[b] Cooper and Moniteau in 1917 and 1918; Cooper, Howard, Moniteau, and Pettis in 1919; Cooper, Howard, Moniteau, Morgan, and Pettis in 1920; and Howard, Moniteau, and Pettis in 1921.
[c] Includes Sullivan County 1917 and 1918.
[d] Other counties include Ralls and Vernon in 1917; Franklin, Ralls, St. Clair, and Vernon in 1918; Chariton, Franklin, Ralls, and St. Clair in 1919; Chariton, Ralls, and St. Clair in 1920; Chariton, Franklin, Ralls, and St. Clair in 1921.

MONTANA.

Hill and Sheridan counties were the only ones in Montana that made an increase in production in 1919. A loss was registered in all the larger counties. The production for the State as a whole was 3,236,369 tons, valued at $8,644,344. As compared with the preceding year this represents a decrease of 1,296,136 tons, or 28.6 per cent, in quantity, and of $2,800,531, or 24.5 per cent, in value. The average value per ton, however, increased 14 cents, rising to $2.67. The number of days in which the mines were in operation dropped from 264 to 194, and the working force was cut about 9.6 per cent. The average production per day per man increased from 3.77 to 4.05 tons.

The production in 1920 was less than that in 1918, but the value was greater. The total output in 1920 was 4,413,866 tons, valued at $13,923,000, an increase over that in 1919 of 1,177,479 tons, or 36.4 per cent, in quantity, and of $5,278,656, or 61.1 per cent, in value. All counties except Hill, Roosevelt, and Sheridan reported a larger output. The average number of days worked reached 250, but the increase in the working force was less than 100 men. The average daily production per man was 4.19 tons.

In 1921 Montana produced 2,733,958 tons of coal, valued at $8,921,600, a decrease of 1,679,908 tons, or 38 per cent, in quantity and of $5,001,400, or 35.9 per cent, in value. The working force was cut to 4,178, and the average number of days worked fell to 143. The production per man per day averaged 4.57 tons. In every county there was a decrease in production. The loss in Carbon, Cascade, and Musselshell, the three leading producing counties, aggregated 1,274,539 tons. The average value per ton increased 10 cents.

Coal produced in Montana in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground.		Surface.	Total.	
					Miners.[a]	All others.			
1919.									
Blaine	....	8,718	4	8,722	12		2	14	243
Carbon	1,182,832	39,969	88,329	1,311,130	1,347		386	1,733	201
Cascade	680,231	22,431	21,741	724,403	589		142	731	182
Hill	607	19,476	65	20,148	23		3	26	260
Musselshell	805,208	19,161	41,538	865,907	927		177	1,104	189
Roosevelt	300	4,450	24	4,774	12		1	13	199
Sheridan	1,763	28,622	258	30,643	44		11	55	212
Other counties[b]	216,679	22,675	11,434	250,788	364		83	447	194
Small mines[c]	....	19,854	....	19,854	....		....	....	....
	2,887,620	185,356	163,393	3,236,369	3,318		805	4,123	194
1920.									
Blaine	300	8,587	353	9,240	13	3	2	18	228
Carbon	1,662,494	50,214	101,778	1,814,486	935	434	346	1,715	268
Cascade	944,632	14,406	24,847	983,885	517	178	173	868	248
Hill	362	17,494	80	17,936	16	7	5	28	231
Musselshell	1,091,223	17,236	31,964	1,140,423	562	309	133	1,004	225
Roosevelt	....	3,000	....	3,000	3	3	2	8	139
Sheridan	1,370	18,248	5	19,623	24	12	12	48	186
Other counties[d]	378,900	20,631	15,742	415,273	234	174	107	515	257
	4,079,281	149,816	174,769	4,403,866	2,304	1,120	780	4,204	250
Small mines	3,000	7,000	....	10,000	....	....	....	....	....
	4,082,281	156,816	174,769	4,413,866	....	....	....	....	....
1921.[e]									
Carbon	1,188,979	39,972	86,771	1,315,722	930	405	323	1,658	181
Cascade	634,622	31,065	20,759	686,446	588	212	154	954	156
Hill	....	9,030	....	9,030	10	3	3	16	186
Musselshell	641,931	7,705	12,451	662,087	640	313	132	1,085	111
Roosevelt	200	2,000	....	2,200	7	....	....	7	150
Sheridan	65	9,009	30	9,104	18	4	2	24	168
Other counties[f]	26,547	16,757	6,065	49,369	203	127	104	434	41
	2,492,344	115,538	126,076	2,733,958	2,396	1,064	718	4,178	143

[a] Includes also loaders and shot firers.
[b] Carter, Chouteau, Dawson, Fergus, Gallatin, Pondera, and Richland.
[c] Includes Toole County.
[d] Carter, Chouteau, Dawson, Fergus, Gallatin, Golden Valley, Judith Basin, Park, Pondera, Richland, and Toole.
[e] Exclusive of product of wagon mines.
[f] Blaine, Carter, Chouteau, Gallatin, Judith Basin, Park, Pondera, Richland, and Toole.

Value of coal produced in Montana in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Blaine	....	$42,593	$20	$42,613	$4.89
Carbon	$3,344,710	102,792	63,847	3,511,349	2.68
Cascade	1,743,597	63,493	55,916	1,863,006	2.57
Hill	1,821	75,610	166	77,597	3.85
Musselshell	2,057,458	71,901	109,903	2,239,262	2.59
Roosevelt	1,000	12,575	67	13,642	2.86
Sheridan	4,843	69,137	590	74,570	2.43
Other counties [a]	640,314	75,934	44,564	760,812	3.03
Small mines [b]	....	61,493	....	61,493	3.10
	7,793,743	575,528	275,073	8,644,344	....
Average value per ton	2.70	3.10	1.68	2.67	2.67
1920.					
Blaine	2,000	39,000	1,000	42,000	4.55
Carbon	5,799,000	162,000	110,000	6,071,000	3.35
Cascade	2,565,000	46,000	68,000	2,679,000	2.72
Hill	1,000	64,000	....	65,000	3.62
Musselshell	3,262,000	74,000	86,000	3,422,000	3.00
Roosevelt	....	9,000	....	9,000	3.00
Sheridan	4,000	47,000	....	51,000	2.60
Other counties [c]	1,418,000	86,000	47,000	1,551,000	3.73
	13,051,000	527,000	312,000	13,890,000	3.15
Small mines	11,000	22,000	....	33,000	3.30
	13,062,000	549,000	312,000	13,923,000	....
Average value per ton	3.20	3.50	1.78	3.16	3.16
1921.[d]					
Carbon	4,486,000	141,000	75,000	4,702,000	3.57
Cascade	1,725,000	100,000	52,000	1,877,000	2.73
Hill	....	28,000	....	28,000	3.10
Musselshell	2,022,000	31,000	37,000	2,090,000	3.16
Roosevelt	1,000	4,000	....	5,000	2.27
Sheridan	200	22,000	100	22,300	2.45
Other counties [e]	111,000	66,300	20,000	197,300	4.00
	8,345,200	392,300	184,100	8,921,600	....
Average value per ton	3.35	3.40	1.46	3.26	3.26

[a] Carter, Chouteau, Dawson, Fergus, Gallatin, Pondera, and Richland.
[b] Includes Toole County.
[c] Carter, Chouteau, Dawson, Fergus, Gallatin, Golden Valley, Judith Basin, Park, Pondera, Richland, and Toole.
[d] Exclusive of product of wagon mines.
[e] Blaine, Carter, Chouteau, Gallatin, Judith Basin, Park, Pondera, Richland, and Toole.

Coal produced in Montana, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Decrease, 1921.
Blaine	(a)	(a)	8,722	9,240	(a)	(a)
Carbon	1,790,270	1,647,705	1,311,130	1,814,486	1,315,722	498,764
Cascade	1,024,907	1,272,916	724,403	983,885	686,446	297,439
Chouteau	(a)	(a)	(a)	(a)	(a)	(a)
Fergus	265,705	(a)	(a)	(a)	....	....
Hill	6,574	9,165	20,148	17,936	9,030	8,906
Musselshell	1,054,021	1,223,091	865,907	1,140,423	662,087	478,336
Roosevelt	....	....	4,774	3,000	2,200	800
Sheridan	12,954	15,812	30,643	19,623	9,104	10 519
Other counties [a]	34,394	347,551	250,788	415,273	49,369	375,144
Small mines	37,864	[b] 16,265	[b] 19,854	10,000	....	10,000
	4,226,689	4,532,505	3,236,369	4,413,866	2,733,958	1,679,908
Total value	$8,919,136	$11,444,875	$8,644,344	$13,923,000	$8,921,600	$5,001,400

[a] Other counties include Blaine, Chouteau, Missoula, Richland, and Valley in 1917; Blaine, Chouteau, Fergus, Phillips, Richland, and Stillwater in 1918; Carter, Chouteau, Dawson, Fergus, Gallatin, Pondera, and Richland in 1919; Carter, Chouteau, Dawson, Fergus, Gallatin, Golden Valley, Judith Basin, Park, Pondera, Richland, and Toole in 1920; and Blaine, Carter, Chouteau, Gallatin, Judith Basin, Park, Pondera, Richland, and Toole in 1921.
[b] Includes Toole County.

NEW MEXICO.

The decrease in the production of coal in 1919 as compared with 1918 in the Raton and Gallup fields in Colfax and McKinley counties, N. Mex., far offset the gains made in other counties. The production for the State in 1919 was 3,138,756 tons, valued at $9,750,833, a decrease of 884,483 tons, or 21.9 per cent, in quantity and of $1,036,249, or 9.6 per cent, in value. Colfax and McKinley counties lost 899,901 tons, and the loss in Colfax County alone was 857,690 tons. The average number of days in which the mines were in operation dropped from 301 to 273, and the number of men employed decreased from 4,095 to 3,745.

The output in 1920 was 3,683,440 tons, valued at $13,568,000, an increase, as compared with 1919, of 544,684 tons, or 17.4 per cent, in quantity and of $3,817,167, or 39.1 per cent, in value. San Juan was the only county that failed to report an increase in output. The aggregate gain for the Raton and Gallup fields was 489,258 tons. The average number of days worked increased to 302, but the number of men employed remained practically the same. The average daily output per man was 3.26 tons, the same as in 1918. In 1920 New Mexico shared with Georgia the distinction of being free from losses by strikes.

In 1921 the output dropped to 2,453,482 tons, valued at $9,585,000, a decrease of 1,229,958 tons, or 33.4 per cent, in quantity and of $3,983,000, or 29.3 per cent, in value. The average value per ton, however, increased to $3.91. The number of men employed rose to 4,577, but the average number of days in which the mines were in operation was cut practically in half. The average daily production per man, however, reached 3.58 tons. The output of Rio Arriba County showed a small gain, but that of all other counties was less than in 1920.

Coal produced in New Mexico in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground.		Surface.	Total.	
						Miners.[a]	All others.			
1919.										
Colfax	1,676,401	13,592	8,505	473,033	2,171,531	1,631		540	2,171	268
Lincoln, Santa Fe, and Socorro	200,830	8,358	10,587	....	219,775	434		85	519	290
McKinley	692,993	10,792	24,547	....	728,332	819		193	1,012	282
Rio Arriba	12,873	5	372	....	13,250	26		9	35	161
San Juan	....	3,949	....	....	3,949	8		......	8	166
Small mines	....	1,919	....	....	1,919	....	....	......	....	....
	2,583,097	38,615	44,011	473,033	3,138,756	2,918		827	3,745	273
1920.										
Colfax	2,084,912	16,477	1,586	453,944	2,556,919	966	632	472	2,070	306
Lincoln, Santa Fe, and Socorro	253,338	9,939	10,864	....	274,141	221	132	135	488	305
McKinley	792,482	13,768	25,952	....	832,202	640	309	186	1,135	296
Rio Arriba	16,536	200	450	....	17,186	28	6	4	38	213
San Juan	....	2,992	....	....	2,992	3	3	1	7	197
	3,147,268	43,376	38,852	453,944	3,683,440	1,858	1,082	798	3,738	302
1921.[b]										
Colfax	1,643,833	14,975	25,608	30,435	1,714,851	1,601	641	425	2,667	150
McKinley	477,319	9,423	27,903	....	514,645	727	353	177	1,257	123
Rio Arriba	19,966	300	450	....	20,716	25	8	7	40	245
Other counties[c]	184,916	10,056	8,298	....	203,270	382	118	113	613	194
	2,326,034	[d] 34,754	62,259	30,435	[d] 2,453,482	2,735	1,120	722	4,577	150

[a] Includes also loaders and shot firers. [b] Exclusive of product of wagon mines.

[c] Lincoln, San Juan, Santa Fe, and Socorro.

[d] In addition to the amounts stated above, 3,460 tons was produced by small mines and sold to local trade. The total production was therefore 2,456,942 tons, and the total sold to local trade and used by employees was 38,214 tons.

Value of coal produced in New Mexico in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Colfax	$4,776,372	$22,096	$8,529	$1,211,286	$6,018,283	$2.77
Lincoln, Santa Fe, and Socorro	932,213	32,243	47,288	....	1,011,744	4.60
McKinley	2,569,297	33,327	62.234	....	2,664,858	3.66
Rio Arriba	40,729	14	879	....	41,622	3.14
San Juan	....	9,426	....	....	9,426	2.39
Small mines	....	4,900	....	....	4,900	2.55
	8,318,611	102,006	118,930	1,211,286	9,750,833	....
Average value per ton	3.22	2.64	2.70	2.56	3.11	3.11
1920.						
Colfax	7,082,000	38,000	4,000	1,369,000	8,493,000	3.32
Lincoln, Santa Fe, and Socorro	1,379,000	45,000	50,000	....	1,474,000	5.38
McKinley	3,410,000	46,000	82,000	....	3,538,000	4.25
Rio Arriba	52,000	1,000	1,000	....	54,000	3.14
San Juan	....	9,000	....	....	9,000	3.01
	11,923,000	139,000	137,000	1,369,000	13,568,000	....
Average value per ton	3.79	3.20	3.53	3.02	3.68	3.68
1921.[a]						
Colfax	5,889,000	42,000	57,000	89,000	6,077,000	3.54
McKinley	2,259,000	38,000	83,000	....	2,380,000	4.62
Rio Arriba	63,000	1,000	1,000	....	65,000	3.14
Other counties[b]	992,000	35,000	36,000	....	1,063,000	5.23
	9,203,000	116,000	177,000	89,000	9,585,000	....
Average value per ton	3.96	3.34	2.84	2.92	3.91	3.91

[a] Exclusive of product of wagon mines.
[b] Lincoln, San Juan, Santa Fe, and Socorro.

Coal produced in New Mexico, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Colfax	3,114,604	3,029,221	2,171,531	2,556,919	1,714,851	−842,068
Lincoln, Santa Fe, and Socorro	208,292	207,534	219,775	274,141	[a]203,270	−[a]73,863
McKinley	665,298	770,543	728,332	832,202	514,645	−317,557
Rio Arriba	[b]10,775	[b]13,874	13,250	17,186	20,716	+3,530
San Juan	([b])	([b])	3,949	2,992	([a])	([a])
Small mines	1,558	2,067	1,919	....	....	....
	4,000,527	4,023,239	3,138,756	3,683,440	2,453,482	−1,229,958
Total value	$7,455,166	$10,787,082	$9,750,833	$13,568,000	$9,585,000	−$3,983,000

[a] Includes also San Juan County in 1921.
[b] Rio Arriba includes San Juan County in 1917 and 1918.

NORTH DAKOTA.

The production of lignite in North Dakota in 1919 amounted to 840,959 tons, valued at $2,100,303, an increase of 121,226 tons, or 16.8 per cent, in quantity and $470,635, or 28.9 per cent, in value. In 1920 the production was 948,625 tons, valued at $2,724,000, an increase of 107,666 tons, or 12.8 per cent, in quantity and of $623,697, or 29.7 per cent, in value over that in 1919. In 1921, however, North Dakota shared in the general decline. The output for the year was 864,903 tons, valued at $2,329,500, a decrease of

83,722 tons, or 8.8 per cent, in quantity, and of $394,500, or 14.5 per cent, in value, as compared with 1920. The zoning system put in effect during the war, the greater demand for eastern coal on shorter hauls, the increasing cost of transportation from the docks and from Illinois and Indiana to North Dakota, and the advances that have been made in the more effective utilization of low-grade fuels have all combined to create a wider home market for the product of this State.

Lignite produced in North Dakota in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.									
Adams	34,920	3,903	300	39,123	20		12	32	256
Billings	31,790	50	100	31,940	23		6	29	305
Burke	54,600	5,135	1,445	61,180	8		54	62	129
Burleigh and Mercer	297,139	15,885	10,060	323,084	293		94	387	228
Divide	27,606	6,296	....	33,902	43		22	65	210
Dunn	....	4,600	40	4,640	8		2	10	183
Hettinger	10,578	2,145	62	12,785	14		12	26	183
McLean	7,595	18,762	80	26,437	37		16	53	203
Morton	1,387	27,204	400	28,991	27		9	36	203
Stark	62,429	4,200	1,800	68,429	43		15	58	300
Ward	56,540	36,173	466	93,179	156		47	203	191
Williams	21,050	45,553	45	66,648	85		18	103	216
Other counties[b]	2,000	5,919	625	8,544	1		7	8	198
Small mines	....	42,077	....	42,077	....	....	......	......	....
	607,634	217,902	15,423	840,959	758		314	1,072	216
1920.									
Billings	47,375	404	....	47,779	26	8	11	45	240
Burke	89,826	7,012	2,355	99,193	4	2	92	98	129
Burleigh	230,958	13,568	10,215	254,741	146	74	83	303	234
Divide	32,756	4,304	82	37,142	39	10	17	66	221
Hettinger	12,122	1,215	96	13,433	17	6	7	30	168
McLean	10,754	21,548	....	32,302	22	9	11	42	219
Mercer	101,504	2,456	3,627	107,587	51	35	26	112	254
Morton	1,049	29,593	300	30,942	20	9	12	41	212
Stark	54,074	6,932	3,108	64,114	31	14	17	62	295
Ward	61,645	24,256	503	86,404	85	31	35	151	213
Williams	35,608	22,843	15,293	73,744	48	21	18	87	212
Other counties[c]	47,618	10,626	2,000	60,244	37	8	28	73	174
	725,289	144,757	37,579	907,625	526	227	357	1,110	218
Small mines	21,000	20,000	....	41,000	....	......	......	......	....
	746,289	164,757	37,579	948,625	....	......	......	......	....
1921.[d]									
Billings	21,138	12,201	....	33,339	24	7	10	41	235
Burke	108,152	11,704	3,866	123,722	7	3	73	83	177
Burleigh	217,845	10,589	8,990	237,424	150	71	61	282	171
Divide	33,118	4,722	44	37,884	45	10	24	79	147
McLean	11,229	9,170	270	20,669	29	11	8	48	181
Mercer	120,597	1,087	8,224	129,908	81	48	39	168	265
Morton	9,400	20,451	....	29,851	19	5	6	30	162
Stark	33,020	6,987	2,697	42,704	27	11	16	54	219
Ward	31,696	26,907	....	58,603	69	9	13	91	151
Williams	26,756	25,980	256	52,992	52	14	12	78	193
Other counties[e]	87,999	5,752	4,056	97,807	63	20	27	110	218
	700,950	135,550	28,403	864,903	566	209	289	1,064	194

[a] Includes also loaders and shot firers.
[b] Bowman, Golden Valley, and Oliver.
[c] Adams, Bowman, Dunn, Golden Valley, and Oliver.
[d] Exclusive of product of wagon mines.
[e] Adams, Bowman, Dunn, Hettinger, and Oliver.

Value of lignite produced in North Dakota in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Adams	$98,772	$9,668	$900	$109,340	$2.79
Billings	65,128	125	192	65,445	2.05
Burke	163,920	13,465	3,435	180,820	2.96
Burleigh and Mercer	739,829	35,802	13,759	789,390	2.44
Divide	76,019	17,117		93,136	2.75
Dunn		10,600	100	10,700	2.30
Hettinger	26,134	4,780	124	31,038	2.43
McLean	20,755	41,771	140	62,666	2.37
Morton	2,219	49,048	560	51,827	1.79
Stark	143,730	6,720	3,575	154,025	2.25
Ward	159,492	85,513	1,382	246,387	2.64
Williams	59,340	130,982	51	190,373	2.85
Other counties [a]	5,500	12,843	1,718	20,061	2.35
Small mines		95,095		95,095	2.26
	1,560,838	513,529	25,936	2,100,303	
Average value per ton	2.57	2.36	1.68	2.50	2.50
1920.					
Billings	105,000	1,000		106,000	2.22
Burke	253,000	18,000	6,000	277,000	2.79
Burleigh	718,000	35,000	32,000	785,000	3.08
Divide	108,000	12,000		120,000	3.23
Hettinger	39,000	4,000		43,000	3.20
McLean	28,000	57,000		85,000	2.63
Mercer	278,000	6,000	5,000	289,000	2.69
Morton	2,000	60,000	1,000	63,000	2.04
Stark	157,000	16,000	5,000	178,000	2.78
Ward	188,000	68,000	2,000	258,000	2.99
Williams	112,000	67,000	46,000	225,000	3.05
Other counties [b]	158,000	27,000	4,000	189,000	3.14
	2,146,000	371,000	101,000	2,618,000	2.88
Small mines	62,000	44,000		106,000	2.59
	2,208,000	415,000	101,000	2,724,000	
Average value per ton	2.96	2.52	2.69	2.87	2.87
1921. [c]					
Billings	63,000	25,000		88,000	2.64
Burke	266,000	26,000	9,000	301,000	2.43
Burleigh	600,000	27,000	24,000	651,000	2.74
Divide	102,000	13,000	100	115,100	3.04
McLean	31,000	22,000	400	53,400	2.58
Mercer	339,000	3,000	17,000	359,000	2.76
Morton	22,000	41,000		33,000	2.11
Stark	95,000	18,000	4,000	117,000	2.74
Ward	92,000	74,000		166,000	2.83
Williams	81,000	70,000	1,000	152,000	2.87
Other counties [d]	249,000	13,000	2,000	264,000	2.70
	1,940,000	332,000	57,500	2,329,500	
Average value per ton	2.77	2.45	2.02	2.69	2.69

[a] Bowman, Golden Valley, and Oliver.
[b] Adams, Bowman, Dunn, Golden Valley, and Oliver.
[c] Exclusive of product of wagon mines.
[d] Adams, Bowman, Dunn, Hettinger, and Oliver.

Lignite produced in North Dakota, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Adams	(a)	(a)	39,123	(a)	(a)	
Billings	(a)	(a)	31,940	47,779	33,339	−14,440
Burke	24,351	18,993	61,180	99,193	123,722	+24,529
Burleigh	[b] 289,744	[b] 327,478	323,084	254,741	237,424	−17,317
Divide	108,843	75,922	33,902	37,142	37,884	+742
Hettinger	5,710	3,840	12,785	13,433	(a)	(a)
McLean	(b)	(b)	26,437	32,302	20,669	−11,633
Mercer	(b)	(b)	(b)	107,587	129,908	+22,321
Morton	24,648	28,500	28,991	30,942	29,851	−1,091
Stark	(a)	(a)	68,429	64,114	42,704	−21,410
Ward	88,376	91,197	93,179	86,404	58,603	−27,801
Williams	48,383	50,317	66,648	73,744	52,992	−20,752
Other counties	[a] 132,120	[a] 82,681	13,184	60,244	97,807	+24,130
Small mines	68,373	40,805	42,077	41,000		−41,000
	790,548	719,733	840,959	948,625	864,903	−83,722
Total value	$1,425,750	$1,629,668	$2,100,303	$2,724,000	$2,329,500	−$394,500

[a] Other counties include Adams, Billings, Bowman, Dunn, Oliver, and Stark counties in 1917 and in 1918; Bowman, Dunn, Golden Valley, and Oliver in 1919; Adams, Bowman, Dunn, Golden Valley, and Oliver in 1920; and Adams, Bowman, Dunn, Hettinger, and Oliver in 1921.
[b] Burleigh County includes McLean and Mercer counties in 1917 and 1918 and Mercer County in 1919.

OHIO.

The production of coal in Ohio in 1919 was 35,876,682 tons, valued at $79,496,301. As compared with 1918 this was a decrease in quantity of 9,936,261 tons, or 21.6 per cent, and in value of $38,599,217, or 32.7 per cent. The average value per ton was $2.22, a decrease of 36 cents. Holmes, Mahoning, and Wayne counties were the only ones in which the output increased over that in 1918, and Columbiana and Tuscarawas counties were among those that suffered the smallest relative losses during the year. The mines worked an average of 164 days in 1919, as against 225 in 1918. The total number of men employed, 49,624, represented an increase of 1,174, but the total number employed above ground decreased 279. The average yearly output naturally was less, but the average daily output per employee increased 0.17 ton, or to 4.41 tons. The losses by strikes, which involved 42,724 men, cost 1,717,426 man-days, and the average loss per man striking was 40 days.

The boom in 1920 carried the output up to 45,878,191 tons, valued at $175,081,000, which exceeded that in 1918 by 65,248 tons and the value by $56,985,482. As compared with 1919, the increase in quantity was 10,001,509 tons, or 27.8 per cent, and the increase in value was $95,584,699, or 120.2 per cent. The average value per ton rose to $3.82. Every county shared in the increase except Noble, where production decreased from 809,198 tons to 668,089 tons. The gain in output was made with an increase as compared with 1919 of less than 15 per cent in the average number of days in which the mines were in operation and of less than 2.5 per cent in the working forces. There was a total increase in the number of men employed of 1,233, of whom 507 were surface workers. The average daily production per man, however, was pushed up to 4.73 tons. The number of men involved in strikes and the time thus lost were substantially diminished. During the year 17,333 men were on strike for an average of 14 days, causing a loss of 245,314 man-days.

Under the influence of the depression in 1921 production slipped back to 31,942,776 tons, valued at $84,686,500, a decrease of 13,935,415 tons, or 30.4 per cent, in quantity, and of $90,394,500, or 51.6 per cent, in value. Belmont County, in the Pittsburgh No. 8 field of eastern Ohio, increased its output 408,365 tons, but every other county showed a loss. The combined losses for Athens, Guernsey, Hocking, Jackson, Jefferson, Perry, and Tuscarawas counties were 10,632,263 tons. The output in Perry and Tuscarawas counties was practically cut to half that in 1920, and the loss was still greater in Hocking and Jackson counties. The average number of days in which the mines of the State were in operation declined from 188 to 134. The number of men employed increased 928, bringing the total up to 51,785, but there was a reduction of 1,708 in the number employed above ground. Although there was an increase of 3,205 in the number of miners, loaders, and shot firers, this shift in the percentage of the underground workers to the total force did not increase the daily average output per employee. On the contrary, Ohio was one of the few States to report a decreased daily output per man in 1921. A slightly greater number of men were involved in strikes during the year, but the losses from this source were less, the average falling to 10 days per striker and the total loss to 176,605 man-days.

The mines in Ohio, like those in Illinois and Indiana, are completely unionized. Here and there a country bank may possibly be found where the mine workers' organization is not recognized, but the output of such banks is too small to have any effect upon the commercial coal market. Because of the geographic location of Ohio and of the area to which its coal is distributed, the operations in the State come into more direct competition with the nonunion operations than those in Illinois and Indiana, although Indiana lies more in the zone of nonunion competitive influence than Illinois. As the production of Ohio in 1921 was a little less than 50 per cent of that of Illinois and about 50 per cent more than that of Indiana, the decrease in output in Ohio in 1921 was equivalent to more than 70 per cent of the decrease in Illinois and was about 54 per cent greater than the decrease in Indiana. The loss in total value in Ohio, however, exceeded that in the other two States both in percentage and in dollars.

Coal produced in Ohio in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.										
Athens	4,685,014	53,805	102,094	....	4,840,913	6,796		1,011	7,807	144
Belmont	9,640,025	351,040	110,617	....	10,101,682	10,291		1,552	11,843	174
Carroll	276,629	50,256	17,741	....	344,626	481		91	572	191
Columbiana	553,226	65,224	15,961	....	634,411	786		123	909	178
Coshocton	223,499	59,399	1,892	....	284,790	592		83	675	138
Gallia	5,743	1,945	....	....	7,688	26		4	30	100
Guernsey	3,182,115	51,688	101,170	....	3,334,973	3,675		479	4,154	160
Harrison	1,374,622	25,171	28,179	....	1,427,972	1,219		527	1,746	174
Hocking	1,513,800	50,458	11,364	....	1,575,622	2,108		415	2,523	141
Holmes	314	8,160	120	....	8,594	21		1	22	182
Jackson	428,287	36,557	27,266	....	492,110	1,245		206	1,451	128
Jefferson	4,591,268	366,071	71,788	1,292	5,030,419	4,181		1,435	5,616	197
Lawrence	109,869	30,129	1,416	....	141,414	336		74	410	165
Mahoning	7,120	43,057	504	....	50,681	94		29	123	231
Medina	....	4,439	460	....	4,899	14		......	14	285
Meigs	846,039	34,273	17,261	....	897,573	1,363		311	1,674	154
Morgan, Scioto, and Washington	204,784	4,042	3,525	....	212,351	381		46	427	122
Muskingum	344,329	82,297	4,609	....	431,235	680		127	807	139
Noble	781,277	11,123	16,798	....	809,198	771		61	832	187
Perry	2,425,425	48,627	44,998	....	2,519,050	2,945		837	3,782	147
Portage	55,152	11,933	8,410	....	75,495	112		31	143	193
Stark	140,048	232,388	14,638	....	387,074	626		93	719	198
Summit	....	28,792	2,284	....	31,076	48		24	72	131
Tuscarawas	1,467,589	305,259	44,248	....	1,817,096	2,082		622	2,704	168
Vinton	167,925	9,059	10,525	....	187,509	388		92	480	122
Wayne	30,004	9,736	1,703	....	41,443	75		14	89	195
Small mines	....	186,788	....	....	186,788	....		......	......	....
	33,054,103	2,161,716	659,571	1,292	35,876,682	41,336		8,288	49,624	164

[a] Includes also loaders and shot firers.

Coal produced in Ohio in 1919–1921—Continued.

County.	Production (net tons).					Number of employees.				Average number of days worked.
						Underground.				
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Miners.[a]	All others.	Surface.	Total.	
1920.										
Athens	6,257,205	108,909	134,899	....	6,501,013	4,949	1,805	1,010	7,764	173
Belmont	10,514,679	498,747	179,359	....	11,192,785	7,204	2,752	1,531	11,487	175
Carroll	418,178	74,420	9,748	....	502,346	425	176	109	710	204
Columbiana	754,431	87,324	15,437	....	857,192	562	274	178	1,014	233
Coshocton	384,374	56,122	2,674	....	443,170	377	178	109	664	196
Gallia	11,640	614	20	....	12,274	16	6	4	26	191
Guernsey	3,537,828	80,947	115,035	....	3,733,810	2,397	1,265	473	4,135	177
Harrison	1,925,996	33,800	42,789	....	2,002,585	857	381	632	1,870	180
Hocking	2,139,836	47,668	11,494	....	2,198,998	1,643	555	412	2,610	171
Holmes	370	9,410	....	....	9,780	9	7	6	22	208
Jackson	718,697	88,665	27,494	....	834,856	957	373	207	1,537	191
Jefferson	5,653,651	499,725	89,057	767	6,243,200	2,875	1,277	1,697	5,849	219
Lawrence	228,630	70,196	2,458	....	301,284	317	98	66	481	240
Mahoning	5,010	56,297	694	....	62,001	82	35	21	138	219
Medina	....	6,641	10	....	6,651	7	3	3	13	293
Meigs	1,438,818	35,550	35,469	....	1,509,837	1,333	537	325	2,195	204
Morgan and Washington	274,963	5,214	6,119	....	286,296	252	82	52	386	175
Muskingum	531,633	116,923	4,500	....	653,056	527	187	204	918	187
Noble	638,220	11,681	18,188	....	668,089	429	260	70	759	167
Perry	3,530,521	64,593	56,229	....	3,651,343	2,192	812	804	3,808	179
Portage and Summit	77,701	51,958	11,215	....	140,874	114	48	46	208	244
Stark	148,215	286,700	14,937	....	449,852	449	177	111	737	214
Tuscarawas	2,213,636	384,465	36,826	....	2,634,927	1,603	630	586	2,819	213
Vinton	309,810	981	11,671	....	322,462	326	174	119	619	196
Wayne	43,849	11,461	2,200	....	57,510	36	32	20	88	198
	41,757,891	2,689,011	828,522	767	45,276,191	29,938	12,124	8,795	50,857	188
Small mines	497,000	105,000	....	....	602,000	....	....	....	....	....
	42,254,891	2,794,011	828,522	767	45,878,191	....	....	....	....	....
1921.[b]										
Athens	3,703,278	42,776	90,536	....	3,836,590	5,356	1,730	873	7,959	102
Belmont	11,211,844	276,322	112,984	....	11,601,150	9,318	3,093	1,480	13,891	179
Carroll	224,031	34,944	6,648	....	265,623	342	125	60	527	159
Columbiana	529,531	59,511	15,686	....	604,728	825	301	171	1,297	150
Coshocton	152,486	53,149	1,531	....	207,166	390	133	74	597	101
Gallia, Morgan, and Washington	199,603	3,246	2,792	....	205,641	311	103	47	461	121
Guernsey	2,817,409	59,957	104,789	....	2,982,155	2,802	1,322	410	4,534	133
Harrison	1,589,938	16,758	28,734	....	1,635,430	1,057	359	592	2,008	136
Hocking	815,224	43,950	10,696	....	869,870	1,471	433	313	2,217	80
Holmes	....	4,535	....	....	4,535	11	....	....	11	167
Jackson	121,831	48,054	8,718	....	178,603	589	199	113	901	64
Jefferson	4,042,864	253,026	57,793	187	4,353,870	3,526	1,323	1,125	5,974	137
Lawrence	14,311	42,397	861	....	57,569	168	45	37	250	91
Mahoning	463	35,528	132	....	36,123	73	12	9	94	163
Medina	....	3,174	10	....	3,184	10	1	1	12	248
Meigs	889,204	15,430	27,401	....	932,035	1,383	557	276	2,216	123
Muskingum	124,855	57,391	3,229	....	185,475	387	105	99	591	77
Noble	513,768	6,884	18,319	....	538,971	543	265	66	874	136
Perry	1,505,431	47,456	31,130	....	1,584,017	2,213	689	668	3,570	89
Portage, Summit, and Wayne	61,413	22,876	13,772	....	98,061	152	74	57	283	115
Stark	99,340	166,053	26,497	....	291,890	484	136	102	722	151
Tuscarawas	1,065,968	266,373	28,438	....	1,360,779	1,448	478	455	2,381	133
Vinton	105,601	163	3,547	....	109,311	284	72	59	415	113
	29,788,393	1,559,953	594,243	187	31,942,776	33,143	11,555	7,087	51,785	134

[a] Includes also loaders and shot firers. [b] Exclusive of product of wagon mines.

Value of coal produced in Ohio in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Athens	$9,987,161	$100,085	$191,961		$10,279,207	$2.12
Belmont	20,679,940	871,611	228,997		21,780,548	2.16
Carroll	663,622	116,769	32,016		812,407	2.36
Columbiana	1,373,038	172,416	42,005		1,587,459	2.50
Coshocton	544,779	130,451	3,588		678,818	2.38
Gallia	13,472	5,070			18,542	2.41
Guernsey	6,720,129	107,351	202,844		7,030,324	2.11
Harrison	2,893,104	60,127	51,062		3,004,293	2.10
Hocking	3,273,382	160,737	24,498		3,458,617	2.19
Holmes	1,089	25,548	240		26,877	3.13
Jackson	1,263,145	91,133	79,957		1,434,235	2.91
Jefferson	10,117,127	950,068	145,249	$3,032	11,215,476	2.23
Lawrence	280,535	75,129	3,183		358,847	2.54
Mahoning	28,420	153,017	1,874		183,311	3.61
Medina		21,480	795		22,275	4.55
Meigs	2,036,557	85,342	39,407		2,161,306	2.41
Morgan, Scioto, and Washington	439,405	9,524	6,874		455,803	2.14
Muskingum	744,138	186,332	8,919		939,389	2.18
Noble	1,708,739	24,112	35,302		1,768,153	2.18
Perry	5,213,967	102,328	84,495		5,400,790	2.14
Portage	186,533	49,307	16,453		252,293	3.34
Stark	416,404	713,304	46,063		1,175,771	3.04
Summit		87,258	4,778		92,036	2.96
Tuscarawas	3,444,646	723,935	105,429		4,274,010	2.35
Vinton	445,945	18,173	23,566		487,684	2.60
Wayne	102,014	37,674	6,090		145,778	3.52
Small mines		452,052			452,052	2.42
	72,577,291	5,530,333	1,385,645	3,032	79,496,301	
Average value per ton	2.20	2.56	2.10	2.35	2.22	2.22
1920.						
Athens	23,200,000	368,000	364,000		23,932,000	3.68
Belmont	37,876,000	1,865,000	538,000		40,279,000	3.60
Carroll	1,607,000	348,000	38,000		1,993,000	3.97
Columbiana	2,862,000	360,000	54,000		3,276,000	3.82
Coshocton	1,661,000	251,000	9,000		1,921,000	4.33
Gallia	49,000	2,000			51,000	4.16
Guernsey	12,603,000	293,000	350,000		13,246,000	3.55
Harrison	7,188,000	104,000	101,000		7,393,000	3.69
Hocking	8,573,000	159,000	34,000		8,766,000	3.99
Holmes	2,000	41,000			43,000	4.40
Jackson	3,119,000	295,000	114,000		3,528,000	4.23
Jefferson	22,023,000	1,667,000	282,000	2,000	23,974,000	3.84
Lawrence	951,000	213,000	8,000		1,172,000	3.89
Mahoning	29,000	252,000	2,000		283,000	4.56
Medina		33,000			33,000	4.96
Meigs	5,998,000	96,000	132,000		6,226,000	4.12
Morgan and Washington	955,000	17,000	14,000		986,000	3.44
Muskingum	2,196,000	396,000	20,000		2,612,000	4.00
Noble	2,132,000	29,000	57,000		2,218,000	3.32
Perry	14,148,000	195,000	140,000		14,483,000	3.97
Portage and Summit	297,000	196,000	43,000		536,000	3.80
Stark	784,000	1,277,000	56,000		2,117,000	4.71
Tuscarawas	9,865,000	1,520,000	136,000		11,521,000	4.37
Vinton	1,298,000	3,000	46,000		1,347,000	4.18
Wayne	246,000	44,000	10,000		300,000	5.21
	159,662,000	10,024,000	2,548,000	2,000	172,236,000	3.80
Small mines	2,556,000	289,000			2,845,000	4.73
	162,218,000	10,313,000	2,548,000	2,000	175,081,000	
Average value per ton	3.84	3.69	3.08	2.61	3.82	3.82

Value of coal produced in Ohio in 1919–1921—Continued.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1921.[a]						
Athens	$9,747,000	$84,000	$207,000		$10,038,000	$2.62
Belmont	28,845,000	723,000	277,000		29,845,000	2.57
Carroll	611,000	88,000	18,000		717,000	2.70
Columbiana	1,608,000	208,000	50,000		1,866,000	3.09
Coshocton	403,000	156,000	3,000		562,000	2.71
Gallia, Morgan, and Washington	527,000	7,600	6,100		540,700	2.63
Guernsey	7,737,000	142,000	264,000		8,143,000	2.73
Harrison	4,103,000	46,000	70,000		4,219,000	2.58
Hocking	2,323,000	102,000	29,000		2,454,000	2.82
Holmes		14,000			14,000	3.09
Jackson	357,000	122,000	24,000		503,000	2.82
Jefferson	11,095,000	692,000	147,000	$400	11,934,400	2.74
Lawrence	37,000	83,000	2,000		122,000	2.12
Mahoning	2,000	105,000	300		107,300	2.97
Medina		16,000	100		16,100	5.06
Meigs	2,416,000	49,000	70,000		2,535,000	2.72
Muskingum	313,000	157,000	8,000		478,000	2.58
Noble	1,344,000	16,000	48,000		1,408,000	2.61
Perry	3,743,000	119,000	66,000		3,928,000	2.48
Portage, Summit, and Wayne	251,000	102,000	41,000		394,000	4.02
Stark	304,000	580,000	101,000		985,000	3.37
Tuscarawas	2,836,000	691,000	77,000		3,604,000	2.65
Vinton	262,000	1,000	10,000		273,000	2.50
	78,864,000	4,303,600	1,518,500	400	84,686,500	
Average value per ton	2.65	2.76	2.56	2.14	2.65	2.65

[a] Exclusive of product of wagon mines.

Coal produced in Ohio, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Athens	6,156,228	6,629,564	4,840,913	6,501,013	3,836,590	−2,664,423
Belmont	11,166,504	11,852,508	10,101,682	11,192,785	11,601,150	+408,365
Carroll	432,827	451,024	344,626	502,346	265,623	−236,723
Columbiana	566,317	673,271	634,411	857,192	604,728	−252,464
Coshocton	301,152	351,872	284,790	443,170	207,166	−236,004
Gallia	[a] 339,498	[a] 395,444	7,688	12,274	[a] 205,641	−[a] 92,929
Guernsey	3,949,852	4,298,812	3,334,973	3,733,810	2,982,155	−751,655
Harrison	1,216,253	2,070,414	1,427,972	2,002,585	1,635,430	−367,155
Hocking	1,954,081	2,083,928	1,575,622	2,198,998	869,870	−1,329,128
Holmes	14,636	3,400	8,594	9,780	4,535	−5,245
Jackson	863,842	836,710	492,110	834,856	178,603	−656,253
Jefferson	5,597,720	6,689,936	5,030,419	6,243,200	4,353,870	−1,889,330
Lawrence	215,754	273,147	141,414	301,284	57,569	−243,715
Mahoning	42,028	34,451	50,681	62,001	36,123	−25,878
Medina	10,088	7,353	4,899	6,651	3,184	−3,467
Meigs	1,171,836	1,299,044	897,573	1,509,837	932,035	−577,802
Morgan	([a])	([a])	[b] 212,351	[b] 286,296	([a])	([a])
Muskingum	476,812	573,836	431,235	653,056	185,475	−467,581
Noble	912,896	986,189	809,198	668,089	538,971	−129,118
Perry	2,376,084	3,116,432	2,519,050	3,651,343	1,584,017	−2,067,326
Portage	[c] 117,830	140,303	75,495	[c] 140,874	[c] 98,061	[c] −100,323
Stark	373,222	533,591	387,074	449,852	291,890	−157,962
Summit	([c])	81,178	31,076	([c])	([c])	([c])
Tuscarawas	1,747,797	1,939,928	1,817,096	2,634,927	1,360,779	−1,274,148
Vinton	196,329	239,123	187,509	322,462	109,311	−213,151
Wayne	124,098	25,683	41,443	57,510	([c])	([c])
Small mines	425,050	225,802	186,788	602,000		−602,000
	40,748,734	45,812,943	35,876,682	45,878,191	31,942,776	−13,935,415
Total value	$100,897,148	$118,095,518	$79,496,301	$175,081,000	$84,686,500	−$90,394,500

[a] Gallia County includes Morgan and Scioto in 1917; Morgan in 1918; and Morgan and Washington in 1921.
[b] Morgan includes Scioto and Washington in 1919; and Washington in 1920.
[c] Portage includes Summit in 1917 and 1920; and Summit and Wayne in 1921.

OKLAHOMA.

The production of coal in Oklahoma in 1919 decreased 1,011,334 tons, or 21 per cent, as compared with that in 1918. The total value of the output decreased $2,963,983, or 16.9 per cent, but the average value per ton increased 19 cents. The output for the year was 3,802,113 tons, valued at $14,544,901. The mines made an average working time of only 184 days. There was practically no change in the total number of men employed, but there was a slight increase in the surface and a decrease in the underground employees, accompanied by a decrease of 0.05 ton in the average daily output per worker. Strikes and lockouts involved 7,963 men and cost 317,538 man-days, an average of 40 days per man out.

In 1920, on the other hand, the output rose to 4,849,288 tons, valued at $23,294,000, exceeding that in 1918 in both tonnage and value. As compared with 1919, there was an increase of 1,047,175 tons, or 27.5 per cent, in quantity and of $8,749,099, or 60.2 per cent, in value. The increase in output in Okmulgee County over the preceding year was 512,180 tons, or about 49 per cent of the total gain, although all counties shared in the increase. The heavier output was made possible by an increase of 33 days in the average number worked during the year and a gain of 0.25 ton in the average daily output per worker. There was a decrease both in the total number of employees and in the number working above ground. The losses by strikes also were sharply reduced; they averaged 11 days for 2,267 men, a total of 24,053 man-days.

In 1921 the production was 3,362,623 tons, valued at $15,546,000, which represented a reduction of 1,486,665 tons, or 30.7 per cent, in quantity and of $7,748,000, or 33.3 per cent, in value. Tulsa County was the only one that showed an increase over the preceding year—33,578 tons. The decrease was greatest in Coal, Latimer, and Okmulgee counties, where it amounted to 1,232,946 tons. The number of employees increased 610, and the average number of days in which the mines worked during the year was reduced to 141. The average output per day per man, however, remained unchanged. The losses by strikes, measured in man-days, were little more than half those for the preceding year; 1,520 men were idle for an average of 8 days per man, or 12,231 man-days.

Coal produced in Oklahoma in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.										
Coal	315,490	83,966	27,850	....	427,306	895		118	1,013	194
Craig	....	12,707	....	....	12,707	22		6	28	212
Latimer	646,133	3,219	47,825	....	697,177	1,123		288	1,411	184
Le Flore	245,905	2,761	17,022	8,909	274,597	598		151	749	162
Okmulgee	946,161	1,746	17,590	....	965,497	1,708		230	1,938	150
Pittsburg	1,099,035	8,881	62,145	....	1,170,061	2,320		334	2,654	216
Tulsa	69,206	3,261	....	....	72,467	113		59	172	227
Other counties [b]	140,364	3,997	6,563	26,603	177,527	217		266	483	145
Small mines	....	4,774	....	....	4,774	....		......	......	......
	3,462,294	125,312	178,995	35,512	3,802,113	6,996		1,452	8,448	184
1920.										
Atoka and Haskell	91,470	800	3,800	....	96,070	20	12	52	84	186
Coal	425,404	7,949	28,041	....	461,394	547	324	127	998	223
Craig	....	12,700	....	....	12,700	15	7	5	27	230
Latimer	745,022	4,701	50,719	....	800,442	669	406	216	1,291	230
Le Flore	394,839	3,674	13,299	....	411,812	359	226	112	697	215
Muskogee, Rogers, and Wagoner	31,853	3,470	....	....	35,323	3	1	49	53	207
Okmulgee	1,452,835	1,583	23,259	....	1,477,677	1,404	676	284	2,364	223
Pittsburg	1,318,536	11,303	74,331	....	1,404,170	1,282	781	397	2,460	208
Tulsa	122,478	7,722	500	....	130,700	116	30	124	270	178
	4,582,437	53,902	193,949	....	4,830,288	4,415	2,463	1,366	8,244	217
Small mines	18,000	1,000	....	....	19,000	....	......	......	......	......
	4,600,437	54,902	193,949	....	4,849,288	....	......	......	......	......
1921.[c]										
Atoka and Haskell	79,710	800	3,400	....	83,910	20	12	48	80	140
Coal	173,384	4,558	9,509	....	187,451	526	272	110	908	91
Craig, Muskogee, Rogers, and Wagoner	25,403	2,100	....	....	27,503	3	......	55	58	191
Latimer	319,401	1,871	23,387	....	344,659	573	360	164	1,097	115
Le Flore	283,276	2,774	10,764	....	296,814	404	173	101	678	165
Okmulgee	958,393	1,621	14,443	....	974,457	1,573	594	429	2,596	119
Pittsburg	1,209,240	9,431	64,880	....	1,283,551	1,750	983	398	3,131	176
Tulsa	159,574	2,404	2,300	....	164,278	151	31	124	306	135
	3,208,381	25,559	128,683	....	3,362,623	5,000	2,425	1,429	8,854	141

[a] Includes also loaders and shot firers.
[b] Atoka, Haskell, Muskogee, Rogers, and Wagoner.
[c] Exclusive of product of wagon mines.

Value of coal produced in Oklahoma in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Coal	$1,195,332	$317,418	$93,576		$1,606,326	$3.76
Craig		43,349			43,349	3.41
Latimer	2,533,366	15,391	169,054		2,717,811	3.90
Le Flore	870,302	8,876	54,025	$31,181	964,384	3.51
Okmulgee	3,434,785	7,390	61,444		3,503,619	3.63
Pittsburg	4,580,825	44,206	219,295		4,844,326	4.14
Tulsa	262,598	15,857			278,455	3.84
Other counties [a]	463,560	16,534	18,226	67,332	565,652	3.19
Small mines		20,979			20,979	4.39
	13,340,768	490,000	615,620	98,513	14,544,901	
Average value per ton	3.85	3.90	3.44	2.77	3.83	3.83
1920.						
Atoka and Haskell	435,000	4,000	14,000		453,000	4.72
Coal	2,067,000	40,000	112,000		2,219,000	4.81
Craig		60,000			60,000	4.72
Latimer	3,704,000	26,000	232,000		3,962,000	4.95
Le Flore	1,693,000	18,000	49,000		1,760,000	4.27
Muskogee, Rogers, and Wagoner	161,000	18,000			179,000	5.07
Okmulgee	6,522,000	8,000	87,000		6,617,000	4.48
Pittsburg	6,927,000	60,000	319,000		7,306,000	5.20
Tulsa	607,000	38,000	3,000		648,000	4.96
	22,116,000	272,000	816,000		23,204,000	4.80
Small mines	87,000	3,000			90,000	4.76
	22,203,000	275,000	816,000		23,294,000	
Average value per ton	4.83	5.01	4.21		4.80	4.80
1921.[b]						
Atoka and Haskell	390,000	2,000	8,000		400,000	4.77
Coal	849,000	23,000	40,000		912,000	4.87
Craig, Muskogee, Rogers, and Wagoner	111,300	7,700			119,000	4.33
Latimer	1,505,000	12,000	94,000		1,611,000	4.67
Le Flore	1,271,000	11,000	44,000		1,326,000	4.47
Okmulgee	3,873,000	9,000	57,000		3,939,000	4.04
Pittsburg	6,234,000	53,000	245,000		6,532,000	5.09
Tulsa	686,000	11,000	10,000		707,000	4.30
	14,919,300	128,700	498,000		15,546,000	
Average value per ton	4.65	5.04	3.87		4.62	4.62

[a] Atoka, Haskell, Muskogee, Rogers, and Wagoner.
[b] Exclusive of product of wagon mines.

Coal produced in Oklahoma in 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Atoka and Haskell	230,174	246,049	129,445	96,070	83,910	−12,160
Coal	581,770	542,254	427,306	461,394	187,451	−273,943
Craig	(a)		12,707	12,700	(b)	(b)
Latimer	841,262	919,487	697,177	800,442	344,659	−455,783
Le Flore	285,239	331,374	274,597	411,812	296,814	−114,998
Muskogee, Rogers, and Wagoner	[b] 35,930	[b] 121,636	48,082	35,323	[b] 27,503	−20,520
Okmulgee	1,051,748	1,282,139	965,497	1,477,677	974,457	−503,220
Pittsburg	1,279,063	1,364,207	1,170,061	1,404,170	1,283,551	−120,619
Tulsa	73,137	(b)	72,467	130,700	164,278	+33,578
Small mines	[a] 8,521	6,301	4,774	19,000		−19,000
	4,386,844	4,813,447	3,802,113	4,849,288	3,362,623	−1,486,665
Total value	$12,335,413	$17,508,884	$14,544,901	$23,294,000	$15,546,000	−$7,748,000

[a] Small mines include Craig County.
[b] No production in Muskogee County in 1917 or 1918; includes Tulsa County in 1918 and Craig County in 1921.

OREGON.

The production of coal in Oregon, which had been decreasing steadily until 1918, showed an upward trend in both 1919 and 1920. The tonnage in 1921 is included with that of California. The Coos Bay field is the only notable producing district in the State.

Coal produced in Oregon in 1917–1920.

Year.	Quantity (net tons).				Value.		Number of employees.	Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Total.	Average per ton.		
1917	13,736	9,087	5,504	28,327	$95,663	$3.38	104	251
1918	4,112	3,946	5,270	13,328	37,454	2.81	40	292
1919	10,917	3,103	4,719	18,739	63,794	3.40	67	259
1920	12,980	1,609	6,128	20,717	93,000	4.47	85	307

PENNSYLVANIA.

ANTHRACITE.

PRODUCTION.

The production of anthracite in Pennsylvania in 1919 was 78,653,751 gross tons, valued at $364,926,950, a decrease, as compared with 1918, of 9,583,824 gross tons, or 10.9 per cent, in quantity, but an increase of $28,446,603, or 8.5 per cent, in value. In 1920 the output was 79,998,437 gross tons, valued at $434,252,198, an increase over that of the preceding year of 1,344,686 gross tons, or 1.7 per cent, in quantity, and of $69,325,248, or 19 per cent, in value. The output of anthracite in 1921, unlike that of bituminous coal, also made a modest gain. The total was 80,779,867 gross tons, valued at $452,304,903, an increase over that in 1920 of 781,430 gross tons, or 1 per cent, in quantity, and of $18,052,705, or 4.2 per cent, in value.

At no time, however, in the three years under review has the total output approached the record made in 1917 and 1918, when 88,939,117 gross tons and 88,237,575 gross tons, respectively, were produced. Nor is it likely that the output in any two years in the near future will even approach that of 1917 and 1918, for in those years the mines were working under the stimulus and strain of the wartime demand, and in the territory where the consumption of anthracite for domestic use is greatest there was an enormous increase in industrial activity and in population. Besides, the wages in factories engaged in making war material were high, so that many who had not before used anthracite as a domestic fuel then began to use it. Then, too, there was a larger market for the smaller or steam sizes. Shipments of sizes smaller than pea during 1917 and 1918 were respectively 3,300,000 and 4,000,000 gross tons more than in any year before or since. Even in 1920, when industrial and export demand was draining the eastern bituminous fields of every car of soft coal that could be produced and shipped, the total shipments of No. 1 buckwheat and smaller sizes of anthracite were only 20,168,519 gross tons, as compared with 24,254,873 gross tons in 1918. The shipments of steam sizes in 1918 included 5,286,293 gross tons of reclaimed coal mined in previous years; the shipments in 1920 included only 3,787,056 gross tons of other than freshly mined coal.

What prevents a marked increase in the production of anthracite, aside from the limitation involved in the physical operation of the mines, is the limitation of the producers' ability to market the smaller sizes of coal. Thus, in 1921, although the total shipments of hard coal were 7,935,480 gross tons less than in the high-record year of 1917, the total shipments of sizes above pea were only 1,144,696 gross tons less and the shipments of pea were only 958,624 gross tons less. In other words, out of a total decrease in shipments of nearly 8,000,000 gross tons, the shipments of sizes below pea decreased 5,832,160 gross tons, and this amount was 74 per cent of the entire decrease. Furthermore, 1919 and 1921 were the low years for total shipments of steam sizes. (See table on p. 623.) Except as the means of using anthracite of the smaller sizes may be improved, as the means of using pea coal have been improved, these sizes must be sold in competition with bituminous coal, not only in quotations f. o. b. mines but in quotations that include the freight rates on the coal delivered. The territory in which these sizes may be distributed for industrial consumption is therefore limited.

In mining and preparing anthracite for domestic use a certain proportion of coal of the smaller sizes must necessarily be produced. Coal of these smaller sizes once went to the culm bank, but such an economic waste would not be countenanced to-day. Nor can the producers carry the smaller sizes in storage indefinitely; the cost of producing the steam sizes is the same as that of producing the larger sizes, and indefinite storage would be too expensive. The ability to market steam sizes affects indirectly the production of the domestic sizes. The smaller sizes are sold not only in direct competition with bituminous coal and other forms of industrial fuel but at prices considerably less than the average price of all coal produced. In order to obtain the necessary average return, therefore, the burden of the lower prices for small sizes becomes a surcharge on the prices fixed for domestic coal. Naturally there are limits to the amounts that may be so surcharged, but the principle of this surcharge was clearly recognized by the United States Fuel Administration in its wage award that became effective November 1, 1918, by which the operators were permitted to charge the entire increase to the domestic sizes, which were advanced $1.05 per gross ton, although the engineering staff of the Fuel Administration estimated that the actual increase in the cost of production per ton for all sizes because of the wage award was only 74 cents. The producers have endeavored to counteract, in part at least, this indirect influence on price by creating a domestic market for No. 1 buckwheat, the next size smaller than pea. In recent years pea has in large part become a domestic rather than a steam fuel.

Anthracite produced in 1890–1921.

Year.	Gross tons.	Value.	Year.	Gross tons.	Value.
1890	41,489,858	[a] $66,383,772	1914	81,090,631	$188,181,399
1895	51,785,122	[a] 82,019,272	1915	79,459,876	184,653,498
1900	51,221,253	[a] 85,757,851	1916	78,195,083	202,009,561
1905	69,339,152	[a] 141,879,000	1917	88,939,117	283,650,723
1910	75,433,246	160,275,302	1918	88,237,575	336,480,347
1911	80,771,488	175,189,392	1919	78,653,751	364,926,950
1912	75,322,855	177,622,626	1920	79,998,437	434,252,198
1913	81,718,680	195,181,127	1921	80,779,867	452,304,903

[a] Excludes value of coal used at collieries.

During the last decade there has been little change in the relative percentages of anthracite shipped from the three principal producing regions. The Wyoming region, from which 55 to 59 per cent of the total output is shipped, is still far in the lead; the Schuylkill region comes second and the Lehigh region third. All regions, including that in Sullivan County, showed a decrease in 1919 as compared with 1918. The greatest decline was in the Wyoming region, where the total output decreased 5,283,038 gross tons. In 1920 the output in the Schuylkill region increased 1,710,833 gross tons over that in 1919, but the output in the Lehigh region decreased 294,255 tons and that in the Wyoming region 118,826 tons. The output in Sullivan County increased 46,934 gross tons. In 1921 the Wyoming region again made an increase in output of 2,398,064 gross tons over that in 1920. This district reported losses in washery recovery, but this loss was more than offset by the gain of 4,411,448 gross tons in freshly mined coal. In 1921 as compared with 1920 the output in the Lehigh region decreased 732,441 gross tons; in the Schuylkill region, 703,194 tons; and in Sullivan County 180,999 tons. The production of freshly mined coal in the anthracite field in 1921 (78,506,691 gross tons) was the largest since 1917 (82,558,949 gross tons).

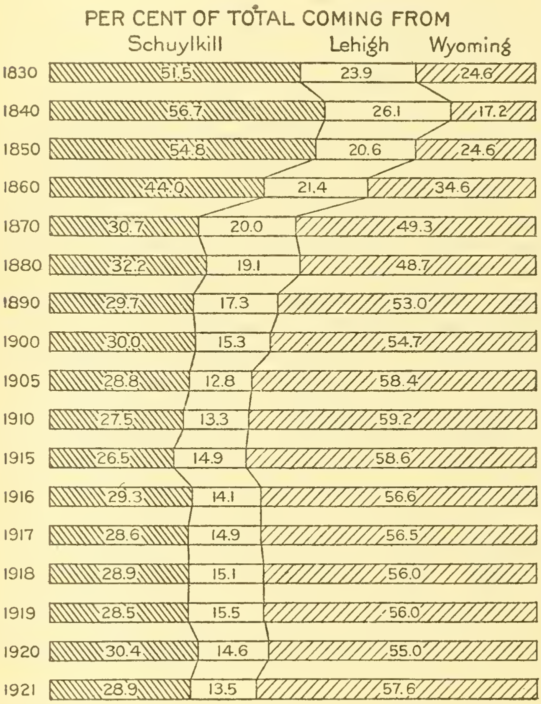


FIGURE 48.—Shipments of anthracite by regions, 1830-1921.

The quantity of coal recovered from the rivers in the anthracite region by dredging has increased during recent years. The reports received by the Geological Survey indicate a dredge output of 152,386 gross tons in 1917, 252,616 tons in 1918, 618,833 tons in 1919, 661,119 tons in 1920, and 556,544 tons in 1921. The statistics for years prior to 1919 may not have been complete, because many of the dredge operations are small and the operators can not be easily reached by correspondence. The statistics for 1919 were collected by field agents of the Census Bureau, who presumably visited every active operation, and this change in the method of obtaining the reports explains in part the sharp increase in the dredge output in 1919 over that of 1918.

In no one of the three years here considered did the washery product equal that in 1918—7,482,576 gross tons. Most of the product of the washeries and dredges is used for making steam.

The percentage of the total output used at the mines and breakers for making steam and heat has shown little change. In 1919 the quantity so used was 8,573,580 tons, or 10.9 per cent of the total; in 1920 it was 8,801,511 tons, or 11 per cent; and in 1921 it was 8,714,098 tons, or 10.8 per cent.

Anthracite produced in 1919–1921, by regions.

Region.	Shipments.		Local sales.		Mine fuel.		Total production.	
	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.
1919.								
Lehigh:								
Freshly mined coal	9,667,200	$48,227,896	403,574	$1,362,356	1,147,473	$2,048,182	11,218,247	$51,638,434
Washery product	717,686	2,475,112	2,701	5,057	48,163	101,463	768,550	2,581,632
Dredge product	67,207	142,190	....	....	300	675	67,507	142,865
	10,452,093	50,845,198	406,275	1,367,413	1,195,936	2,150,320	12,054,304	54,362,931
Schuylkill:								
Freshly mined coal	17,897,847	91,308,502	368,840	1,821,962	3,074,679	2,439,193	21,341,366	95,569,657
Washery product	1,102,079	3,415,725	86	387	200,749	330,608	1,302,914	3,746,720
Dredge product	248,354	282,125	279,274	398,809	6,280	10,644	533,908	691,578
	19,248,280	95,006,352	648,200	2,221,158	3,281,708	2,780,445	23,178,188	100,007,955
Wyoming:								
Freshly mined coal	36,694,081	193,871,715	1,031,398	4,724,884	3,443,843	5,413,284	41,169,322	204,009,883
Washery product	1,197,138	3,735,161	4,451	16,868	599,911	873,374	1,801,500	4,625,403
Dredge product	8,128	16,418	8,742	16,787	548	1,098	17,418	34,303
	37,899,347	197,623,294	1,044,591	4,758,539	4,044,302	6,287,756	42,988,240	208,669,589
Sullivan County:								
Freshly mined coal	372,575	1,726,838	8,810	41,436	51,634	118,201	433,019	1,886,475
Total freshly mined coal	64,631,703	335,134,951	1,812,622	7,950,638	7,717,629	10,018,860	74,161,954	353,104,449
Total washery product	3,016,903	9,625,998	7,238	22,312	848,823	1,305,445	3,872,964	10,953,755
Total dredge product	323,689	440,733	288,016	415,596	7,128	12,417	618,833	868,746
Grand total	67,972,295	345,201,682	2,107,876	8,388,546	8,573,580	11,336,722	78,653,751	364,926,950
1920.								
Lehigh:								
Freshly mined coal	9,177,704	55,316,537	580,169	1,958,945	1,185,446	2,298,261	10,943,319	59,573,743
Washery product	722,414	2,993,502	40,430	80,869	14,722	34,331	777,566	3,108,702
Dredge product	39,123	86,153	....	....	41	164	39,164	86,317
	9,939,241	58,396,192	620,599	2,039,814	1,200,209	2,332,756	11,760,049	62,768,762
Schuylkill:								
Freshly mined coal	18,628,633	111,309,896	451,326	2,627,580	3,246,184	2,792,189	22,326,143	116,729,665
Washery product	1,759,280	6,490,011	28	121	193,543	284,383	1,952,851	6,774,515
Dredge product	345,515	437,611	258,300	309,903	6,212	8,124	610,027	755,638
	20,733,428	118,237,518	709,654	2,937,604	3,445,939	3,084,696	24,889,021	124,259,818

Anthracite produced in 1919–1921, by regions—Continued.

Region.	Shipments.		Local sales.		Mine fuel.		Total production.	
	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.	Gross tons.	Value.
1920.								
Wyoming:								
Freshly mined coal	35,371,288	$222,628,776	1,234,803	$6,401,709	3,312,547	$5,539,060	39,918,638	$234,569,545
Washery product	2,133,820	8,200,962	11,018	42,979	794,010	1,861,713	2,938,848	10,105,654
Dredge product	11,928	20,341					11,928	20,341
	37,517,036	230,850,079	1,245,821	6,444,688	4,106,557	7,400,773	42,869,414	244,695,540
Sullivan County:								
Freshly mined coal	421,058	2,356,826	10,089	57,590	48,806	113,662	479,953	2,528,078
Total freshly mined coal	63,598,683	391,612,035	2,276,387	11,045,824	7,792,983	10,743,172	73,668,053	413,401,031
Total washery product	4,615,514	17,684,475	51,476	123,969	1,002,275	2,180,427	5,669,265	19,988,871
Total dredge product	396,566	544,105	258,300	309,903	6,253	8,288	661,119	862,296
Grand total	68,610,763	409,840,615	2,586,163	11,479,696	8,801,511	12,931,887	79,998,437	434,252,198
1921.								
Lehigh:								
Freshly mined coal	9,092,702	56,344,295	537,329	1,905,323	1,117,214	1,774,374	10,747,245	60,023,992
Washery product	242,944	1,016,075	14,272	25,608	1,398	5,065	258,614	1,046,748
Dredge product	21,599	27,336			150	300	21,749	27,636
	9,357,245	57,387,706	551,601	1,930,931	1,118,762	1,779,739	11,027,608	61,098,376
Schuylkill:								
Freshly mined coal	19,382,865	119,259,110	435,606	2,659,909	3,311,935	2,100,261	23,130,406	124,019,280
Washery product	449,390	1,515,108			88,843	122,682	538,233	1,637,790
Dredge product	225,913	220,010	286,725	363,692	4,550	4,631	517,188	588,333
	20,058,168	120,994,228	722,331	3,023,601	3,405,328	2,227,574	24,185,827	126,245,403
Wyoming:								
Freshly mined coal	39,268,163	248,866,892	1,227,457	6,920,174	3,834,466	4,859,113	44,330,086	260,646,179
Washery product	616,102	2,232,474	241	506	303,442	394,783	919,785	2,627,763
Dredge product	17,199	33,115	308	1,520	100	50	17,607	34,685
	39,901,464	251,132,481	1,228,006	6,922,200	4,138,008	5,253,946	45,267,478	263,308,627
Sullivan County:								
Freshly mined coal	237,686	1,475,463	9,268	57,474	52,000	119,560	298,954	1,652,497
Total freshly mined coal	67,981,416	425,945,760	2,209,660	11,542,880	8,315,615	8,853,308	78,506,691	446,341,948
Total washery product	1,308,436	4,763,657	14,513	26,114	393,683	522,530	1,716,632	5,312,301
Total dredge product	264,711	280,461	287,033	365,212	4,800	4,981	556,544	650,654
Grand total	69,554,563	430,989,878	2,511,206	11,934,206	8,714,098	9,380,819	80,779,867	452,304,903

SHIPMENTS.

Anthracite shipped from the Schuylkill, Lehigh, and Wyoming regions in 1807 and from 1820 to 1921.

Year.	Schuylkill region.		Lehigh region.		Wyoming region.		Total (gross tons).
	Gross tons.	Percentage.	Gross tons.	Percentage.	Gross tons.	Percentage.	
1807					55		55
1820			365				365
1821			1,073				1,073
1822	1,480	39.8	2,240	60.2			3,720
1823	1,128	16.2	5,823	83.8			6,951
1824	1,567	14.1	9,541	85.9			11,108
1825	6,500	18.6	28,393	81.4			34,893
1826	16,767	34.9	31,280	65.1			48,047
1827	31,360	49.4	32,074	50.6			63,434
1828	47,284	61.0	30,232	39.0			77,516
1829	79,973	71.4	25,110	22.4	7,000	6.2	112,083
1830	89,984	51.5	41,750	23.9	43,000	24.6	174,734
1831	81,854	46.3	40,966	23.2	54,000	30.5	176,820
1832	209,271	57.6	70,000	19.3	84,000	23.1	363,271
1833	252,971	51.9	123,001	25.2	111,777	22.9	487,749
1834	226,692	60.2	106,244	28.2	43,700	11.6	376,636
1835	339,508	60.5	131,250	23.4	90,000	16.1	560,758
1836	432,045	63.1	148,211	21.7	103,861	15.2	684,117
1837	530,152	61.0	223,902	25.7	115,387	13.3	869,441
1838	446,875	60.5	213,615	28.9	78,207	10.6	738,697
1839	475,077	58.1	221,025	27.0	122,300	14.9	818,402
1840	490,596	56.7	225,313	26.1	148,470	17.2	864,379
1841	624,466	65.1	143,037	14.9	192,270	20.0	959,773
1842	583,273	52.6	272,540	24.6	252,599	22.8	1,108,412
1843	710,200	56.2	267,793	21.2	285,605	22.6	1,263,598
1844	887,937	54.5	377,002	23.1	365,911	22.4	1,630,850
1845	1,131,724	56.2	429,453	21.3	451,836	22.5	2,013,013
1846	1,308,500	55.8	517,116	22.1	518,389	22.1	2,344,005
1847	1,665,735	57.8	633,507	22.0	583,067	20.2	2,882,309
1848	1,733,721	56.1	670,321	21.7	685,196	22.2	3,089,238
1849	1,728,500	53.3	781,556	24.1	732,910	22.6	3,242,966
1850	1,840,620	54.8	690,456	20.6	827,823	24.6	3,358,899
1851	2,328,525	52.3	964,224	21.7	1,156,167	26.0	4,448,916
1852	2,636,835	52.8	1,072,136	21.5	1,284,500	25.7	4,993,471
1853	2,665,110	51.3	1,054,309	20.3	1,475,732	28.4	5,195,151
1854	3,191,670	53.2	1,207,186	20.1	1,603,478	26.7	6,002,334
1855	3,552,943	53.8	1,284,113	19.4	1,771,511	26.8	6,608,567
1856	3,603,029	52.0	1,351,970	19.5	1,972,581	28.5	6,927,580
1857	3,373,797	50.8	1,318,541	19.8	1,952,603	29.4	6,644,941
1858	3,273,245	47.9	1,380,030	20.2	2,186,094	31.9	6,839,369
1859	3,448,708	44.1	1,628,311	20.9	2,731,236	35.0	7,808,255
1860	3,749,632	44.0	1,821,674	21.4	2,941,817	34.6	8,513,123
1861	3,160,747	39.7	1,738,377	21.9	3,055,140	38.4	7,954,264
1862	3,372,583	42.8	1,351,054	17.2	3,145,770	40.0	7,869,407
1863	3,911,683	40.9	1,894,713	19.8	3,759,610	39.3	9,566,006
1864	4,161,970	40.9	2,054,669	20.2	3,960,836	38.9	10,177,47
1865	4,356,959	45.2	2,040,913	21.1	3,254,519	33.7	9,652,391
1866	5,787,902	45.6	2,179,364	17.1	4,736,616	37.3	12,703,882
1867	5,161,671	39.7	2,502,054	19.3	5,325,000	41.0	12,988,725
1868	5,330,737	38.6	2,502,582	18.1	5,968,146	43.3	13,801,465
1869	5,775,138	41.7	1,949,673	14.0	6,141,369	44.3	13,866,180
1870	4,968,157	30.7	3,239,374	20.0	7,974,660	49.3	16,182,191
1871	6,552,772	41.8	2,235,707	14.2	6,911,242	44.0	15,699,721
1872	6,694,890	34.1	3,873,339	19.7	9,101,549	46.2	19,669,778
1873	7,212,601	34.0	3,705,596	17.4	10,309,755	48.6	21,227,952
1874	6,866,877	34.1	3,773,836	18.7	9,504,408	47.2	20,145,121
1875	6,281,712	31.9	2,834,605	14.4	10,596,155	53.7	19,712,472
1876	6,221,934	33.6	3,854,919	20.9	8,424,158	45.5	18,501,011
1877	8,195,042	39.3	4,332,760	20.8	8,300,377	39.9	20,828,179
1878	6,282,226	35.7	3,237,449	18.4	8,085,587	45.9	17,605,262
1879	8,960,829	34.3	4,595,567	17.6	12,586,293	48.1	26,142,689
1880	7,554,742	32.3	4,463,221	19.0	11,419,279	48.7	23,437,242

Anthracite shipped from the Schuylkill, Lehigh, and Wyoming regions in 1807 and from 1820 to 1921—Continued.

Year	Schuylkill region.		Lehigh region.		Wyoming region.		Total (gross tons).
	Gross tons.	Percentage.	Gross tons.	Percentage.	Gross tons.	Percentage.	
1881	9,253,958	32.4	5,294,676	18.6	13,951,383	49.0	28,500,017
1882	9,459,288	32.5	5,689,437	19.5	13,971,371	48.0	29,120,096
1883	10,074,726	31.7	6,113,809	19.2	15,604,492	49.1	31,793,027
1884	9,478,314	30.9	5,562,226	18.1	15,677,753	51.0	30,718,293
1885	9,488,426	30.0	5,898,634	18.7	16,236,470	51.3	31,623,530
1886	9,381,407	29.2	5,723,129	17.8	17,031,826	53.0	32,136,362
1887	10,609,028	30.6	4,347,061	12.6	19,684,929	56.8	34,641,018
1888	10,654,116	27.9	5,639,236	14.8	21,852,366	57.3	38,145,718
1889	10,486,185	29.3	6,294,073	17.6	19,036,835	53.1	35,817,093
1890	10,867,822	29.7	6,329,658	17.3	19,417,979	53.0	36,615,459
1891	12,741,258	31.5	6,381,838	15.8	21,325,240	52.7	40,448,336
1892	12,626,784	30.1	6,451,076	15.4	22,815,480	54.5	41,893,340
1893	12,357,444	28.7	6,892,352	16.0	23,839,741	55.3	43,089,537
1894	12,035,005	29.1	6,705,434	16.2	22,650,761	54.7	41,391,200
1895	14,269,932	30.7	7,298,124	15.7	24,943,421	53.6	46,511,477
1896	13,097,571	30.4	6,490,441	15.0	23,589,473	54.6	43,177,485
1897	12,181,061	29.3	6,249,540	15.0	23,207,263	55.7	41,637,864
1898	12,078,875	28.8	6,253,109	14.9	23,567,767	56.3	41,899,751
1899	14,199,009	29.8	6,887,909	14.4	26,578,286	55.8	47,665,204
1900	13,502,732	30.0	6,918,627	15.3	24,686,125	54.7	45,107,484
1901	16,019,591	29.7	7,211,974	13.5	30,337,036	56.6	53,568,601
1902	8,471,391	27.2	3,470,736	11.1	19,258,763	61.7	31,200,890
1903	16,474,790	27.7	7,164,783	12.1	35,723,258	60.2	59,362,831
1904	16,379,293	28.5	7,107,220	12.4	34,006,009	59.1	57,492,522
1905	17,703,099	28.8	7,849,205	12.8	35,857,897	58.4	61,410,201
1906	16,011,285	28.8	7,046,617	12.6	32,640,693	58.6	55,698,595
1907	20,141,288	30.0	8,329,653	12.4	38,638,452	57.6	67,109,393
1908	18,006,464	27.9	7,786,255	12.0	38,872,295	60.1	64,665,014
1909	16,864,147	27.2	7,532,271	12.2	37,573,467	60.6	61,969,885
1910	17,845,020	27.5	8,627,539	13.3	38,433,227	59.2	64,905,786
1911	19,118,300	27.4	9,682,147	13.9	41,033,354	58.7	69,833,801
1912	18,213,960	28.2	8,800,125	13.6	37,653 164	58.2	64,667,249
1913	19,417,385	27.4	10,180,021	14.4	41,160,906	58.2	70,758,312
1914 [a]	18,416,586	26.3	10,272,308	14.7	41,258,463	59.0	69,947,357
1915 [a]	18,043,709	26.5	10,190,421	14.9	39,945,344	58.6	68,179,474
1916 [a]	19,677,476	29.3	9,437,545	14.1	37,945,335	56.6	67,060,356
1917 [a]	22,028,055	28.6	11,456,963	14.9	43,577,769	56.5	77,062,787
1918 [a]	22,009,607	28.9	11,552,042	15.1	42,746,038	56.0	76,307,687
1919 [a]	19,248,280	28.5	10,452,093	15.5	37,899,347	56.0	67,599,720
1920 [a]	20,733,428	30.4	9,939,241	14.6	37,517,036	55.0	68,189,705
1921 [a]	20,058,168	28.9	9,357,245	13.5	39,901,464	57.6	69,316,877
	774,334,689	30.7	384,803,248	15.3	1,359,181,829	54.0	2,518,319,766

[a] 1914–1921, inclusive of dredge shipments.

Anthracite shipped in 1919–1921, by regions and sizes, in gross tons.

Size.	Lehigh region.			Schuylkill region.			Wyoming region.			Sullivan County (mines).	Total.	
	Mines.	Washeries.	Dredges.	Mines.	Washeries.	Dredges.	Mines.	Washeries.	Dredges.		Quantity.	Percentage of total.
1919.												
Lump	956			23,732			2,167				26,855	0.3
Broken	344,407	592		723,264			1,776,565	35		16,748	2,861,611	4.2
Egg	1,270,857	9,193		2,360,418	5,809		6,000,496	17,471		36,951	9,701,195	14.2
Stove	1,698,669	14,107		3,310,515	7,447		8,252,979	17,392		53,379	13,354,488	19.6
Chestnut	2,407,612	147,119		4,223,114	99,052	14	10,357,708	93,866		76,917	17,405,402	25.6
Pea	1,031,703	64,353	1,407	1,989,414	148,911	83	2,812,545	138,052	100	50,830	6,237,398	9.1
Buckwheat No. 1	1,294,670	90,807	7,391	2,961,400	302,038	2,693	3,665,200	250,390	260		8,574,852	12.5
Buckwheat No. 2 (rice)	693,394	79,721	9,644	1,271,208	239,739	33,595	2,286,900	387,568	4,967		5,006,736	7.4
Buckwheat No. 3 (barley)	593,365	243,947	48,762	935,020	268,403	128,215	1,118,809	164,089	2,765		3,503,375	5.2
Boiler	77,399	64,915		13,669	9,605	56,955	281,018	51,102			554,663	0.8
Other [a]	254,168	2,932		86,093	21,075	26,799	139,694	77,173	36	137,750	745,720	1.1
	9,667,200	717,686	67,207	17,897,847	1,102,079	248,354	36,694,081	1,197,138	8,128	372,575	67,972,295	100.0
1920.												
Lump	1,024			28,041			4,259				33,324	.1
Broken	373,471	1,844		928,341			1,972,377	6,584		18,961	3,301,578	4.8
Egg	1,242,426	10,785		2,315,683	6,181		6,294,294	34,237		37,978	9,941,584	14.5
Stove	1,623,253	20,563		3,087,585	4,592		7,514,769	71,057		58,811	12,380,630	18.0
Chestnut	2,265,043	157,492		4,304,752	195,707	17	10,052,270	266,427		85,832	17,327,540	25.2
Pea	956,644	71,822	1,813	1,900,374	212,371	26	2,098,234	163,337	169	52,798	5,457,588	8.0
Buckwheat No. 1	1,328,694	74,570	3,745	3,195,618	451,284	8,463	3,773,327	331,867	366		9,167,934	13.4
Buckwheat No. 2 (rice)	642,585	78,657	5,318	1,389,797	422,958	36,301	2,153,301	779,184	11,393		5,519,494	8.0
Buckwheat No. 3 (barley)	563,158	301,320	28,247	1,131,456	394,555	164,974	1,089,468	273,139			3,946,317	5.7
Boiler	45,014			272,549	47,394	85,475	263,902	98,029			812,363	1.2
Other [a]	136,392	5,361		74,437	24,238	50,259	155,087	109,959		166,678	722,411	1.1
	9,177,704	722,414	39,123	18,628,633	1,759,280	345,515	35,371,288	2,133,820	11,928	421,058	68,610,763	100.0
1921.												
Lump				9,703			2,627				12,330	
Broken	174,262	1,145		641,957	3,507		1,643,335	68		10,416	2,474,690	3.6
Egg	1,307,612	12,221		2,520,409	5,496		6,361,616	6,990		25,515	10,239,859	14.7
Stove	1,757,426	16,293		3,793,819	4,991		9,035,728	35,344		44,037	14,687,638	21.1
Chestnut	2,358,864	38,244		4,807,884	53,948		11,235,371	76,837		65,534	18,636,682	26.8
Pea	981,552	26,596	865	2,020,455	47,060	28	2,684,236	68,646	1,280	34,661	5,865,379	8.4
Buckwheat No. 1	1,233,111	28,518	1,165	3,347,167	103,958	40,423	4,479,479	113,228	1,960		9,349,009	13.4
Buckwheat No. 2 (rice)	598,681	29,082		1,151,726	90,587	2,915	2,508,298	134,325			4,515,614	6.5
Buckwheat No. 3 (barley)	563,106	89,537	19,569	1,043,122	130,317	40,680	1,128,820	146,368	3,199		3,164,718	4.6
Boiler	15,493	1,308		4,985	21	68,799	147,082	29,748	10,760		278,196	.4
Other [a]	102,595			41,638	9,505	73,068	41,571	4,548		57,523	330,448	.5
	9,092,702	242,944	21,599	19,382,865	449,390	225,913	39,268,163	616,102	17,199	237,686	69,554,563	100.0

[a] Includes quantity reported as culm, buckwheat No. 4, screenings, settlings, silt, mine run, dirt, and slush.

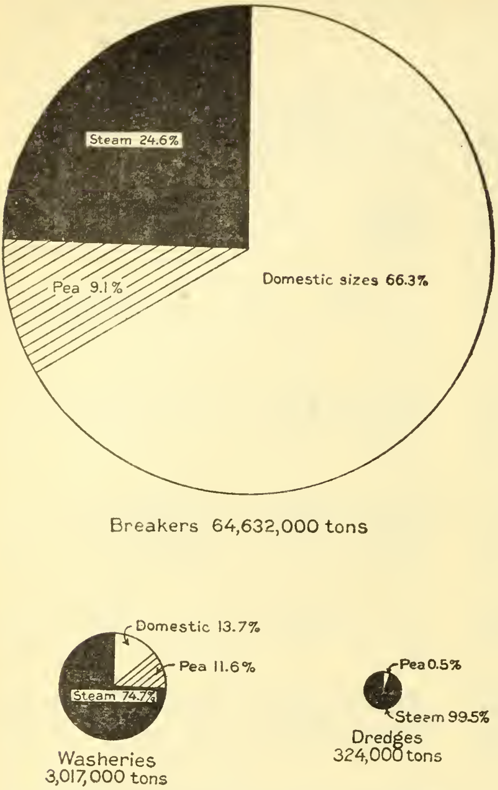


FIGURE 49.—Shipments of domestic sizes, pea, and steam sizes of anthracite by breakers, washeries, and dredges, 1919.

The percentage of sizes in the output of the breakers shows little change from year to year. Although the relation that the output of each size bears to the total output (including that of the washeries and dredges) is not absolutely constant, except for stove, the change in no year has exceeded 2 per cent. The percentage of freshly mined coal of sizes above pea has increased gradually since 1915. In that year it formed 62.2 per cent of the total shipments of freshly mined coal, in 1917 and 1918 it formed 64.7 per cent, in 1919 and 1920 it formed 66.4 per cent, and in 1921 it formed 67.4 per cent. The difference from year to year in the output of the washeries and dredges results in a greater fluctuation in the percentage of the total shipments of all coal smaller than pea, but this percentage was lower in 1921 than in any year since 1913, as shown in the table on page 623.

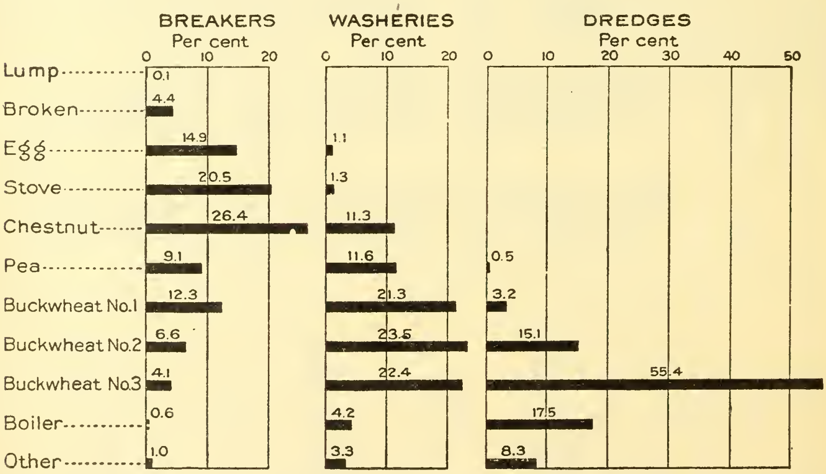


FIGURE 50.—Percentage of each size in shipments of anthracite from breakers, washeries, and dredges, 1919.

Anthracite shipped, 1913–1921, by sizes.[a]

	Sizes above pea.		Pea.		Sizes below pea.		Total (gross tons).
	Gross tons.	Percentage of total.	Gross tons.	Percentage of total.	Gross tons.	Percentage of total.	
1913:							
Freshly mined coal	43,781,936	63.3	8,056,919	11.6	17,366,691	25.1	69,205,546
Total shipments	43,935,224	61.6	8,209,479	11.5	19,198,469	26.9	71,343,172
1914:							
Freshly mined coal	43,112,545	62.8	8,142,829	11.8	17,472,101	25.4	68,727,475
Total shipments	43,176,836	61.3	8,277,619	11.7	19,009,591	27.0	70,464,046
1915:							
Freshly mined coal	41,125,513	62.2	8,011,934	12.1	17,036,370	25.7	66,173,817
Total shipments	41,213,703	60.0	8,210,668	12.0	19,242,085	28.0	68,666,456
1916:							
Freshly mined coal	40,575,269	63.1	7,223,529	11.2	16,568,956	25.7	64,367,754
Total shipments	40,747,215	60.4	7,520,804	11.1	19,233,344	28.5	67,501,363
1917:							
Freshly mined coal	46,640,319	64.7	6,298,870	8.7	19,138,145	26.6	72,077,334
Total shipments	47,195,895	60.9	6,824,003	8.8	23,470,145	30.3	77,490,043
1918:							
Freshly mined coal	45,323,253	64.7	5,798,401	8.3	18,968,580	27.0	70,090,234
Total shipments	45,994,903	60.0	6,471,381	8.4	24,254,873	31.6	76,721,157
1919:							
Freshly mined coal	42,937,454	66.4	5,884,492	9.1	15,809,757	24.5	64,631,703
Total shipments	43,349,551	63.8	6,237,398	9.2	18,385,346	27.0	67,972,295
1920:							
Freshly mined coal	42,209,170	66.4	5,008,050	7.9	16,381,463	25.7	63,598,683
Total shipments	42,984,656	62.6	5,457,588	8.0	20,168,519	29.4	68,610,763
1921:							
Freshly mined coal	45,796,115	67.4	5,720,904	8.4	16,464,397	24.2	67,981,416
Total shipments	46,051,199	66.2	5,865,379	8.4	17,637,985	25.4	69,554,563

[a] Includes shipments of dredge coal.

By excluding dredge coal, the record for which begins in 1909, and by excluding the product of the Bernice Basin, in Sullivan County, it is possible to present figures showing the relative proportions of the shipments of steam and domestic sizes for a much longer period than that given in the table.

During the last three decades shipments of the domestic sizes other than pea have declined from 76.9 per cent of the total in 1890 to between 60 and 66 per cent in recent years. Details are given in the following table:

Anthracite shipped from mines and washeries, by sizes, 1890–1921.[a]

Year.	Domestic.		Pea and steam.		Total (gross tons).
	Gross tons.	Percentage of total.	Gross tons.	Percentage of total.	
1890	28,154,000	76.9	8,461,000	23.1	36,615,000
1891	30,604,000	75.7	9,844,000	24.3	40,448,000
1892	31,868,000	76.0	10,025,000	24.0	41,893,000
1893	32,294,000	74.9	10,796,000	25.1	43,090,000
1894	30,482,000	73.7	10,909,000	26.3	41,391,000
1895	32,469,000	69.9	14,042,000	30.1	46,511,000
1896	30,355,000	70.3	12,822,000	29.7	43,177,000
1897	28,510,000	68.5	13,128,000	31.5	41,638,000
1898	28,199,000	67.3	13,701,000	32.7	41,900,000
1899	31,507,000	66.1	16,158,000	33.9	47,665,000
1900	29,162,000	64.7	15,945,000	35.3	45,107,000
1901	34,413,000	64.2	19,156,000	35.8	53,569,000
1902	19,026,000	61.0	12,175,000	39.0	31,201,000
1903	37,739,000	63.6	21,624,000	36.4	59,363,000
1904	35,637,000	62.0	21,856,000	38.0	57,493,000
1905	37,425,000	60.9	23,985,000	39.1	61,410,000
1906	32,894,000	59.1	22,805,000	40.9	55,699,000
1907	39,333,000	58.6	27,776,000	41.4	67,109,000
1908	38,319,000	59.3	26,346,000	40.7	64,665,000
1909	36,205,000	58.3	25,948,000	41.7	62,153,000
1910	38,186,000	58.6	27,008,000	41.4	65,194,000
1911	41,476,000	59.4	28,358,000	40.6	69,834,000
1912	39,298,000	60.8	25,369,000	39.2	64,667,000

[a] Exclusive of Sullivan County and dredge coal.

Anthracite shipped from mines and washeries, by sizes, 1890–1921—Continued.

Year.	Domestic.		Pea.		Steam.		Total (gross tons).
	Gross tons.	Percentage of total.	Gross tons.	Percentage of total.	Gross tons.	Percentage of total.	
1913	43,689,000	61.7	8,143,000	11.5	18,927,000	26.8	70,759,000
1914	42,952,000	61.4	8,208,000	11.7	18,770,000	26.9	69,930,000
1915	40,993,000	60.1	8,152,000	12.0	19,017,000	27.9	68,162,000
1916	40,556,000	60.5	7,468,000	11.1	19,006,000	28.4	67,030,000
1917	47,003,000	61.0	6,774,000	8.8	23,239,000	30.2	77,016,000
1918	45,795,000	60.1	6,417,000	8.4	23,972,000	31.5	76,184,000
1919	43,166,000	64.2	6,185,000	9.2	17,925,000	26.6	67,276,000
1920	42,784,000	63.1	5,402,000	8.0	19,607,000	28.9	67,793,000
1921	45,906,000	66.5	5,828,000	8.4	17,318,000	25.1	69,052,000

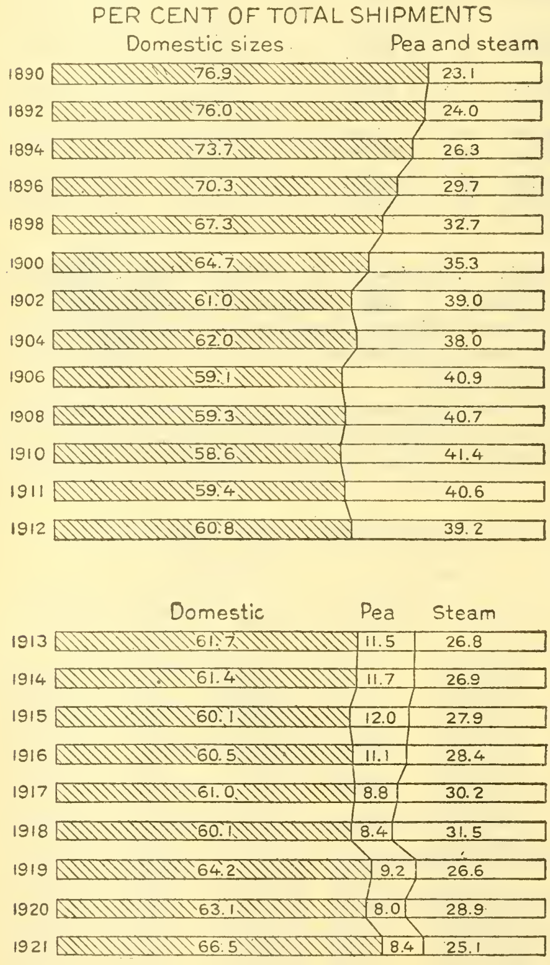


FIGURE 51.—Sizes of anthracite shipped from mines and washeries, 1890–1921. (Shipments from Sullivan County and dredges not included.)

The decline in the percentage of domestic sizes in the total shipments reflects of course the increase in shipments of washery and dredge coal, in which the steam sizes greatly predominate. The following table shows for the period between 1890 and 1921 the relative proportions of the total shipments contributed by breakers, washeries, and dredges. The output of the washeries, which was small in 1890, reached a maximum in 1907 and afterward declined. In response to the immense demand for steam coal during the war, however, it rose to 6,506,000 tons in 1918, the highest figure ever recorded and one that is not likely to be attained again. The statistics in the following table include, where possible, the output of Sullivan County.

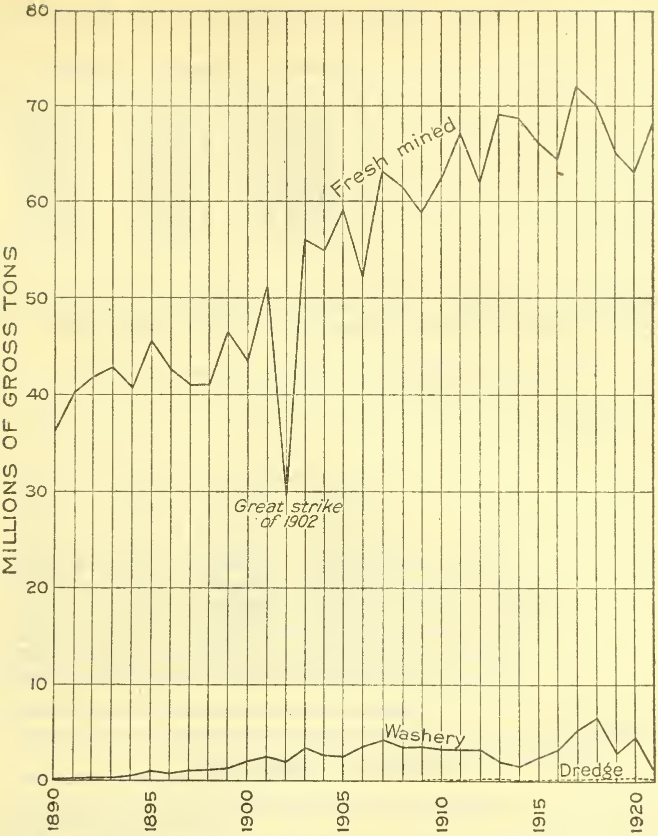


FIGURE 52.—Shipments of anthracite from mines, washeries, and dredges, 1890–1921. (Includes Sullivan County.)

Anthracite shipped from mines, washeries, and dredges, 1890-1921, in gross tons.[a]

Year.	Mines.	Washeries.	Dredges.	Total.
1890	36,573,000	42,009		36,615,000
1891	40,362,000	86,000		40,448,000
1892	41,803,000	90,000		41,893,000
1893	42,845,000	245,000		43,090,000
1894	40,757,000	634,000		41,391,000
1895	45,430,000	1,081,000		46,511,000
1896	42,282,000	895,000		43,177,000
1897	40,802,000	994,000		41,796,000
1898	40,944,000	1,099,000		42,043,000
1899	46,455,000	1,368,000		47,823,000
1900	43,218,000	2,059,000		45,277,000
1901	51,128,000	2,567,000		53,695,000
1902	29,527,000	1,959,000		31,486,000
1903	56,046,000	3,563,000		59,609,000
1904	54,927,000	2,800,000		57,727,000
1905	59,010,000	2,644,000		61,654,000
1906	52,139,000	3,847,000		55,986,000
1907	63,158,000	4,301,000		67,459,000
1908	61,473,000	3,646,000		65,119,000
1909	58,994,000	3,685,000	9,000	62,688,000
1910	62,417,000	3,296,000	22,000	65,735,000
1911	67,253,000	3,172,000	17,000	70,442,000
1912	62,046,000	3,155,000	28,000	65,229,000
1913	69,206,000	2,090,000	47,000	71,343,000

[a] Includes shipments from Sullivan County, except for 1891 to 1896, for which data are not available.

Anthracite shipped from mines, washeries, and dredges, 1890–1921, in gross tons—Contd.

Year.	Mines.	Washeries.	Dredges.	Total.
1914	68,727,000	1,720,000	17,000	70,464,000
1915	66,174,000	2,475,000	17,000	68,666,000
1916	64,368,000	3,104,000	29,000	67,501,000
1917	72,077,000	5,366,000	47,000	77,490,000
1918	70,090,000	6,506,000	125,000	76,721,000
1919	64,632,000	3,017,000	323,000	67,972,000
1920	63,599,000	4,616,000	396,000	68,611,000
1921	67,981,000	1,308,000	265,000	69,554,000

Shipments by months, 1917–1921, as reported by the Anthracite Bureau of Information, are given in the following table:

Anthracite shipped in 1917–1921, by months, in gross tons.[a]

Month.	1917	1918	1919	1920	1921
January	5,940,725	5,638,383	5,934,241	5,713,319	5,740,538
February	5,178,432	5,812,082	3,871,932	4,913,664	5,966,101
March	6,989,075	7,276,777	3,938,908	6,077,821	5,737,771
April	5,592,299	6,368,373	5,224,715	4,814,211	5,967,465
May	6,917,525	6,887,256	5,711,915	6,155,878	5,793,895
June	7,049,037	6,867,669	5,619,591	6,319,957	6,031,937
July	6,724,252	7,084,775	6,052,334	6,389,100	5,462,760
August	7,013,996	7,180,923	6,144,144	6,207,653	5,575,115
September	6,372,756	6,234,395	5,687,401	3,592,954	5,519,412
October	7,110,950	6,286,366	6,560,150	6,240,901	5,872,783
November	6,545,313	5,276,659	5,971,671	5,765,347	5,314,014
December	5,698,945	5,736,260	6,138,460	6,436,320	4,635,922
	77,133,305	76,649,918	66,855,462	68,627,125	67,617,713

[a] Does not include shipments from Sullivan County nor from dredges.

NUMBER OF OPERATIONS.

In contrast to the thousands of mines that produce bituminous coal, the number of mines in the anthracite region is small. In 1920 the Geological Survey received reports from 174 producers of anthracite, who operated during that year a total of 252 breakers, 62 washeries, and 60 dredges. In the following year the prices of the steam sizes declined notably, and the number of breakers and washeries in operation also declined.

Number of anthracite breakers, washeries, and dredges active in 1918–1921.

	1918	1919	1920	1921		1918	1919	1920	1921
Lehigh:					Wyoming:				
Breakers	34	34	36	33	Breakers	139	142	135	130
Washeries	11	12	10	11	Washeries	40	42	33	27
Dredges	0	3	3	1	Dredges	1	3	1	2
Total	45	49	49	45	Total	180	187	169	159
Schuylkill:					Sullivan County:				
Breakers	78	80	78	79	Breakers	3	3	3	3
Washeries	25	24	19	17	Total breakers	254	259	252	245
Dredges	31	74	56	59	Total washeries	76	78	62	55
					Total dredges	32	80	60	62
Total	134	178	153	155	Grand total	362	417	374	362

LABOR STATISTICS.

Statistics of labor employed in the production of anthracite in Pennsylvania in 1919, 1920, and 1921 are given in the following tables. Even with the several increases in the working force made in 1919 and 1921, the average number of all men employed in 1921 was less than in 1914 and was even slightly less than in 1916, when the number was greatly reduced. The average daily output per man, including all workers, was 2.14 net tons in 1919, 2.28 net tons in 1920, and 2.09 net tons in 1921. The average in 1919 and in 1920 was increased by the large output of the washeries and dredges. If the output of the washeries and dredges and the number of men employed by them are excluded the average daily output per employee was 2.04 net tons in 1919, 2.13 net tons in 1920, and 2.05 net tons in 1921, although the percentage of surface employees was less in 1919 and 1921 than in 1920, especially in 1920, when the percentage of top men (exclusive of dredge and washery workers) was 25.9 per cent of the total working force.

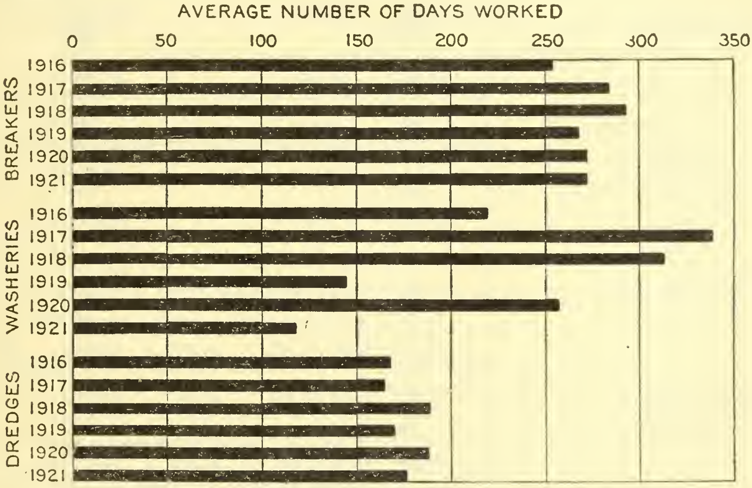


FIGURE 53.—Days worked in the anthracite region, by type of operation, 1916-1921.

The work of preparing anthracite for the market, however, is much more complicated than that of preparing bituminous coal. Anthracite must not only be screened into sizes but must be actually broken down, whereas bituminous coal is broken down in the process of mining, and the top work is confined to screening and cleaning. Hence, the percentage of men necessarily employed above ground in the anthracite field is larger than that so employed in the bituminous fields. From 1919 to 1921 the percentage of underground employees in the bituminous fields increased from 81.8 per cent to 85.5 per cent, and the percentage of underground employees in the anthracite regions increased from 69.8 per cent to 73.2 per cent. Other facts to be considered in interpreting the average production per man per day are considered on page 496.

Men employed and days worked in the anthracite field in 1919–1921, by regions.

Region.	Average number of men employed.					Average number of days worked.
	Surface.	Underground.			Total.	
		Miners.[a]	All others.	Total.		
1919.						
Lehigh:						
Freshly mined coal	6,920	11,954			18,874	275
Washery product	246				246	199
Dredge product	44				44	155
	7,210	11,954			19,164	274
Schuylkill:						
Freshly mined coal	15,340	30,224			45,564	266
Washery product	1,556				1,556	117
Dredge product	415				415	173
	17,311	30,224			47,535	259
Wyoming:						
Freshly mined coal	20,980	65,087			86,067	268
Washery product	949				949	173
Dredge product	30				30	154
	21,959	65,087			87,046	267
Sullivan County:						
Freshly mined coal	262	564			826	263
Total freshly mined coal	43,502	107,829			151,331	268
Total washery product	2,751				2,751	145
Total dredge product	489				489	170
Grand total	46,742	107,829			154,571	266
1920.						
Lehigh:						
Freshly mined coal	6,497	6,899	5,273	12,172	18,669	270
Washery product	290				290	274
Dredge product	37				37	216
	6,824	6,899	5,273	12,172	18,996	270
Schuylkill:						
Freshly mined coal	15,641	19,183	10,125	29,308	44,949	273
Washery product	1,095				1,095	265
Dredge product	280				280	184
	17,016	19,183	10,125	29,308	46,324	273
Wyoming:						
Freshly mined coal	19,098	36,947	22,057	59,004	78,102	272
Washery product	867				867	240
Dredge product	9				9	200
	19,974	36,947	22,057	59,004	78,978	271
Sullivan County:						
Freshly mined coal	237	310	229	539	776	252
Total freshly mined coal	41,473	63,339	37,684	101,023	142,496	272
Total washery product [b]	2,252				2,252	257
Total dredge product	326				326	188
Grand total	44,051	63,339	37,684	101,023	145,074	271

[a] Operators were requested to give number of "all miners (contract, consideration, and company) and their laborers."

[b] Certain producers who reported a production of about one-sixth that of the total washery coal were unable to separate the men employed in their washeries from their breaker employees. These washery employees are therefore included with the breaker employees.

Men employed and days worked in the anthracite field in 1919–1921, by regions—Contd.

Region.	Average number of men employed.					Average number of days worked.
	Surface.	Underground.			Total.	
		Miners.[a]	All others.	Total.		
1921.						
Lehigh:						
Freshly mined coal	6,738	7,732	6,154	13,886	20,624	270
Washery product	96				96	224
Dredge product	7				7	155
	6,841	7,732	6,154	13,886	20,727	270
Schuylkill:						
Freshly mined coal	15,566	21,341	11,819	33,160	48,726	278
Washery product	744				744	86
Dredge product	291				291	180
	16,601	21,341	11,819	33,160	49,761	274
Wyoming:						
Freshly mined coal	18,413	44,484	24,813	69,297	87,710	270
Washery product	515				515	144
Dredge product	15				15	120
	18,943	44,484	24,813	69,297	88,240	269
Sullivan County:						
Freshly mined coal	297	420	54	474	771	206
Total freshly mined coal	41,014	73,977	42,840	116,817	157,831	272
Total washery product[b]	1,355				1,355	118
Total dredge product	313				313	176
Grand total	42,682	73,977	42,840	116,817	159,499	271

[a] Operators were requested to give number of "all miners (contract, consideration, and company) and their laborers."

[b] Certain producers who reported a production of about one-sixth that of the total washery coal were unable to separate the men employed in their washeries from their breaker employees. These washery employees are therefore included with the breaker employees.

During the five years from 1917 to 1921 there were no extensive strikes or lockouts in the anthracite region except the so-called "vacation" of September, 1920, when about 60 per cent of the miners quit work in protest over the wage award of the Anthracite Coal Commission. In 1921 a total of 52,117 men were stated to have been on strike at one time or another for an average of 16 days each. The loss per man employed, a better measure of the importance of the strike, was only 5 days. By regions the strike record was as follows:

Labor strikes in the Pennsylvania anthracite field, 1917–1921.

Region.	1917		1918		1919		1920		1921	
	Days.	Men.	Days.	Men.	Days.	Men.	Days.	Men.	Days.	Men.
Lehigh	5	6,975	2	1,092	4	6,518	15	15,666	18	10,847
Schuylkill	7	4,096	4	9,945	4	4,212	17	41,945	5	5,523
Wyoming	4	22,819	4	7,785	8	24,409	23	39,229	17	35,747
Sullivan County	4	330	2	468						
	5	34,220	4	19,290	7	35,139	19	96,840	16	52,117

METHODS OF MINING.

In 1919 the quantity of anthracite mined by machines was 1,406,433 gross tons. In 1920 it declined to 837,565 gross tons, an output made by 139 mining machines, of which 14 were at work in Sullivan County and 125 in the Wyoming region.

In 1921 the number of machines in use in Sullivan County increased to 17, but the number in the Wyoming region dropped to 97. Nevertheless the quantity of machine-mined coal in the Wyoming region increased from 566,356 gross tons in 1920 to 636,021 gross tons in 1921, but the machine output of Sullivan County decreased from 271,209 tons to 238,216 tons, making a total net increase in the output of machine-mined coal of 36,672 gross tons. In 1919 the number of steam and electric shovels in use in the anthracite regions was 89, and their output was 1,791,856 gross tons; in 1920 the number increased to 96 and the output to 1,834,322 gross tons; but in 1921 the number dropped to 85 and the output to 1,810,527 gross tons.

Pennsylvania anthracite mined by machines in 1920–1921.

Region.	1920		1921	
	Number of machines.	Gross tons.	Number of machines.	Gross tons.
Wyoming	125	566,356	97	636,021
Sullivan County	14	271,209	17	238,216
	139	837,565	114	874,237

Pennsylvania anthracite recovered from steam-shovel strip pits in 1920 and 1921.

Region.	1920		1921	
	Number of shovels.	Gross tons.	Number of shovels.	Gross tons.
Lehigh	37	1,032,170	29	865,877
Schuylkill	30	574,982	34	680,869
Wyoming	29	227,170	22	263,781
	96	1,834,322	85	1,810,527

VALUE OF ANTHRACITE PRODUCED AND SHIPPED.

The value of the anthracite shipped as reported to the Geological Survey is its value at the breaker less losses through depreciation and the cost of selling. In order to determine the average value per ton for each size the proceeds of the sale of coal of each size are reported, and these amounts are divided by the total number of tons of that size shipped.

Federal regulation of the prices of anthracite was stopped at the end of January, 1919. The recognition that the United States Fuel Administration had given to the larger "independent" producers—those not affiliated with the railroads—in permitting them to charge for domestic fuel a maximum of 75 cents per gross ton in excess of the prices fixed for the "company" operators, however, persists in the schedules of prices prevailing to-day.[7] Prior to that time the

[7] The "company" operators, as specified in the Executive order of August 23, 1917, fixing base prices, were the Philadelphia & Reading Coal & Iron Co., Lehigh Coal & Navigation Co., Lehigh & Wilkes-Barre Coal Co., Hudson Coal Co., Delaware & Hudson Co., Scranton Coal Co., Lehigh Valley Coal Co., Coxe Bros. & Co., Pennsylvania Coal Co., Hillside Coal & Iron Co., Delaware, Lackawanna & Western Railroad Co., Delaware, Lackawanna & Western Coal Co., Susquehanna Coal Co., Susquehanna Collieries Co., Lytle Coal Co., and M. A. Hanna Coal Co. Subsequently the M. A. Hanna Coal Co. was allowed to charge the "independent" differential over the base prices named for the other companies.

individual company prices had fluctuated, in accordance with demand, above and below the prices established by the so-called "company" or "railroad" operators, but the action of the Fuel Administration was based upon the idea that the cost of production at the individual mines was greater.

The advance in wages on November 1, 1918 (see p. 453) averaged 74 cents a ton, according to the figures of the engineers of the United States Fuel Administration, but the operators were permitted to increase the prices of the domestic sizes $1.05 per gross ton. This advance was the chief cause of the increase in the average value of the shipments of anthracite coal in 1919 to $5.08 per ton, an increase of 94 cents over the price in the preceding year. The average prices of buckwheat and boiler coal, which reflect the competition with bituminous coal for the industrial market, were all lower in 1919 than in 1918, except the price of No. 1 buckwheat, which showed an average increase of 3 cents a ton. There was also an increase in the average value of "other" coal, and all the larger sizes showed substantial advances.

In 1920, owing to further increases in wages and a larger market for the smaller sizes, the average value for all sizes again advanced, this time 89 cents. Every size also showed a higher average price in 1920 than in 1919. In 1921 the average value for all sizes increased 23 cents, or to $6.20 a gross ton, but every size below pea suffered a diminution in value.

Average value per gross ton of anthracite shipped, local sales, mine fuel, and total production, by regions, 1916–1921.

Year and region.	Shipments.	Local trade.	Mine fuel.	Total.	Year and region.	Shipments.	Local trade.	Mine fuel	Total.
1916.					**1919.**				
Lehigh	$2.81	$1.84	$0.57	$2.53	Lehigh	$4.86	$3.37	$1.80	$4.51
Schuylkill	2.76	2.33	.39	2.40	Schuylkill	4.94	3.43	.85	4.31
Wyoming	2.94	2.44	.50	2.71	Wyoming	5.21	4.55	1.55	4.85
Sullivan County	2.06	2.45	.88	1.96	Sullivan County	4.63	4.70	2.29	4.36
	2.86	2.33	.47	2.58		5.08	3.98	1.32	4.64
1917.					**1920.**				
Lehigh	3.44	2.20	1.10	3.18	Lehigh	5.88	3.29	1.94	5.34
Schuylkill	3.48	2.82	.72	3.08	Schuylkill	5.70	4.14	.90	4.99
Wyoming	3.48	3.03	.99	3.25	Wyoming	6.15	5.17	1.80	5.71
Sullivan County	2.95	3.44	1.63	2.85	Sullivan County	5.60	5.71	2.33	5.27
	3.47	2.85	.90	3.19		5.97	4.44	1.47	5.43
1918.					**1921.**				
Lehigh	4.01	2.68	1.36	3.71	Lehigh	6.13	3.50	1.59	5.54
Schuylkill	4.13	3.33	.91	3.67	Schuylkill	6.03	4.19	.65	5.22
Wyoming	4.18	3.39	1.45	3.92	Wyoming	6.29	5.64	1.27	5.82
Sullivan County	3.97	3.99	2.29	3.79	Sullivan County	6.21	6.20	2.30	5.53
	4.14	3.25	1.23	3.81		6.20	4.75	1.08	5.60

Value of anthracite shipped in 1919, by regions and size.

Size.	Lehigh region.						Schuylkill region.					
	Mines.		Washeries.		Dredges.		Mines.		Washeries.		Dredges.	
	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.
Lump	$6,151	$6.43					$143,461	$6.04				
Broken	1,985,917	5.77	$3,233	$5.46			4,247,839	5.87				
Egg	7,782,583	6.12	55,565	6.04			14,466,017	6.13	$34,192	$5.89		
Stove	10,626,221	6.26	89,314	6.33			21,108,037	6.38	43,737	5.87		
Chestnut	15,316,403	6.36	934,994	6.35			27,172,172	6.43	628,171	6.34	$77	$5.50
Pea	5,059,829	4.90	322,897	5.02	$5,972	$4.24	9,726,784	4.89	722,191	4.85	465	5.60
Buckwheat No. 1	4,212,829	3.25	301,403	3.32	23,032	3.11	9,673,544	3.27	961,649	3.18	11,538	4.28
Buckwheat No. 2 (rice)	1,775,612	2.56	211,991	2.66	25,034	2.60	3,086,534	2.43	581,280	2.42	40,019	1.19
Buckwheat No. 3 (barley)	1,103,897	1.86	505,229	2.07	88,152	1.81	1,566,837	1.68	410,981	1.53	141,686	1.10
Boiler	176,543	2.28	46,986	.72			26,211	1.92	19,842	2.07	56,744	1.00
Other	181,911	.72	3,500	1.19			91,066	1.06	13,682	.65	31,596	1.18
	48,227,896	4.99	2,475,112	3.45	142,190	2.12	91,308,502	5.10	3,415,725	3.10	282,125	1.14

Size.	Wyoming region.						Sullivan County.		All regions.	
	Mines.		Washeries.		Dredges.		Mines.		Total.	Average. per ton.
	Total.	Average. per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.		
Lump	$13,794	$6.37							$163,406	$6.08
Broken	10,033,566	5.65	$203	$5.80			$102,222	$6.10	16,372,980	5.72
Egg	36,047,142	6.00	121,200	6.94			221,411	5.99	58,728,110	6.05
Stove	50,749,579	6.14	100,595	5.78			332,895	6.24	83,050,378	6.22
Chestnut	64,303,584	6.20	607,731	6.47			493,882	6.42	109,457,014	6.29
Pea	13,289,260	4.72	630,865	4.57	$474	$4.74	251,047	4.94	30,009,784	4.81
Buckwheat No. 1	11,225,226	3.06	757,139	3.02	837	3.22			27,167,197	3.16
Buckwheat No. 2 (rice)	5,101,085	2.23	863,994	2.23	10,751	2.16			11,696,300	2.33
Buckwheat No. 3 (barley)	2,127,302	1.90	309,232	1.88	4,336	1.57			6,257,652	1.78
Boiler	556,600	1.98	124,401	2.43					1,007,327	1.82
Other	424,577	3.04	219,801	2.85	20	.56	325,381	2.36	1,291,534	1.73
	193,871,715	5.28	3,735,161	3.12	16,418	2.02	1,726,838	4.63	345,201,682	5.08

Value of anthracite shipped in 1920, by regions and size.

Size.	Lehigh region.						Schuylkill region.					
	Mines.		Washeries.		Dredges.		Mines.		Washeries.		Dredges.	
	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.
Lump	$7,996	$7.81					$196,170	$6.99				
Broken	2,639,174	7.07	$12,379	$6.71			7,004,699	7.55				
Egg	9,210,337	7.41	77,197	7.16			17,304,675	7.47	$43,102	$6.97		
Stove	12,362,601	7.62	154,973	7.54			23,814,766	7.71	34,107	7.43		
Chestnut	17,296,056	7.64	1,151,691	7.31			33,388,549	7.76	1,542,871	7.88	$149	$8.76
Pea	5,473,221	5.72	424,316	5.91	$9,189	$5.07	11,021,435	5.80	1,213,887	5.72	132	5.08
Buckwheat No. 1	5,044,994	3.80	284,891	3.82	11,438	3.05	12,240,122	3.83	1,720,094	3.81	20,983	2.48
Buckwheat No. 2 (rice)	1,945,220	3.03	237,468	3.02	15,379	2.89	3,679,530	2.65	1,130,020	2.67	59,553	1.64
Buckwheat No. 3 (barley)	1,141,959	2.03	643,918	2.14	50,147	1.78	2,052,416	1.81	700,816	1.78	171,670	1.04
Boiler	118,021	2.62					556,889	2.04	93,168	1.97	110,755	1.30
Other	76,958	.56	6,669	1.24			50,645	.68	11,946	.49	74,369	1.48
	55,316,537	6.03	2,993,502	4.15	86,153	2.20	111,309,896	5.98	6,490,011	3.69	437,611	1.27

Size.	Wyoming region.						Sullivan County.		All regions.	
	Mines.		Washeries.		Dredges.		Mines.		Total.	Average. per ton.
	Total.	Average. per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.		
Lump	$40,051	$9.40							$244,217	$7.33
Broken	13,311,547	6.75	$44,880	$6.81			$158,714	$8.37	23,171,393	7.02
Egg	44,714,391	7.10	267,313	7.81			289,793	7.63	71,906,808	7.23
Stove	55,599,619	7.40	510,065	7.18			444,572	7.56	92,920,703	7.51
Chestnut	74,437,071	7.40	2,174,614	8.16			711,236	8.29	130,702,237	7.54
Pea	11,748,817	5.60	874,794	5.36	$372	$2.20	312,016	5.91	31,078,179	5.69
Buckwheat No. 1	13,899,789	3.68	1,192,886	3.59	821	2.21			34,416,018	3.75
Buckwheat No. 2 (rice)	5,644,472	2.62	2,101,038	2.70	19,148	1.68			14,831,828	2.69
Buckwheat No. 3 (barley)	2,205,862	2.02	535,827	1.96					7,502,615	1.90
Boiler	672,573	2.55	258,583	2.64					1,809,989	2.23
Other	354,584	2.28	240,962	2.19			440,495	2.64	1,256,628	1.74
	222,628,776	6.29	8,200,962	3.84	20,341	1.71	2,356,826	5.60	409,840,615	5.97

Value of anthracite shipped in 1921, by regions and size.

Size.	Lehigh region.						Schuylkill region.					
	Mines.		Washeries.		Dredges.		Mines.		Washeries.		Dredges.	
	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.
Lump							$72,768	$7.50				
Broken	$1,308,653	$7.51	$8,326	$7.27			4,983,053	7.76	$27,090	$7.72		
Egg	10,042,861	7.68	91,236	7.47			19,234,895	7.63	41,064	7.47		
Stove	13,946,710	7.94	131,046	8.04			29,647,890	7.81	39,915	8.00		
Chestnut	18,557,999	7.87	304,531	7.96			38,074,078	7.92	394,674	7.32		
Pea	5,812,210	5.92	161,178	6.06	$2,890	$3.34	11,710,372	5.80	259,573	5.52	$56	$2.00
Buckwheat No. 1	4,305,755	3.49	101,947	3.57	2,562	2.20	11,508,711	3.44	348,767	3.35	49,244	1.22
Buckwheat No. 2 (rice)	1,437,219	2.40	68,509	2.36			2,558,390	2.22	212,845	2.35	3,627	1.24
Buckwheat No. 3 (barley)	868,234	1.54	146,143	1.63	21,884	1.12	1,425,757	1.37	184,536	1.42	33,554	.82
Boiler	15,481	1.00	3,159	2.42			12,110	2.43	39	1.86	67,702	.98
Other	49,173	.48					31,086	.75	6,605	.69	65,827	.90
	56,344,295	6.20	1,016,075	4.18	27,336	1.27	119,259,110	6.15	1,515,108	3.37	220,010	.97

Size.	Wyoming region.						Sullivan County.		All regions.	
	Mines.		Washeries.		Dredges.		Mines.		Total.	Average. per ton.
	Total.	Average. per ton.	Total.	Average per ton.	Total.	Average per ton.	Total.	Average per ton.		
Lump	$13,683	$5.21							$86,451	$7.01
Broken	11,839,868	7.20	$553	$8.13			$77,715	$7.46	18,245,258	7.37
Egg	46,329,198	7.28	47,591	6.81			191,176	7.49	75,978,021	7.42
Stove	68,305,209	7.56	262,090	7.42			338,167	7.68	112,671,027	7.67
Chestnut	84,281,697	7.50	548,017	7.13			504,408	7.70	142,665,404	7.66
Pea	15,130,474	5.64	384,487	5.60	$7,040	$5.50	204,683	5.91	33,672,963	5.74
Buckwheat No. 1	15,247,964	3.40	401,797	3.55	4,900	2.50			31,971,647	3.42
Buckwheat No. 2 (rice)	5,650,883	2.25	304,732	2.27					10,236,205	2.27
Buckwheat No. 3 (barley)	1,665,024	1.48	214,807	1.47	10,339	3.23			4,570,278	1.44
Boiler	336,690	2.29	60,518	2.03	10,836	1.01			506,535	1.82
Other	66,202	1.59	7,882	1.73			159,314	2.77	386,089	1.17
	248,866,892	6.34	2,232,474	3.62	33,115	1.93	1,475,463	6.21	430,989,878	6.20

BITUMINOUS COAL.

In 1919 the production of bituminous coal in Pennsylvania amounted to 150,758,154 net tons, valued at $365,430,504, a decrease, as compared with 1918, of 27,792,587 tons, or 15.6 per cent, in quantity, and of $97,729,232, or 21.1 per cent, in value. Pennsylvania was one of the few States in which the average value per ton decreased in 1919, the loss being 17 cents. Greene and Somerset were among the larger producing counties that made a small increase, and Beaver and Lawrence counties also made gains. On the other hand, production in Allegheny County declined from 17,375,035 to 14,856,781 tons; in Cambria County from 20,569,253 to 16,899,818 tons; in Clearfield County from 9,376,429 to 7,573,392 tons; in Fayette County from 32,925,888 to 29,660,105 tons; in Indiana County from 12,743,190 to 8,526,404 tons; in Washington County from 23,537,263 to 19,515,856 tons; and in Westmoreland County from 28,121,234 to 24,947,773 tons. The quantity of coal coked at the mines decreased from 32,460,487 to 21,607,070 tons. In Fayette County alone the loss was more than 6,000,000 tons and in Washington County it was more than 500,000 tons. The increase in the total number of workers was small, but the increase in the number of underground employees amounted to more than 3,000. The average output per worker per day increased from 3.81 to 3.96 tons, so that the loss in output is directly chargeable to the decrease in the total number of days on which the mines were in operation during the year, the average falling from 269 in 1918 to 218 in 1919. Strikes and lockouts during the year involved 97,089 workers, an average of 39 days, and the total loss was 3,765,144 man-days, the largest for any State.

In 1920 the output was 170,607,847 tons, valued at $642,630,000, an increase over that in 1919 of 19,849,693 tons, or 13.2 per cent, in quantity, and of $277,199,496, or 75.9 per cent, in value. The average value per ton increased to $3.76, a gain of $1.34. Every county except Blair and Westmoreland shared in the increase, and the largest gains were made in Allegheny, Armstrong, Cambria, Clearfield, Indiana, Jefferson, and Washington counties. The quantity of coal coked at the mines increased to 24,053,766 tons. The total number of men employed decreased 580, and the number of surface workers decreased 618. The average output per man per day was unchanged, the larger total production being due to an increase of 26 in the total number of days worked. The losses by strikes were also materially reduced; during the year 27,728 workers lost an average of 17 days because of strikes, and the total loss in man-days was 479,708.

In 1921 more than one-third of the total loss in the production of bituminous coal in the United States occurred in Pennsylvania. Despite this fact, the output of the State was so much greater than that of West Virginia and Illinois, which rank second and third, respectively, that its leadership has never been threatened. The output in 1921 was 116,013,942 tons, valued at $322,538,300, a decrease of 54,593,905 tons, or 32 per cent, in quantity, and $320,091,700, or 49.8 per cent, in value. The average value per ton was $2.78. The output of Greene and Lawrence counties showed an increase over that in 1920 of 215,966 and 35,723 tons, respectively.

On the other hand, the output of Allegheny County decreased 4,116,048 tons; of Armstrong County, 2,586,301 tons; of Cambria County, 2,628,526 tons; of Clearfield County, 3,388,494 tons; of Fayette County, 11,481,458 tons; of Indiana County, 5,056,077 tons; of Jefferson County, 2,638,564 tons; of Washington County, 8,604,211 tons; and of Westmoreland County, 6,443,748 tons. The decrease in the quantity of coal coked at the mines was 16,933,126 tons. The total number of men employed increased 16,673, but the number of surface employees decreased 3,673. The average output per man per day rose to 4.03 tons, the decline in the total output for the year being due to the smaller number of days worked—151 against 244. Although the average time lost per striker in 1921 was 3 days more than in 1920, the total loss of 302,525 man-days represented a substantial reduction, because only 14,895 workers were involved in strikes and lockouts during the year.

Bituminous coal produced in Pennsylvania in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground.		Surface.	Total.	
						Miners.[a]	All others			
1919.										
Allegheny	13,507,894	1,109,992	237,837	1,058	14,856,781	14,023		2,597	16,620	204
Armstrong	4,135,868	329,510	199,854	....	4,665,232	5,224		1,162	6,386	196
Beaver	99,699	39,398	197	....	139,294	211		93	304	185
Bedford	505,530	18,025	10,901	169,833	704,289	1,066		165	1,231	190
Blair	174,396	277	4,806	1,730	181,209	248		38	286	205
Bradford and Lycoming	12,498	811	64	....	13,373	25		5	30	165
Butler	1,036,865	58,483	32,844	....	1,128,192	1,567		364	1,931	188
Cambria	14,746,463	1,058,070	248,356	846,929	16,899,818	18,329		3,359	21,688	218
Center	1,282,048	12,178	1.835	....	1,296,061	1,502		376	1,878	187
Clarion	1,284,658	86,952	22,037	....	1,393,647	2,055		391	2,446	195
Clearfield	6,945,214	298,409	157,564	172,205	7,573,392	10,397		1,823	12,220	197
Clinton	272,201	12,243	3,656	....	288,100	275		65	340	222
Elk	894,994	27,731	24,870	....	947,595	1,379		310	1,689	192
Fayette	14,497,425	424,348	719,150	14,019,182	29,660.105	21,770		5,871	27,641	252
Greene	1,321,870	16,254	48,182	36,812	1,423,118	1,259		518	1,777	236
Huntingdon	778,772	6,933	24,534	23,451	833,690	1,364		116	1,480	205
Indiana	8,057,757	105,224	173,762	189,661	8.526,404	10,055		1,811	11,866	195
Jefferson	3,126,673	111,152	180,942	422,711	3,841,478	4,637		1,004	5,641	192
Lawrence	124,622	6,176	9,256	....	140,054	185		51	236	279
Mercer	434,508	8,881	38,132	....	481,521	581		212	793	201
Somerset	10,051,925	150,201	231,626	....	10,433,752	10,238		2,022	12,260	227
Tioga	565,518	17,721	10,398	....	593,637	994		246	1,240	199
Washington	17,798,473	567,250	346,074	804,059	19,515,856	17,318		3,669	20,987	204
Westmoreland	19,021,079	431,244	576,011	4,919,439	24,947,773	19,087		4,438	23,525	239
Small mines[b]	27,295	243,612	2,876	....	273,783	49		6	55	202
	120,704,245	5,141,075	3,305,764	21,607,070	150,758,154	143,838		30,712	174,550	218

[a] Includes also loaders and shot firers.
[b] Includes Fulton and McKean counties; number of employees Fulton and McKean counties only.

Bituminous coal produced in Pennsylvania in 1919–1921—Continued.

County.	Production (net tons). Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Number of employees. Underground. Miners.[a]	All others.	Surface.	Total.	Average number of days worked.
1920.										
Allegheny	14,031,063	1,782,864	233,648	....	16,047,575	8,816	3,798	2,450	15,064	244
Armstrong	5,566,081	187,149	221,833	....	5,975,063	4,151	1,458	1,049	6,658	249
Beaver	120,135	50,765	....	....	170,900	132	46	83	261	241
Bedford	585,782	25,994	14,433	159,694	785,903	816	355	154	1,325	159
Blair	110,627	6,748	6,531	34,351	158,257	140	55	32	227	190
Bradford, Fulton, and Lycoming	63,730	3,741	461	....	67,932	55	17	12	84	249
Butler	1,446,869	66,223	29,215	....	1,542,307	1,361	463	329	2,153	233
Cambria	15,944,272	1,605,323	263,889	1,154,270	18,967,754	13,348	5,047	3,003	21,398	227
Center	1,654,965	76,228	3,852	....	1,735,045	1,439	471	291	2,201	224
Clarion	1,437,827	106,784	22,484	....	1,567,095	1,642	476	385	2,503	191
Clearfield	8,567,779	324,447	155,827	194,363	9,242,416	7,998	2,533	1,757	12,288	228
Clinton	297,876	26,973	2,447	....	327,296	183	63	68	314	281
Elk	1,205,088	26,119	27,627	....	1,258,834	1,086	282	331	1,699	262
Fayette	15,187,787	388,482	846,942	14,319,025	30,742,236	11,089	10,620	5,997	27,706	272
Greene	1,920,505	20,699	54,466	83,165	2,078,835	957	767	632	2,356	272
Huntingdon	779,818	8,536	22,528	28,731	839,613	949	227	136	1,312	215
Indiana	10,806,727	103,737	206,914	296,670	11,414,048	7,576	2,634	1,882	12,092	248
Jefferson	4,416,323	148,884	214,806	566,445	5,346,458	3,531	1,235	958	5,724	253
Lawrence	130,165	18,450	9,319	....	157,934	144	64	50	258	259
Mercer	492,863	8,293	29,271	....	530,427	461	184	154	799	243
Somerset	10,110,568	220,361	202,038	....	10,532,967	7,581	2,881	1,884	12,346	226
Tioga	728,163	23,797	11,651	....	763,611	779	176	181	1,136	305
Washington	21,237,911	398,232	339,756	1,345,296	23,321,195	12,412	5,123	3,764	21,299	242
Westmoreland	17,539,139	510,613	588,638	5,871,756	24,510,146	11,894	6,361	4,512	22,767	248
	134,382,063	6,139,442	3,508,576	24,053,766	168,083,847	98,540	45,336	30,094	173,970	244
Small mines	2,363,000	161,000	....	....	2,524,000	....	....	....	....	....
	136,745,063	6,300,442	3,508,576	24,053,766	170,607,847	....	....	....	....	....
1921.[c]										
Allegheny	10,513,579	1,201,262	216,064	622	11,931,527	13,992	4,420	2,662	21,074	146
Armstrong	3,026,839	212,159	149,764	....	3,388,762	4,784	1,713	1,080	7,577	121
Beaver	121,073	40,306	30	....	161,409	180	27	73	280	195
Bedford	201,099	43,178	8,885	64,082	317,244	749	272	139	1,160	81
Blair	73,418	18,161	565	....	92,144	220	66	35	321	106
Bradford, Fulton, Lycoming, and McKean	50,369	4,492	435	....	55,296	88	24	26	138	137
Butler	856,061	50,918	16,412	....	923,391	1,434	409	326	2,169	129
Cambria	14,541,992	1,061,642	212,839	522,755	16,339,228	16,873	4,952	2,788	24,613	165
Center	691,723	69,740	3,531	....	764,994	1,538	384	253	2,175	111
Clarion	1,151,474	79,749	17,071	....	1,248,294	1,917	556	346	2,819	151
Clearfield	5,486,633	209,543	115,540	42,206	5,853,922	8,705	2,487	1,477	12,669	143
Clinton	59,571	23,560	510	....	83,641	192	61	65	318	75
Elk	838,947	21,968	17,286	....	878,201	1,517	295	234	2,046	167
Fayette	13,799,565	234,090	630,965	4,596,158	19,260,778	11,960	9,323	4,901	26,184	150
Greene	2,228,672	20,956	45,173	....	2,294,801	1,414	804	637	2,855	244
Huntingdon	428,373	8,462	16,181	30,992	484,008	1,051	243	146	1,440	123
Indiana	5,964,908	108,353	153,562	131,148	6,357,971	8,859	2,786	1,735	13,380	131
Jefferson	2,318,151	74,490	142,294	172,959	2,707,894	4,045	1,157	789	5,991	132
Lawrence	174,157	9,601	9,899	....	193,657	189	90	42	321	274
Mercer	450,783	4,504	24,600	....	479,887	554	263	146	963	171
Somerset	8,623,857	195,061	156,891	....	8,975,809	8,730	2,732	1,670	13,132	173
Tioga	410,859	17,551	9,292	....	437,702	833	187	195	1,215	166
Washington	14,169,333	245,336	214,845	87,470	14,716,984	15,242	4,915	2,667	22,824	144
Westmoreland	15,843,904	360,508	389,738	1,472,248	18,066,398	14,752	6,238	3,989	24,979	164
	102,025,340	4,315,590	2,552,372	7,120,640	116,013,942	119,818	44,404	26,421	190,643	151

[a] Includes also loaders and shot firers.
[c] Exclusive of product of wagon mines.

Value of bituminous coal produced in Pennsylvania in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Allegheny	$31,291,681	$2,830,277	$497,988	$2,698	$34,622,644	$2.33
Armstrong	10,256,449	866,971	415,938	....	11,539,358	2.47
Beaver	238,059	124,368	685	....	363,112	2.61
Bedford	1,363,464	43,442	27,034	417,528	1,851,468	2.63
Blair	477,766	905	13,166	5,295	497,132	2.74
Bradford and Lycoming	56,217	3,220	256	....	59,693	4.46
Butler	2,531,019	157,364	81,939	....	2,770,322	2.46
Cambria	41,056,640	2,851,711	669,871	2,144,346	46,722,568	2.76
Center	3,410,405	34,842	4,982	....	3,450,229	2.66
Clarion	3,218,987	221,567	53,057	....	3,493,611	2.51
Clearfield	18,905,771	745,199	323,603	421,902	20,396,475	2.69
Clinton	694,831	20,303	8,367	....	723,501	2.51
Elk	2,291,183	56,273	52,766	....	2,400,222	2.53
Fayette	31,491,717	968,349	1,602,438	30,564,019	64,626,523	2.18
Greene	3,060,959	39,466	95,160	77,669	3,273,254	2.30
Huntingdon	2,234,485	19,409	62,565	64,484	2,380,943	2.86
Indiana	21,091,822	233,484	429,381	440,225	22,194,912	2.60
Jefferson	8,085,858	225,998	385,386	993,907	9,691,149	2.52
Lawrence	352,843	19,358	22,276	....	394,477	2.82
Mercer	1,166,903	30,176	105,702	....	1,302,781	2.71
Somerset	27,350,137	389,823	579,112	....	28,319,072	2.71
Tioga	1,658,086	50,320	27,930	....	1,736,336	2.92
Washington	40,314,388	1,270,839	776,510	1,815,681	44,177,418	2.26
Westmoreland	45,202,480	971,025	1,287,236	10,302,539	57,763,280	2.32
Small mines [a]	79,156	593,022	7,846	....	680,024	2.48
	297,881,306	12,767,711	7,531,194	47,250,293	365,430,504	....
Average value per ton	2.47	2.48	2.28	2.19	2.42	2.42
1920.						
Allegheny	52,691,000	6,370,000	664,000	....	59,725,000	3.72
Armstrong	21,119,000	600,000	694,000	....	22,413,000	3.75
Beaver	485,000	221,000	....	....	706,000	4.13
Bedford	2,668,000	98,000	55,000	623,000	3,444,000	4.38
Blair	561,000	28,000	20,000	110,000	719,000	4.54
Bradford, Fulton, and Lycoming	262,000	20,000	1,000	....	283,000	4.17
Butler	6,980,000	212,000	116,000	....	7,308,000	4.74
Cambria	66,618,000	5,259,000	877,000	3,966,000	76,720,000	4.04
Center	7,135,000	301,000	18,000	....	7,454,000	4.30
Clarion	5,772,000	387,000	77,000	....	6,236,000	3.98
Clearfield	36,023,000	1,269,000	480,000	661,000	38,433,000	4.16
Clinton	1,072,000	100,000	9,000	....	1,181,000	3.61
Elk	4,982,000	67,000	74,000	....	5,123,000	4.07
Fayette	53,976,000	1,410,000	2,639,000	42,457,000	100,482,000	3.27
Greene	8,172,000	84,000	213,000	333,000	8,802,000	4.23
Huntingdon	3,137,000	30,000	68,000	109,000	3,344,000	3.98
Indiana	39,801,000	371,000	672,000	977,000	41,821,000	3.66
Jefferson	17,413,000	558,000	638,000	1,914,000	20,523,000	3.84
Lawrence	433,000	79,000	29,000	....	541,000	3.42
Mercer	2,188,000	32,000	129,000	....	2,349,000	4.43
Somerset	43,672,000	739,000	829,000	....	45,240,000	4.30
Tioga	3,079,000	84,000	41,000	....	3,204,000	4.20
Washington	79,749,000	1,520,000	1,020,000	4,254,000	86,543,000	3.71
Westmoreland	62,819,000	1,632,000	1,796,000	18,578,000	84,825,000	3.46
	520,807,000	21,471,000	11,159,000	73,982,000	627,419,000	3.72
Small mines	14,558,000	653,000	....	....	15,211,000	6.03
	535,365,000	22,124,000	11,159,000	73,982,000	642,630,000	....
Average value per ton	3.91	3.51	3.18	3.08	3.76	3.76

[a] Includes Fulton and McKean counties.

Value of bituminous coal produced in Pennsylvania in 1919–1921—Continued.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1921.[b]						
Allegheny	$31,007,000	$3,279,000	$590,000	$1,000	$34,877,000	$2.92
Armstrong	9,387,000	531,000	451,000		10,369,000	3.06
Beaver	295,000	118,000	100		413,100	2.56
Bedford	665,000	147,000	27,000	213,000	1,052,000	3.32
Blair	228,000	55,000	3,000		286,000	3.10
Bradford, Lycoming, and McKean	191,000	11,000	1,200		203,200	3.67
Butler	2,172,000	156,000	38,000		2,366,000	2.56
Cambria	44,812,000	2,922,000	653,000	1,382,000	49,769,000	3.05
Center	2,051,000	275,000	8,000		2,334,000	3.05
Clarion	3,184,000	266,000	45,000		3,495,000	2.80
Clearfield	15,671,000	554,000	342,000	124,000	16,691,000	2.85
Clinton	204,000	47,000	1,000		252,000	3.01
Elk	2,602,000	54,000	49,000		2,705,000	3.08
Fayette	33,180,000	571,000	1,554,000	10,736,000	46,041,000	2.39
Greene	5,751,000	52,000	132,000		5,935,000	2.59
Huntingdon	1,465,000	27,000	59,000	90,000	1,641,000	3.39
Indiana	17,439,000	350,000	363,000	279,000	18,431,000	2.90
Jefferson	7,048,000	182,000	429,000	501,000	8,160,000	3.01
Lawrence	521,000	30,000	33,000		584,000	3.01
Mercer	1,331,000	14,000	69,000		1,414,000	2.95
Somerset	24,953,000	601,000	467,000		26,021,000	2.90
Tioga	1,617,000	69,000	34,000		1,720,000	3.93
Washington	37,600,000	626,000	542,000	186,000	38,954,000	2.65
Westmoreland	43,243,000	951,000	1,018,000	3,613,000	48,825,000	2.70
	286,617,000	11,888,000	6,908,300	17,125,000	322,538,300	
Average value per ton	2.81	2.75	2.71	2.40	2.78	2.78

[b] Exclusive of product of wagon mines.

Bituminous coal produced in Pennsylvania, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Allegheny	17,836,377	17,375,035	14,856,781	16,047,575	11,931,527	− 4,116,048
Armstrong	5,574,861	6,051,753	4,665,232	5,975,063	3,388,762	− 2,586,301
Beaver	129,163	128,572	139,294	170,900	161,409	− 9,491
Bedford	947,053	1,050,528	704,289	785,903	317,244	− 468,659
Blair	271,598	279,817	181,209	158,257	92,144	− 66,113
Bradford and Lycoming	47,151	31,299	13,373	[a] 67,932	[a] 55,296	− [a] 12,636
Butler	1,201,963	1,397,927	1,128,192	1,542,307	923,391	− 618,916
Cambria	19,730,770	20,569,253	16,899,818	18,967,754	16,339,228	− 2,628,526
Cameron and McKean [b]	12,165	7,483	(c)		(a)	(a)
Center	1,999,407	1,984,664	1,296,061	1,735,045	764,994	− 970,051
Clarion	1,380,494	1,607,641	1,393,647	1,567,095	1,248,294	− 318,801
Clearfield	9,336,533	9,376,429	7,573,392	9,242,416	5,853,922	− 3,388,494
Clinton	401,812	360,123	288,100	327,296	83,641	− 243,655
Elk	907,187	968,868	947,595	1,258,834	878,201	− 380,633
Fayette	32,083,027	32,925,888	29,660,105	30,742,236	19,260,778	− 11,481,458
Greene	900,378	1,269,425	1,423,118	2,078,835	2,294,801	+ 215,966
Huntingdon	1,155,602	1,371,562	833,690	839,613	484,008	− 355,605
Indiana	12,053,766	12,743,190	8,526,404	11,414,048	6,357,971	− 5,056,077
Jefferson	5,551,658	5,140,833	3,841,478	5,346,458	2,707,894	− 2,638,564
Lawrence	132,929	107,086	140,054	157,934	193,657	+ 35,723
Mercer	527,421	690,785	481,521	530,427	479,887	− 50,540
Somerset	9,454,537	10,264,083	10,433,752	10,532,967	8,975,809	− 1,557,158
Tioga	866,803	834,385	593,637	763,611	437,702	− 325,909
Washington	21,513,603	23,537,263	19,515,856	23,321,195	14,716,984	− 8,604,211
Westmoreland	28,027,782	28,121,234	24,947,773	24,510,146	18,066,398	− 6,443,748
Small mines	[c] 404,102	[c] 355,615	[c] 273,783	2,524,000		− 2,524,000
	172,448,142	178,550,741	150,758,154	170,607,847	116,013,942	− 54,593,905
Total value	$421,268,808	$463,159,736	$365,430,504	$642,630,000	$322,538,300	−$320,091,700

[a] Bradford and Lycoming counties include Fulton in 1920 and 1921 and McKean in 1921.
[b] No production in Cameron County since 1918.
[c] Small mines include Fulton County in 1917, 1918, and 1919, and McKean County in 1919.

RHODE ISLAND.

A small quantity of graphitic anthracite was mined in Rhode Island in 1921 and used for fuel. The last year preceding of which the Geological Survey has record of any production in that State was 1912.

SOUTH DAKOTA.

The production of lignite in South Dakota, which reached 14,417 tons in 1919, declined in each of the two years following. The deposits occur in a sparsely settled region, and, although five counties report production, the total number of men engaged in the industry is less than 50. The bulk of the output is sold for local consumption; less than 500 tons is loaded annually for shipment. In this respect, as well as in the extent of the operations, the industry in South Dakota differs materially from that in the adjoining State of North Dakota.

Lignite produced in South Dakota in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground.		Surface.	Total.	
					Miners.[a]	All others.			
1919.									
Dewey, Harding, and Ziebach	450	5,513	28	5,991	9		3	12	169
Meade	....	824	....	824	7		......	7	84
Perkins	....	7,602	....	7,602	27		......	27	153
	450	13,939	28	14,417	43		3	46	164
1920.									
Dewey and Harding	232	5,887	....	6,119	8	5	3	16	122
Meade and Ziebach	....	650	....	650	2	1	2	5	72
Perkins	....	6,008	....	6,008	12	9	5	26	131
	232	12,545	....	12,777	22	15	10	47	133
1921.									
Dewey and Harding	450	1,441	....	1,891	16	......	......	16	139
Meade and Ziebach	....	791	....	791	66	......	......	6	83
Perkins	....	4,837	34	4,871	21	......	......	21	135
	450	7,069	34	7,553	43	......	......	43	129

[a] Includes also loaders and shot firers.

Value of lignite produced in South Dakota in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Dewey, Harding, and Ziebach	$1,762	$20,302	$105	$22,169	$3.70
Meade	......	4,843	....	4,843	5.83
Perkins	......	18,695	....	18,695	2.49
	1,762	43,840	105	45,707	....
Average value per ton	3.92	2.34	3.75	3.17	3.17
1920.					
Dewey and Harding	1,000	23,000	....	24,000	3.92
Meade and Ziebach	......	3,000	....	3,000	4.62
Perkins	......	19,000	....	19,000	3.16
	1,000	45,000	....	46,000	....
Average value per ton	4.31	3.59	....	3.60	3.60
1921 [a]					
Dewey and Harding	1,500	3,300	....	4,800	2.54
Meade and Ziebach	......	2,300	....	2,300	2.91
Perkins	......	14,000	100	14,100	2.89
	1,500	19,600	100	21,200	
Average value per ton	3.33	2.77	2.94	2.81	2.81

[a] Exclusive of product of wagon mines.

Lignite produced in South Dakota, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease 1921.
Dewey and Harding	[a] 3,092	[a] 2,579	[a] 5,991	6,119	1,891	−4,228
Meade	395	645	824	[a] 650	[a] 791	+[a] 141
Perkins	3,955	4,718	7,602	6,008	4,871	−1,137
	7,442	7,942	14,417	12,777	7,553	−5,224
Total value	$23,348	$22,230	$45,707	$46,000	$21,200	−$24,800

[a] Includes Ziebach County.

TENNESSEE.

Every county in Tennessee showed a decrease in output in 1919. The production for the State was 5,213,205 tons, valued at $14,448,168, a decrease, as compared with 1918, of 1,617,843 tons, or 23.7 per cent, in quantity, and of $4,857,035, or 25.2 per cent in value. The average value per ton decreased to $2.77, a loss of 6 cents. The total number of employees increased 829, less than 10 per cent, but the total number employed underground increased 778. There was not only a loss in yearly output per man, through a reduction in the number of days worked, which fell from 265 days in 1918 to 201 days in 1919, but a loss of 0.16 ton in the average daily output per man, despite the increase in the number of underground employees. Strikes that involved 10,199 men resulted in an average loss of 33 days per man striking and a total loss of 334,315 man-days.

In 1920 the recovery carried production within 168,620 tons of the output for 1918, the highest on record except that for 1910. The production for the State as a whole in 1920 was 6,662,428 tons, valued at $26,778,000, an increase, as compared with 1919, of 1,449,223 tons, or 27.8 per cent, in quantity, and of $12,329,832, or 85.3 per cent, in value. Marion and Roane counties were the only ones for which separate statistics are reported that did not show increases. There was a reduction of 170 in the total number of men employed, but an increase of 251 in the number of underground workers. The average output per man per day increased 0.23 ton, or to 2.48 tons, and the average number of days in which the mines were in operation rose to 234. The losses by strikes were among the smallest recorded for any State; 202 men were out an average of 7 days, and the total loss was 1,478 man-days.

In 1921 the production was 4,460,326 tons, valued at $14,932,000, a decrease of 2,202,102 tons, or 33.1 per cent, in quantity, and of $11,846,000, or 44.2 per cent, in value. There were further decreases in the total number of men employed and in all classes of workers, and the average number of days in which the mines were in operation dropped to 154. The average output per man per day, however, increased to 2.80 tons. The losses by strikes were larger; 638 men were out an average of 27 days each, and the total loss was 17,350 man-days.

Coal produced in Tennessee in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
						Underground.				
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Miners.[a]	All others.	Surface.	Total.	
1919.										
Anderson	476,581	6,492	14,569	....	497,642	865		193	1,058	199
Campbell	1,083,560	45,752	32,410	....	1,161,722	1,895		524	2,419	197
Claiborne	1,046,135	7,221	24,416	....	1,077,772	1,171		393	1,564	192
Cumberland	25,881	233	2,416	13,387	41,917	80		55	135	201
Fentress	344,713	2,314	6,401	....	353,428	458		84	542	222
Grundy	343,292	750	1,683	32,722	378,447	801		216	1,017	202
Marion	352,621	5,885	8,924	16,628	384,058	420		242	662	233
Morgan	340,890	5,387	10,959	18,212	375,448	1,151		160	1,311	238
Roane	14,955	27,143	12,331	108,216	162,645	302		46	348	235
Scott	81,877	18,003	575	....	100,455	221		99	320	151
Other counties[b]	634,038	7,635	31,947	4,446	678,066	1,612		535	2,147	177
Small mines	....	1,605	....	....	1,605	....		.....	....	....
	4,744,543	128,420	146,631	193,611	5,213,205	8,976		2,547	11,523	201
1920.										
Anderson	586,427	10,137	23,525	....	620,089	677	289	218	1,184	194
Campbell	1,097,989	54,765	24,483	104,550	1,281,787	1,509	569	379	2,457	201
Claiborne	1,125,825	9,424	22,032	....	1,157,281	771	440	245	1,456	231
Cumberland	69,549	1,300	3,300	....	74,149	70	34	24	128	202
Fentress	535,460	5,745	11,069	....	552,274	438	189	95	722	243
Grundy	566,932	1,497	2,343	41,411	612,183	614	195	227	1,036	282
Hamilton	224,423	5,638	14,110	306	244,477	308	144	90	542	242
Marion	344,350	6,503	6,566	....	357,419	362	132	153	647	263
Morgan	426,483	8,244	9,203	....	443,930	638	284	193	1,115	256
Roane	20,785	69	12,618	118,131	151,603	173	74	81	328	285
Scott	136,058	11,552	860	....	148,470	209	46	80	335	212
Other counties[c]	845,065	21,549	29,352	46,000	941,966	722	340	341	1,403	251
	5,979,346	136,423	159,461	310,398	6,585,628	6,491	2,736	2,126	11,353	234
Small mines	76,600	200	....	....	76,800	....	....	.....	....	....
	6,055,946	136,623	159,461	310,398	6,662,428	....	....	.....	....	....
1921.[d]										
Anderson	317,207	8,944	7,265	....	333,416	599	269	172	1,040	117
Campbell	989,685	23,877	30,475	....	1,044,037	1,517	582	448	2,547	159
Claiborne	818,533	9,327	20,165	....	848,025	702	344	202	1,248	189
Fentress	380,493	4,935	9,466	....	394,894	408	84	95	587	140
Grundy	363,509	1,610	1,918	19,727	386,764	637	247	144	1,028	161
Marion	256,782	4,299	7,603	....	268,684	271	119	144	534	172
Morgan	261,321	1,208	12,389	21,500	296,418	387	253	114	754	210
Overton	153,164	1,589	1,199	....	155,952	175	41	34	250	118
Scott	106,034	7,212	590	....	113,836	203	59	68	330	160
Other counties[e]	547,636	25,198	32,660	12,806	618,300	1,162	502	365	2,029	121
	4,194,364	88,199	123,730	54,033	4,460,326	6,061	2,500	1,786	10,347	154

[a] Includes also loaders and shot firers.
[b] Bledsoe, Hamilton, Overton, Rhea, Sequatchie, and White.
[c] Bledsoe, Overton, Rhea, Sequatchie, and White.
[d] Exclusive of product of wagon mines.
[e] Bledsoe, Cumberland, Hamilton, Rhea, Roane, Sequatchie, and White.

Value of coal produced in Tennessee in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Anderson	$1,380,205	$16,941	$37,337		$1,434,483	$2.88
Campbell	3,192,061	122,920	87,873		3,402,854	2.93
Claiborne	2,880,272	17,412	65,199		2,962,883	2.75
Cumberland	68,905	693	6,295	$35,740	111,633	2.66
Fentress	846,330	5,954	13,902		866,186	2.45
Grundy	980,896	2,092	4,628	98,581	1,086,197	2.87
Marion	853,206	13,061	21,121	34,919	922,307	2.40
Morgan	939,941	14,871	30,030	19,123	1,003,965	2.67
Roane	45,343	82,000	35,223	382,701	545,267	3.35
Scott	209,963	40,483	1,809		252,255	2.51
Other counties [a]	1,750,091	17,949	73,303	14,191	1,855,534	2.74
Small mines		4,604			4,604	2.87
	13,147,213	338,980	376,720	585,255	14,448,168	
Average value per ton	2.77	2.64	2.57	3.02	2.77	2.77
1920.						
Anderson	2,495,000	40,000	92,000		$2,627,000	4.24
Campbell	5,126,000	182,000	95,000	341,000	5,744,000	4.48
Claiborne	4,133,000	32,000	78,000		4,243,000	3.67
Cumberland	353,000	5,000	15,000		373,000	5.03
Fentress	1,808,000	22,000	32,000		1,862,000	3.37
Grundy	2,301,000	6,000	9,000	155,000	2,471,000	4.04
Hamilton	1,026,000	22,000	46,000		1,094,000	4.47
Marion	1,138,000	19,000	20,000		1,177,000	3.29
Morgan	2,021,000	39,000	34,000		2,094,000	4.72
Roane	107,000		45,000	423,000	575,000	3.79
Scott	637,000	42,000	3,000		682,000	4.59
Other counties [b]	3,055,000	71,000	86,000	207,000	3,419,000	3.63
	24,200,000	480,000	555,000	1,126,000	26,361,000	4.00
Small mines	416,000	1,000			417,000	5.43
	24,616,000	481,000	555,000	1,126,000	26,778,000	
Average value per ton	4.06	3.52	3.48	3.63	4.02	4.02
1921. [c]						
Anderson	944,000	24,000	19,000		987,000	2.96
Campbell	3,889,000	70,000	114,000		4,073,000	3.90
Claiborne	2,771,000	32,000	69,000		2,872,000	3.39
Fentress	1,120,000	14,000	22,000		1,156,000	2.93
Grundy	1,227,000	5,000	6,000	58,000	1,296,000	3.35
Marion	751,300	12,000	24,000		787,000	2.93
Morgan	971,000	15,000	35,000	21,000	1,042,000	3.51
Overton	548,000	4,000	3,000		555,000	3.56
Scott	306,000	19,000	2,000		327,000	2.87
Other counties [d]	1,637,000	84,000	90,000	26,000	1,837,000	2.97
	14,164,000	279,000	384,000	105,000	14,932,000	
Average value per ton	3.38	3.16	3.10	1.94	3.35	3.35

[a] Bledsoe, Hamilton, Overton, Rhea, Sequatchie, and White.
[b] Bledsoe, Overton, Rhea, Sequatchie, and White.
[c] Exclusive of product of wagon mines.
[d] Bledsoe, Cumberland, Hamilton, Rhea, Roane, Sequatchie, and White.

Coal produced in Tennessee, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Decrease, 1921.
Anderson	418,558	619,381	497,642	620,089	333,416	286,673
Campbell	1,288,049	1,367,448	1,161,722	1,281,787	1,044,037	237,750
Claiborne	1,265,639	1,345,914	1,077,772	1,157,281	848,025	309,256
Cumberland	(a)	53,127	41,917	74,149	(a)	(a)
Fentress	434,035	474,331	353,428	552,274	394,894	157,380
Grundy	421,749	432,623	378,447	612,183	386,764	225,419
Hamilton	(a)	(a)	(a)	244,477	(a)	(a)
Marion	588,545	490,771	384,058	357,419	268,684	88,735
Morgan	545,480	645,344	375,448	443,930	296,418	147,512
Overton	124,742	227,392	(a)	(a)	155,952	(a)
Roane	(a)	(a)	162,645	151,603	(a)	(a)
Scott	116,728	152,703	100,455	148,470	113,836	34,634
Other counties [a]	976,678	1,015,912	678,066	941,966	618,300	637,943
Small mines	14,018	6,102	1,605	76,800		76,800
	6,194,221	6,831,048	5,213,205	6,662,428	4,460,326	2,202,102
Total value	$13,592,998	$19,305,203	$14,448,168	$26,778,000	$14,932,000	$11,846,000

[a] Other counties include Bledsoe, Cumberland, Hamilton, Rhea, Roane, Sequatchie, and White in 1917; Bledsoe, Hamilton, Rhea, Roane, Sequatchie, and White in 1918; Bledsoe, Hamilton, Overton, Rhea, Sequatchie, and White in 1919; Bledsoe, Overton, Rhea, Sequatchie, and White in 1920; and Bledsoe, Cumberland, Hamilton, Rhea, Roane, Sequatchie, and White in 1921.

TEXAS.

The output of coal in Texas declined in each of the three years considered in this report, but the losses in bituminous coal were much greater than those in lignite. The total output in 1919 was 1,680,656 tons, valued at $4,527,640. The output of bituminous coal during the year was 734,087 tons, and that of lignite was 946,569 tons. As compared with the output in 1918 these amounts represented a loss of 580,479 tons, or 25.7 per cent, in all coal mined; of 340,096 tons, or 31.7 per cent, in bituminous coal; and of 240,383 tons, or 20.3 per cent, in lignite. The average value per ton of all coal, however, increased 6 cents, or to $2.69. The number of men employed decreased from 3,936 to 3,644, and the average number of days in which the mines were in operation decreased from 273 to 228 days in the bituminous mines and from 244 to 225 days in the lignite mines, or from 262 to 227 days in all mines.

In 1920 the total output, 1,615,015 tons, valued at $6,062,000, represented a decrease of 65,641 tons, or 3.5 per cent, from that in 1919. The output of bituminous coal decreased 188,860 tons, or 25.7 per cent, but the output of lignite increased 123,219 tons, or 13 per cent. The average value per ton for all coal increased to $3.75. The average value per ton of bituminous coal was $5.11, as compared with $4.16 in 1919, and that of lignite $3.06, as compared with $1.55. The total number of men employed at all mines decreased 694, but the average daily output per worker increased from 2.03 to 2.26 tons. The average number of days in which the bituminous coal mines were in operation rose to 243, and the average for the lignite mines was just 1 day less. Strikes involved 824 men, who were out for an average of 12 days, as compared with 1,747 men, who were out for an average of 30 days in 1919.

In 1921 the total output decreased to 972,839 tons, valued at $2,563,600, a decrease, as compared with 1920, of 642,176 tons, or 39.8 per cent. The output of bituminous coal decreased 334,589 tons, or 61.4 per cent, below that in 1920; the output of lignite dropped to 762,201 tons, a decrease of 307,587 tons, or 28.7 per cent. Owing to a decrease in the average value per ton of lignite from $3.06 to $1.74 the average value of all coal was only $2.64 per ton, although the average value of bituminous coal increased to $5.89. There was a slight decrease in the total number of employees, but an increase of 0.16 ton in the average daily output per employee. The average number of days worked in the bituminous coal mines, however, fell to 121 and in the lignite mines to 161 days. No strike losses were reported in 1921—a record matched only by that of Georgia and Virginia.

Coal produced in Texas in 1919–1921.

Kind.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground.		Surface.	Total.	
					Miners.[a]	All others.			
1919.									
Bituminous [b]	709,444	2,775	21,868	734,087	1,783		431	2,214	228
Lignite [c]	920,351	1,145	25,073	946,569	1,235		195	1,430	225
	1,629,795	3,920	46,941	1,680,656	3,018		626	3,644	227
1920.									
Bituminous [b]	522,639	3,653	18,935	545,227	1,036	401	242	1,679	243
Lignite [d]	1,053,070	1,870	14,848	1,069,788	846	290	135	1,271	242
	1,575,709	5,523	33,783	1,615,015	1,882	691	377	2,950	242
1921.[e]									
Bituminous [f]	196,004	2,286	12,348	210,638	1,077	351	168	1,596	121
Lignite [g]	751,585	405	10,211	762,201	912	258	126	1,296	161
	947,589	2,691	22,559	972,839	1,989	609	294	2,892	139

[a] Includes also loaders and shot firers.
[b] Erath, Maverick, Palo Pinto, Webb, Wise, and Young counties.
[c] Bastrop, Fayette, Henderson, Hopkins, Houston, Leon, Medina, Milam, Nacogdoches, Titus, and Wood counties.
[d] Bastrop, Henderson, Hopkins, Houston, Lee, Leon, Medina, Milam, Nacogdoches, Shelby, and Wood counties.
[e] Exclusive of product of wagon mines.
[f] Erath, Maverick, Palo Pinto, Webb, and Wise counties.
[g] Bastrop, Henderson, Hopkins, Houston, Leon, Medina, Milam, Shelby, and Wood counties.

Value of coal produced in Texas in 1919–1921.

Kind.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.
1919.				
Bituminous: [a]				
Total	$3,009,696	$14,423	$32,439	$3,056,558
Average value per ton	4.24	5.20	1.48	4.16
Lignite: [b]				
Total	1,435,409	2,040	33,633	1,471,082
Average value per ton	1.56	1.78	1.34	1.55
	4,445,105	16,463	66,072	4,527,640
Average value per ton	2.73	4.20	1.41	2.69
1920.				
Bituminous: [a]				
Total	2,718,000	21,000	48,000	2,787,000
Average value per ton	5.20	5.75	2.53	5.11
Lignite: [c]				
Total	3,241,000	4,000	30,000	3,275,000
Average value per ton	3.08	2.14	2.02	3.06
	5,959,000	25,000	78,000	6,062,000
Average value per ton	3.78	4.53	2.31	3.75
1921.[d]				
Bituminous: [e]				
Total	1,196,000	12,000	33,000	1,241,000
Average value per ton	6.10	5.25	2.67	5.89
Lignite: [f]				
Total	1,302,700	1,200	18,700	1,322,600
Average value per ton	1.73	2.96	1.83	1.74
	2,498,700	13,200	51,700	2,563,600
Average value per ton	2.64	4.90	2.29	2.64

[a] Erath, Maverick, Palo Pinto, Webb, Wise, and Young counties.
[b] Bastrop, Fayette, Henderson, Hopkins, Houston, Leon, Medina, Milam, Nacogdoches, Titus, and Wood counties.
[c] Bastrop, Henderson, Hopkins, Houston, Lee, Leon, Medina, Milam, Nacogdoches, Shelby, and Wood counties.
[d] Exclusive of product of wagon mines.
[e] Erath, Maverick, Palo Pinto, Webb, and Wise counties.
[f] Bastrop, Henderson, Hopkins, Houston, Leon, Medina, Milam, Shelby, and Wood counties.

Coal produced in Texas, 1917–1921, in net tons.

Kind.	1917	1918	1919	1920	1921	Decrease, 1921.
Bituminous [a]	1,259,276	1,074,183	734,087	545,227	210,638	334,589
Lignite [b]	1,096,539	1,186,952	946,569	1,069,788	762,201	307,587
	2,355,815	2,261,135	1,680,656	1,615,015	972,839	642,176
Total value	$4,177,608	$5,937,997	$4,527,640	$6,062,000	$2,563,600	$3,498,400

[a] Includes Erath, Maverick, Palo Pinto, Webb, Wise, and Young counties in 1917, 1918, 1919, and 1920; Erath, Maverick, Palo Pinto, Webb, and Wise counties in 1921.

[b] Includes Bastrop, Henderson, Hopkins, Houston, Leon, Medina, Milam, Robertson, Titus, and Wood counties in 1917 and 1918; Bastrop, Fayette, Henderson, Hopkins, Houston, Leon, Medina, Milam, Nacogdoches, Titus, and Wood counties in 1919; Bastrop, Henderson, Hopkins, Houston, Lee, Leon, Medina, Milam, Nacogdoches, Shelby, and Wood counties in 1920; Bastrop, Henderson, Hopkins, Houston, Leon, Medina, Milam, Shelby, and Wood counties in 1921.

UTAH.

In 1919 the production of coal in Utah dropped to 4,631,323 tons, valued at $12,760,613. As compared with 1918 this represented a decrease of 505,502 tons, or 9.8 per cent, in quantity and $1,176,484, or 8.4 per cent, in value. The average value per ton, however, was 5 cents higher than in 1918. All the producing counties made a decrease in output. Utah was one of the States that reported a smaller working force in 1919 than in 1918, but contrary to the general tendency in the country as a whole the decrease in the number of underground employees was greater than in the total number of workers. The average number of days in which the mines were in operation dropped from 258 to 239. Despite these facts, the average tonnage per man per day increased from 4.79 to 5.03 tons, the largest average for any State in the Union. The losses by strikes were small: only 317 men were involved, and the average loss was 15 days per man striking. The total loss was 4,866 man-days, the smallest reported except for Georgia and North Dakota, neither of which can be compared with Utah in production.

In 1920 the State established a new maximum record for production by mining 6,005,199 tons, valued at $19,350,000. As compared with the preceding year this represents an increase of 1,373,876 tons, or 29.7 per cent, in quantity, and of $6,589,387, or 51.6 per cent, in value. The average value per ton increased from $2.76 to $3.22. Every county but Uintah shared in the increase. Carbon County, however, led with an increase of 1,205,200 tons. The increase in output was due to three causes—the working force was augmented by 647, though the number of surface employees decreased by 203; the average number of days on which the mines were in operation increased to 252 and the average output per man per day to 5.29 tons. The losses by strikes were negligible; during the year only 113 men were involved for an average of 7 days, and the total loss was 791 man-days. During the same year Georgia and New Mexico were free from strikes, and the man-day loss in North Dakota was 473.

The production in 1921, exclusive of that of small mines, was 4,078,784 tons, valued at $13,662,000, a decrease, as compared with that in 1920, of 1,926,415 tons, or 32.1 per cent, in quantity, and of $5,688,000, or 29.4 per cent, in value. The average value per ton, however, increased to $3.35. The decline in the output of Carbon County was 1,611,561 tons. There was a slight decrease in the total number of employees and in the number of surface workers.

Mr. C. A. Allen, the engineer of the Industrial Commission of Utah, with whom the Geological Survey cooperates in collecting statistics for the State, reports that the figure showing the average number of days worked in 1921 does not give a correct measure of the time the mines were operated. The average given is based on tipple time, and for 1921 it is 151 days. Mr. Allen observes that in 1921 certain mines continued to operate during the period of depression, but with reduced working forces. Coal might therefore have been loaded every day underground, but the tipple might be operated only on alternate days, so that an average based on tipple time would understate the number of days worked and overstate the average daily production. The figures for 1921 would lead to such an error, for they indicate a remarkable increase in the output per man employed per day worked, which rose from 5.29 tons in 1920 to 6.10 tons in 1921.

A further explanation of the continued leadership in Utah in the average daily output per employee is found in the exceptionally favorable physical conditions prevailing in the mines, particularly in the thickness of the seams worked. A study of production classified in this manner, made in a report by the Geological Survey,[8] showed that in 1917 83.7 per cent of the output of coal in Utah was recovered from seams ranging from 8 to 17 feet in thickness, as compared with 12.6 per cent of the output of the country as a whole from such seams. In 1917 Utah mined 34.1 per cent of its coal from seams ranging from 16 to 17 feet in thickness, as against only 0.4 per cent of the total bituminous output in the country as a whole from like seams.

Coal produced in Utah in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground.		Surface.	Total.	
						Miners.[a]	All others.			
1919.										
Carbon	[b] 3,565,322	70,155	75,605	396,920	4,108,002	2,419		1,006	3,425	239
Emery	[c] 325,016	9,697	341		335,054	132		96	228	250
Grand and Iron	112,112	2,695	3,360		118,167	88		21	109	223
Summit	49,014	3,468	2,400		54,882	50		15	65	219
Uintah		9,929			9,929	20		10	30	262
Small mines		5,289			5,289					
	4,051,464	101,233	81,706	396,920	4,631,323	2,709		1,148	3,857	239
1920.										
Carbon	4,797,494	31,472	96,653	387,583	5,313,202	2,151	1,007	842	4,000	253
Emery	472,487	9,883	458		482,828	156	58	53	267	261
Grand and Iron	124,827	2,906	4,444		132,177	63	44	26	133	211
Summit	60,159	1,968	3,226		65,353	35	24	18	77	256
Uintah		9,190	38		9,228	16	5	6	27	205
Small mines		2,411			2,411					
	5,454,967	57,830	104,819	387,583	6,005,199	2,421	1,138	945	4,504	252

[a] Includes also loaders and shot firers.
[b] In addition 13,970 tons, which was included in the production for earlier years, was shipped from storage piles.
[c] In addition 4,836 tons, which was included in the production for earlier years, was shipped from storage piles.

[8] U. S. Geol. Survey Mineral Resources, 1917, pt. 2, p. 944, 1920.

Coal produced in Utah in 1919–1921—Continued.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground.		Surface.	Total.	
						Miners.[a]	All others.			
1921.[d]										
Carbon	3,314,553	55,832	69,203	262,053	3,701,641	2,178	929	851	3,958	156
Emery	231,525	9,284	469	....	241,278	161	50	44	255	95
Grand, Iron, and San Pete	69,569	2,247	2,064	....	73,880	60	31	13	104	83
Summit	53,014	3,618	1,539	....	58,171	47	27	21	95	186
Uintah	....	3,724	90	....	3,814	4	4	2	10	185
	3,668,661	[e] 74,705	73,365	262,053	[e]4,078,784	2,450	1,041	931	4,422	151

[a] Includes also loaders and shot firers.
[d] Exclusive of product of wagon mines.
[e] In addition to this amount, 11,611 tons was produced by small mines and sold to local trade. The total production of the State was therefore 4,090,395 tons, and the total sold to local trade and used by employees was 86,316 tons.

Value of coal produced in Utah in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Carbon	$10,951,034	$177,622	$152,126	([a])	$11,280,782	$2.75
Emery	967,957	23,184	683	....	991,824	2.96
Grand and Iron	271,665	8,742	8,639	....	289,046	2.45
Summit	117,463	12,657	5,000	....	135,120	2.46
Uintah	....	46,257	....	....	46,257	4.66
Small mines	....	17,584	....	....	17,584	3.32
	12,308,119	286,046	166,448	([a])	12,760,613	....
Average value per ton	3.04	2.83	2.04	([a])	2.76	2.76
1920.						
Carbon	16,843,000	88,000	221,000	([a])	17,152,000	3.23
Emery	1,501,000	28,000	1,000	....	1,530,000	3.17
Grand and Iron	398,000	11,000	14,000	....	423,000	3.20
Summit	174,000	8,000	8,000	....	190,000	2.91
Uintah	....	46,000	....	....	46,000	4.98
Small mines	....	9,000	....	....	9,000	3.73
	18,916,000	190,000	244,000	([a])	19,350,000	....
Average value per ton	3.47	3.29	2.33	([a])	3.22	3.22
1921.[c]						
Carbon	11,970,000	165,000	174,000	([a])	12,309,000	3.33
Emery	842,000	26,000	2,000	....	870,000	3.61
Grand, Iron, and San Pete	278,000	9,000	9,000	....	296,000	4.00
Summit	153,000	13,000	4,000	....	170,000	2.92
Uintah	....	17,000	([b])	....	17,000	4.54
	13,243,000	230,000	189,000	([a])	13,662,000	....
Average value per ton	3.61	3.08	2.58	....	3.35	3.35

[a] Value of coal made into coke at the mines included in that of coal loaded at mines for shipment.
[b] Included in value of coal sold to local trade and used by employees.
[c] Exclusive of product of wagon mines.

Coal produced in Utah, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Decrease, 1921.
Carbon	3,701,891	4,607,192	4,108,002	5,313,202	3,701,641	1,611,561
Emery	[a] 377,727	[a] 453,172	335,054	482,828	241,278	241,550
Grand	([a])	([a])	[b] 118,167	[b] 132,177	[b] 73,880	[b] 58,297
Summit } Uintah }	38,140	67,641	54,882	65,353	58,171	7,182
			9,929	9,228	3,814	5,414
Small mines	[c] 7,472	[c] 8,820	5,289	2,411	....	2,411
	4,125,230	5,136,825	4,631,323	6,005,199	4,078,784	1,926,415
Total value	$8,531,382	$13,937,097	$12,760,613	$19,350,000	$13,662,000	$5,688,000

[a] Emery County includes Grand.
[b] Grand County includes Iron County in 1919 and 1920: Iron and San Pete counties in 1921.
[c] Small mines include Iron County in 1917 and 1918.

VIRGINIA.

In 1919 Virginia produced 9,326,830 tons, valued at $23,774,941, a loss of 962,978 tons, or 9.4 per cent, in quantity and of $2,090,954, or 8.1 per cent, in value as compared with 1918. Dickenson County, which ranked fifth in output among the counties in Virginia in 1918, more than quadrupled its output in 1919 without changing its relative position. The average value per ton increased 4 cents in 1919 over that in 1918. The working force in 1919 increased about 5 per cent, but the number of surface employees slightly decreased. The average daily output per worker declined from 3.38 to 3.26 tons. A reduction in the average number of days worked contributed to the reduction in output. The losses by strikes involved 947 men for an average of 24 days, and the total loss was 22,956 man-days.

Virginia established a record for maximum production in 1920, when the total output was 11,378,606 tons, valued at $45,446,000, an increase over the record for 1919 of 2,051,776 tons, or 22 per cent, in quantity and of $21,671,059, or 91.2 per cent, in value. Every county shared in the increase, and the output in Wise County exceeded that in 1919 by 1,012,889 tons. The average value per ton, $3.99, also represents a high record for the State. An increase in the number of employees from 11,586 to 14,010 (including an increase of 1,342 in the number of surface workers) contributed greatly to the larger production, although there was also a small increase in the average number of days worked. The efficiency of the labor employed as measured by the average output per man per day declined still further, falling to 3.06 tons, so that the yearly output per worker, despite the greater number of days in which the mines were in operation, was 2 tons less than in 1919. The losses by strikes were insignificant, involving only 48 men an average of 36 days.

The industrial depression in 1921 brought the output of the State down to 7,492,378 tons, valued at $22,947,700, a decrease, as compared with 1920, of 3,886,228 tons, or 34.2 per cent, in quantity, and of $22,498,300, or 49.5 per cent, in value. The average value per ton declined to $3.06. The largest reductions in output were those in Russell County, which lost 579,029 tons, and Wise County, which lost 2,593,172 tons. The working force was reduced 2,088, the reduction including 1,342 top men. The average number of days in which the mines were in operation dropped to 166, but the average daily output per man rose to 3.78 tons, the first increase in three years. The year passed without a strike in this State.

Coal produced in Virginia in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
						Underground.				
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Miners.[a]	All others.	Surface.	Total.	
1919.										
Dickenson	455,607	5,017	11,435	....	472,059	595		260	855	244
Lee	671,585	4,469	2,963	....	679,017	959		214	1,173	204
Montgomery	27,681	11,480	4,920	....	44,081	98		41	139	262
Russell	1,762,728	32,470	6,409	....	1,801,607	1,673		371	2,044	227
Tazewell	1,158,762	25,021	25,031	....	1,208,814	1,444		328	1,772	222
Wise	3,424,842	80,270	59,011	1,485,313	5,049,436	4,633		867	5,500	273
Other counties [b] and small mines	57,302	6,706	7,808	....	71,816	69		34	103	191
	7,558,507	165,433	117,577	1,485,313	9,326,830	9,471		2,115	11,586	247
1920.										
Dickenson	594,777	5,998	14,129	....	614,904	461	318	191	970	263
Lee	923,414	11,798	10,913	....	946,125	777	372	328	1,477	208
Montgomery	33,359	5,751	5,140	....	44,250	68	37	31	136	193
Russell	2,078,286	37,844	6,761	....	2,122,891	1,085	695	409	2,189	253
Tazewell	1,270,524	25,356	27,832	....	1,323,712	779	613	620	2,012	217
Wise	4,235,936	180,990	22,900	1,622,499	6,062,325	2,648	2,506	1,740	6,894	290
Other counties [b]	83,326	31,236	15,337	....	129,899	119	75	138	332	272
	9,219,622	298,973	103,012	1,622,499	11,244,106	5,937	4,616	3,457	14,010	262
Small mines	134,200	300	....	....	134,500	....	....	....	....	....
	9,353,822	299,273	103,012	1,622,499	11,378,606	....	....	....	....	....
1921.[c]										
Chesterfield and Pulaski	24,173	13,931	14,312	....	52,416	78	35	41	154	258
Dickenson	433,955	4,528	9,904	....	448,387	281	229	145	655	191
Lee	677,029	7,952	2,947	....	687,928	748	390	253	1,391	159
Montgomery	25,368	5,752	5,610	....	36,730	61	24	20	105	189
Russell	1,514,803	22,481	6,578	....	1,543,862	873	597	484	1,954	171
Tazewell	1,199,618	25,455	28,829	....	1,253,902	836	806	278	1,920	195
Wise	2,943,232	72,630	30,770	422,521	3,469,153	2,874	1,975	894	5,743	153
	6,818,178	152,729	98,950	422,521	7,492,378	5,751	4,056	2,115	11,922	166

[a] Includes also loaders and shot firers.
[b] Pulaski and Scott.
[c] Exclusive of product of wagon mines.

Value of coal produced in Virginia in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Dickenson	$1,156,046	$11,902	$28,380		$1,196,328	$2.54
Lee	1,805,991	6,833	7,486		1,820,310	2.68
Montgomery	88,018	71,321	14,380		173,719	3.94
Russell	4,305,075	72,914	15,886		4,393,875	2.44
Tazewell	3,240,080	63,356	61,393		3,364,829	2.78
Wise	8,561,844	181,774	153,698	$3,746,631	12,643,947	2.50
Other counties [a] and small mines	144,688	17,695	19,550		181,933	2.53
	19,301,742	425,795	300,773	3,746,631	23,774,941	
Average value per ton	2.55	2.57	2.56	2.52	2.55	2.55
1920.						
Dickenson	2,448,000	17,000	45,000		2,510,000	4.08
Lee	3,986,000	28,000	31,000		4,045,000	4.27
Montgomery	129,000	24,000	15,000		168,000	3.80
Russell	7,642,000	79,000	30,000		7,751,000	3.65
Tazewell	6,457,000	67,000	86,000		6,610,000	4.99
Wise	17,019,000	512,000	92,000	5,324,000	22,947,000	3.78
Other counties [a]	454,000	51,000	43,000		548,000	4.22
	38,135,000	778,000	342,000	5,324,000	44,579,000	3.96
Small mines	866,000	1,000			867,000	6.45
	39,001,000	779,000	342,000	5,324,000	45,446,000	
Average value per ton	4.17	2.60	3.32	3.28	3.99	3.99
1921.[b]						
Chesterfield and Pulaski	141,500	26,200	36,000		203,700	3.89
Dickenson	1,337,000	13,000	28,000		1,378,000	3.07
Lee	1,904,000	16,000	7,000		1,927,000	2.80
Montgomery	110,000	25,000	20,000		155,000	4.22
Russell	4,575,000	49,000	15,000		4,639,000	3.00
Tazewell	3,852,000	66,000	71,000		3,989,000	3.18
Wise	9,183,000	196,000	76,000	1,201,000	10,656,000	3.07
	21,102,500	391,200	253,000	1,201,000	22,947,700	
Average value per ton	3.09	2.56	2.56	2.84	3.06	3.06

[a] Pulaski and Scott.
[b] Exclusive of product of wagon mines.

Coal produced in Virginia, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Decrease, 1921.
Dickenson	13,593	110,931	472,059	614,904	448,387	166,517
Lee	871,642	888,400	679,017	946,125	687,928	258,197
Montgomery	[a] 127,836	[a] 131,448	44,081	44,250	36,730	7,520
Pulaski	(a)	(a)	[b] 65,592	[b] 129,899	[b] 52,416	[b] 77,483
Russell	2,000,540	1,998,144	1,801,607	2,122,891	1,543,862	579,029
Tazewell	1,631,849	1,624,736	1,208,814	1,323,712	1,253,902	69,810
Wise	5,427,455	5,514,132	5,049,436	6,062,325	3,469,153	2,593,172
Small mines	14,176	22,017	6,224	134,500		134,500
	10,087,091	10,289,808	9,326,830	11,378,606	7,492,378	3,886,228
Total value	$20,125,713	$25,865,895	$23,774,941	$45,446,000	$22,947,700	$22,498,300

[a] Montgomery County included Pulaski and Wythe in 1917; Pulaski and Scott in 1918.
[b] Pulaski County includes Scott in 1919 and 1920; Chesterfield in 1921.

WASHINGTON.

In 1919 the production of coal in the State of Washington dropped to 2,990,447 tons, valued at $10,691,222, a loss, as compared with the high-record year, 1918, of 1,091,765 tons, or 26.7 per cent, in quantity and $3,441,647, or 24.4 per cent, in value. The percentage of the loss in value was less because the average value per ton increased from \$3 46 to \$3.58. The heaviest decrease was in Kittitas County, but no county escaped loss. The reduction in tonnage was due chiefly to a decrease in the number of days worked, 217 in 1919, as against 275 in 1918, and a decrease in the average daily output per worker from 2.91 to 2.74 tons. The decrease in the number of men employed, less than 1.5 per cent, was negligible. The losses by strikes, however, largely aided in curtailing production. During the year 4,369 men were out an average of 43 days, so that strikes caused a loss of 186,942 man-days.

In 1920, under the improved industrial conditions, the production rose to 3,757,093 tons, valued at \$14,560,000, which was an increase of 766,646 tons, or 25.6 per cent, in quantity, and of \$3,868,778, or 36.2 per cent, in value. The average value per ton increased to \$3.88. Every county reported a larger output, and the Roslyn field, in Kittitas County, again made the greatest gain. Increased efficiency as measured in daily output (probably due to the greater number of underground workers employed, although the total working force was slightly reduced) and more days worked explain the larger output for the year. The average daily output per man increased to 2.89 tons, 0.02 ton less than in 1918, when the maximum output recorded was made, and the average number of days in which the mines were in operation increased to 260. Losses by strikes, both in the number of men involved and the man-day loss, decreased considerably, but as 201 workers were on a strike for an average of 114 days each, Washington headed the list in the average time lost per man striking.

In 1921 the production in Washington was the lowest since 1899. The total output for the year, 2,428,722 tons, valued at \$9,787,000, represented a loss of 1,328,371 tons, or 35.4 per cent, in quantity, and of \$4,773,000, or 32.8 per cent, in value, as compared with 1920. The average value per ton, however, rose to \$4.03. The working force was 660 less than in 1920, and the number of surface employees was 180 less. The average number of days in which the mines were in operation fell to 159, but the average daily output per worker increased to 3.52 tons. In 1921, as in 1920, Washington led in the average number of days lost per man striking, which was 173, and the strikes involved 802 men.

Coal produced in Washington in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.										
King	826,126	32,195	73,522	....	931,843	1,277		566	1,843	218
Kittitas	1,230,096	18,149	62,141	....	1,310,386	1,454		327	1,781	220
Lewis	109,242	16,624	8,624	....	134,490	190		45	235	200
Pierce	271,112	6,211	22,981	54,800	355,104	640		214	854	211
Thurston, Whatcom, and Skagit	244,668	5,971	7,985	....	258,624	240		83	323	230
	2,681,244	79,150	175,253	54,800	2,990,447	3,801		1,235	5,036	217

[a] Includes also loaders and shot firers.

Coal produced in Washington in 1919–1921—Continued.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1920.										
King	907,294	30,940	37,132	....	975,366	769	592	391	1,752	244
Kittitas	1,749,564	20,602	67,773	....	1,837,939	885	511	277	1,673	292
Lewis	124,593	16,290	10,803	....	151,686	148	81	42	271	201
Pierce	331,230	8,307	26,166	47,876	413,579	360	307	237	904	257
Thurston, Whatcom, and Skagit	354,103	11,524	8,896	....	374,523	225	88	81	394	241
	3,466,784	87,663	150,770	47,876	3,753,093	2,387	1,579	1,028	4,994	260
Small mines	4,000	....	....	....	4,000	....	....	......	....	....
	3,470,784	87,663	150,770	47,876	3,757,093	....	....	......	....	....
1921.[b]										
King	316,597	11,904	13,045	....	341,546	576	523	310	1,409	99
Kittitas	1,316,747	21,845	52,937	....	1,391,529	1,149	402	288	1,839	194
Lewis	125,358	10,449	3,630	....	139,437	75	56	45	176	225
Pierce	86,778	2,297	7,151	6,291	102,517	184	168	102	454	129
Skagit and Whatcom	180,500	10,951	5,372	....	196,823	146	52	57	255	277
Thurston	248,222	2,198	6,450	....	256,870	111	44	46	201	202
	2,274,202	59,644	88,585	6,291	2,428,722	2,241	1,245	848	4,334	159

[a] Includes also loaders and shot firers. [b] Exclusive of product of wagon mines.

Value of coal produced in Washington in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
King	$3,436,618	$141,956	$279,393	....	$3,857,967	$4.14
Kittitas	3,947,106	42,607	114,562	....	4,104,275	3.13
Lewis	283,748	57,296	24,899	....	365,943	2.72
Pierce	1,335,155	25,503	94,136	$248,666	1,703,460	4.80
Thurston, Whatcom, and Skagit	610,511	29,367	19,699	....	659,577	2.55
	9,613,138	296,729	532,689	248,666	10,691,222	....
Average value per ton	3.59	3.75	3.04	4.54	3.58	3.58
1920.						
King	3,749,000	156,000	154,000	....	4,059,000	4.16
Kittitas	6,670,000	52,000	139,000	....	6,861,000	3.73
Lewis	382,000	55,000	30,000	....	467,000	3.08
Pierce	1,681,000	40,000	93,000	286,000	2,100,000	5.08
Thurston, Whatcom, and Skagit	969,000	64,000	24,000	....	1,057,000	2.82
	13,451,000	367,000	440,000	286,000	14,544,000	3.88
Small mines	16,000	....	....	....	16,000	4.00
	13,467,000	367,000	440,000	286,000	14,560,000	....
Average value per ton	3.88	4.19	2.92	5.97	3.88	3.88
1921.[a]						
King	936,000	61,000	56,000	....	1,053,000	3.08
Kittitas	5,609,000	55,000	102,000	....	5,766,000	4.14
Lewis	409,000	34,000	6,000	....	449,000	3.22
Pierce	530,000	14,000	36,000	33,000	613,000	5.98
Skagit and Whatcom	800,000	72,000	23,000	....	895,000	4.55
Thurston	993,000	5,000	13,000	....	1,011,000	3.94
	9,277,000	241,000	236,000	33,000	9,787,000	....
Average value per ton	4.08	4.04	2.66	5.25	4.03	4.03

[a] Exclusive of product of wagon mines.

Coal produced in Washington, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
King	1,313,976	1,318,152	931,843	975,366	341,546	−633,820
Kittitas	1,743,639	1,733,408	1,310,386	1,837,939	1,391,529	−446,410
Lewis	133,051	150,247	134,490	151,686	139,437	−12,249
Pierce	608,767	600,471	355,104	413,579	102,517	−311,062
Thurston and Whatcom[a]	210,469	279,934	258,624	378,523	453,693	+75,170
	4,009,902	4,082,212	2,990,447	3,757,093	2,428,722	−1,328,371
Total value	$10,727,362	$14,132,869	$10,691,222	$14,560,000	$9,787,000	−$4,773,000

[a] Includes Skagit County in 1917-1921 and small mines in 1920.

WEST VIRGINIA.

In 1919 West Virginia produced 79,036,553 tons of coal, valued at $196,551,015. As compared with the output in 1918 this was a decrease of 10,899,286 tons, or 12.1 per cent, in quantity and of $33,957,831, or 14.7 per cent, in value. The average value per ton decreased from $2.56 to $2.49. Heavy losses were made in the regions that produce smokeless coal and in the fields in southern West Virginia that produce coal containing a high percentage of volatile matter. The Panhandle district, which includes Brooke, Hancock, Marshall, and Ohio counties, showed a slight increase, every county in that district gaining except Marshall. There was a decline of over 1,000,000 tons in the Elk Garden district, which includes Grant, Mineral, Randolph, and Tucker counties. The working force was 94,705 men, as against 89,530 in 1918, but the increase was confined to the underground employees. The number of days on which the mines were in operation dropped from 238 to 200 and the average output per man per day from 4.22 to 4.18 tons.

A new record of production was established in 1920, when the total output for the State was 89,970,707 tons, valued at $390,046,000, an increase over 1919 of 10,934,154 tons, or 13.8 per cent, and of $193,494,985, or 98.4 per cent, in value. The average value per ton jumped to $4.34. The Mingo field (Mingo and Wayne counties) alone showed a decrease, its production dropping from 2,951,460 to 1,924,496 tons. The loss may be attributed, in great part at least, to long-continued labor troubles in 1920 and 1921. The smallest increase was made in the Pocahontas region, embracing McDowell and Mercer counties, where, despite the widespread demand for low-volatile coals, both for domestic and export shipment, the increase in output over 1919 was only 22,566 tons. On the other hand, the Fairmont region, in the northern part of the State, including Monongalia, Marion, Harrison, Lewis, Gilmer, and Braxton counties, showed an increase of 3,239,440 tons, and the New River and Kanawha districts combined, including Fayette, Raleigh, Wyoming, Kanawha, Nicholas, Clay, Putnam, Lincoln, Logan, and Boone counties, showed an increase of more than 3,750,000 tons. The total working force increased 8,245, but the entire gain was in underground workers, though the decrease in the number of surface employees was small. Something of the toll imposed by the railroad difficulties that followed the "outlaw" switchmen's strike in the spring of 1920 is shown by the decrease to 198 in the average number of days on which the mines were in operation. Kentucky was the only other large producing State that reported a smaller average number of days worked in 1920 than in 1919. The rapid growth of the mining industry in eastern Kentucky was perhaps followed by some retrenchment. Both West Virginia and Kentucky were called upon to supply in large part the deficit created by strikes in the organized fields in November and December, 1919, and the mines in these States afterward suffered some loss of business. Cars were thrown out of the normal channels on unusual hauls, and for months after the strike ended the car supply remained short. Although the average time lost per striking employee was greater in 1920 than in 1919—41 days as compared with 24—the average loss in man-days was less because fewer men were involved. In 1919 there were 48,062 men on strike and the total loss was 1,158,094 man-days; in 1920 there were only 12,340 men on strike and the loss decreased to 511,225 man-days.

In 1921 the production dropped to 72,786,996 tons, valued at $206,661,500, which represents a loss of 17,183,711 tons, or 19.1 per cent, in quantity, and of $183,384,500, or 47 per cent, in value. The average value per ton declined to $2.84. The Logan and Mingo districts alone showed increase, the Logan district gaining approximately 857,000 tons and the Mingo district 4,486 tons. The decrease in the Panhandle region was small. The output in the Fairmont region decreased nearly 3,300,000 tons; in the Preston-Barbour region approximately 2,800,000 tons; in the Elk Garden district 1,400,000 tons; in the Kanawha and New River districts about 6,400,000 tons; and in McDowell and Mercer counties 2,647,000 tons. The average number of days on which the mines were in operation dropped to 149. The working force was reduced by 1,100, but the number of men employed above ground was reduced by 2,959. The average output per worker per day rose from 4.39 to 4.79 tons. The losses by strikes diminished: 7,198 men were out for an average of 24 days each, and the strike caused a total loss of 170,017 man-days.

Coal produced in West Virginia in 1919–1921.

County.	Production (net tons).					Number of employees.				Average number of days worked.
						Underground.				
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Miners.[a]	All others.	Surface.	Total.	
1919.										
Barbour	1,225,353	8,772	24,925	21,135	1,280,185	1,470		321	1,791	157
Boone	1,329,725	19,719	22,108		1,371,552	1,612		431	2,043	177
Braxton	344,385	30,764	6,718		381,867	338		109	447	215
Brooke	1,172,954	225,536	9,595		1,408,085	1,158		215	1,373	199
Clay	449,317	4,415	8,753		462,485	420		152	572	189
Fayette	7,256,720	179,554	96,494	505,862	8,038,630	9,101		2,615	11,716	198
Gilmer	73,763	1,855	3,914		79,532	58		46	104	165
Grant	230,387	1,557	6,041		237,985	242		135	377	207
Hancock	878	15,500			16,378	20			20	246
Harrison	4,715,459	73,035	33,351	2,782	4,824,627	4,479		1,088	5,567	172
Kanawha	4,912,128	101,499	55,298		5,068,925	6,219		1,507	7,726	173
Lewis	47,174	1,764			48,938	98		33	131	135
Lincoln	179,655	2,531	4,152		186,338	276		94	370	134
Logan	9,457,615	191,121	48,460	4,124	9,701,320	7,300		2,004	9,304	195

[a] Includes also loaders and shot firers.

Coal produced in West Virginia in 1919–1921—Continued.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.										
McDowell	15,362,678	286,815	296,804	833,759	16,780,056	13,190		4,323	17,513	233
Marion	4,672,547	52,302	154,095	79,208	4,958,152	4,237		939	5,176	205
Marshall	544,691	388,186	21,391	....	954,268	1,099		150	1,249	199
Mason	72,226	38,707	3,420	....	114,353	280		58	338	125
Mercer	2,581,576	34,736	21,698	71,395	2,709,405	2,436		620	3,056	227
Mineral	360,403	5,670	3,397	....	369,470	692		212	904	139
Mingo	2,744,066	106,344	58,384	....	2,908,794	2,719		912	3,631	225
Monongalia	2,431,798	69,884	4,088	16,334	2,522,104	2,085		638	2,723	172
Nicholas	178,929	18,990	6,954	1,353	206,226	298		67	365	176
Ohio	716,201	203,433	5	....	919,639	1,050		159	1,209	220
Preston	1,079,531	176,745	22,529	76,648	1,355,453	1,583		456	2,039	203
Putnam	291,609	3,920	13,429	....	308,958	603		143	746	185
Raleigh	6,692,862	117,016	86,818	....	6,896,696	5,987		1,669	7,656	207
Randolph	735,579	17,386	13,824	92,636	859,425	623		149	772	226
Taylor	953,280	8,922	12,463	....	974,665	1,125		212	1,337	152
Tucker	1,015,166	10,038	40,048	10,348	1,075,600	1,266		210	1,476	211
Upshur	547,758	13,614	7,711	2,314	571,397	713		194	907	186
Wayne	41,698	584	384	....	42,666	125		40	165	125
Webster	28,523	18,205	....	....	46,728	86		9	95	203
Wyoming	1,153,940	13,135	8,360	....	1,175,435	1,141		405	1,546	190
Other counties[b]	71,953	59,066	1,621	....	132,640	221		40	261	180
Small mines	....	47,576	....	....	47,576	.....		.....	.....	....
	73,672,527	2,548,896	1,097,232	1,717,898	79,036,553	74,350		20.355	94,705	200
1920.										
Barbour	1,820,807	12,224	28,408	34,186	1,895,625	1,183	612	429	2,224	172
Boone	1,561,448	30,729	21,532	....	1,613,709	1,043	636	396	2,075	155
Braxton	334,499	6,637	6,881	....	348,017	380	166	124	670	216
Brooke	1,166,508	535,836	9,368	....	1,711,712	968	343	364	1,675	239
Clay	495,469	13,642	10,253	....	519,364	354	203	159	716	195
Fayette	8,085,671	214,618	90,908	624,703	9,015,900	6,323	3,760	2,051	12,134	201
Gilmer	114,606	3,078	5,109	....	122,793	91	71	49	211	140
Grant	253,042	1,702	7,795	....	262,539	168	112	68	348	214
Hancock	3,016	6,859	....	....	9,875	14	5	4	23	219
Harrison	5,951,274	70,346	26,183	5,703	6,053,506	3,423	1,885	1,122	6,430	176
Kanawha	6,272,010	105,801	48,233	....	6,426,044	4,252	2,192	1,455	7,899	197
Lewis	71,623	1,528	....	....	73,151	85	31	22	138	163
Lincoln	281,876	3,079	7,460	....	292,415	235	92	82	409	163
Logan	10,311,704	261,761	51,170	2,628	10,627,263	4,647	3,680	1,977	10,304	172
McDowell	15,441,990	232,289	275,318	869,551	16,819,148	6,889	6,117	4,192	17,198	221
Marion	5,239,547	42,661	151,730	264,938	5,698,876	2,827	1,813	1,042	5,682	181
Marshall	678,616	546,625	26,306	....	1,251,547	644	331	286	1,261	231
Mason	162,833	44,302	8,677	....	215,812	173	83	52	308	186
Mercer	2,573,988	50,729	18,487	49,675	2,692,879	1,291	1,211	767	3,269	217
Mineral	608,424	6,501	6,278	....	621,203	548	193	179	920	195
Mingo	1,805,262	22,417	29,792	....	1,857,471	1,724	1,198	656	3,578	151
Monongalia	3,603,680	125,420	10,283	53,558	3,792,941	1,929	1,048	613	3,590	191
Nicholas	243,907	19,625	9,156	20,533	293,221	220	123	69	412	223
Ohio	1,126,879	265,544	50	....	1,392,473	829	337	168	1,334	253
Preston	1,736,485	50,278	16,236	198,441	2,001,440	1,188	646	351	2,185	216
Putnam	318,665	9,248	11,179	....	339,092	469	268	134	871	212
Raleigh	7,548,866	140,487	70,350	....	7,759,703	4,286	2,923	1,845	9,054	202
Randolph	887,039	15,144	17,679	109,364	1,029,226	1,241	833	336	2,410	272
Taylor	1,098,694	6,629	11,769	....	1,117,092	776	376	218	1,370	177
Tucker	1,113,916	13,983	43,885	17,227	1,189,011	726	380	194	1,300	211
Upshur	679,798	18,679	9,586	19,097	727,160	448	220	135	803	176
Wayne	65,842	273	910	....	67,025	70	35	38	143	190
Webster	32,420	9,869	....	....	42,289	50	20	15	85	187
Wyoming	1,427,043	16,651	3,360	....	1,447,054	645	642	424	1,711	197
Other counties[c]	81,558	41,444	1,129	....	124,131	97	72	41	210	207
	83,199,005	2,946,638	1,035,460	2,269,604	89,450,707	50,236	32,657	20,057	102,950	198
Small mines	513,000	7,000	....	....	520,000	....	......	.....	......	....
	83,712,005	2,953,638	1,035,460	2,269,604	89,970,707	....	......	.....	......	....

[a] Includes also loaders and shot firers.
[b] Greenbrier, Summers, and Wetzel.
[c] Greenbrier and Summers.

Coal produced in West Virginia in 1919–1921—Continued.

County.	Production (net tons).					Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1921.[d]										
Barbour	966,561	13,814	24,024	43	1,004,442	1,111	513	267	1,891	114
Boone	1,156,322	15,247	8,539	....	1,180,108	1,330	596	373	2,299	118
Braxton	138,548	32,458	4,773	....	175,779	228	100	59	387	91
Brooke	879,797	647,379	4,281	....	1,531,457	1,526	372	254	2,152	182
Clay	593,324	19,661	7,542	....	620,527	463	168	160	791	205
Fayette	5,792,650	153,488	63,656	127,002	6,136,796	6,171	3,461	1,690	11,322	129
Grant	150,833	847	3,954	....	155,634	179	84	81	344	122
Greenbrier	110,557	32,818	1,546	....	144,921	207	91	58	356	103
Hancock	1,654	1,627	75	....	3,356	11	....	......	11	85
Harrison	3,623,794	130,544	13,226	....	3,767,564	3,878	1,609	949	6,436	110
Kanawha	3,842,356	93,462	19,401	....	3,955,219	3,993	2,020	1,433	7,446	126
Lewis	20,929	2,305	206	....	23,440	54	25	16	95	82
Lincoln	240,581	2,356	2,706	....	245,643	220	111	75	406	166
Logan	11,213,913	228,571	41,633	....	11,484,117	6,045	4,412	2,080	12,537	168
McDowell	13,184,559	207,600	232,851	78,486	13,703,496	7,119	5,624	3,411	16,154	163
Marion	4,566,535	196,337	138,393	37,609	4,938,874	3,420	1,691	887	5,998	160
Marshall	744,290	324,114	23,905	....	1,092,309	803	346	186	1,335	174
Mason	32,174	32,314	4,907	....	69,395	109	46	34	189	116
Mercer	2,964,327	107,419	15,873	73,891	3,161,510	1,667	1,305	687	3,659	232
Mineral	99,808	1,337	999	....	102,144	343	106	90	539	63
Mingo	1,766,828	99,180	27,715	....	1,893,723	1,536	1,097	593	3,226	155
Monongalia	3,747,064	91,255	1,494	....	3,839,813	2,566	970	621	4,157	142
Nicholas	117,944	11,614	3,642	....	133,200	180	83	49	312	120
Ohio	1,278,466	166,108	30	....	1,444,604	1,076	356	175	1,607	207
Preston	479,184	180,997	12,728	15,024	687,933	1,155	643	300	2,098	88
Putnam	272,003	5,046	11,281	....	288,330	470	246	108	824	191
Raleigh	7,012,640	119,682	68,580	....	7,200,902	4,422	3,008	1,471	8,901	153
Randolph	519,261	17,197	11,540	2,003	550,001	508	180	110	798	108
Taylor	503,549	5,147	8,153	....	516,849	712	313	185	1,210	90
Tucker	844,923	11,976	38,326	6,072	901,297	930	309	126	1,365	162
Upshur	488,411	11,625	8,938	....	508,974	433	208	137	778	123
Wayne	34,487	122	650	....	35,259	70	34	23	127	120
Webster	11,463	9,073	....	....	20,536	45	10	5	60	145
Wyoming	1,218,624	7,505	224	....	1,226,353	765	783	385	1,933	156
Other counties[e]	36,837	2,836	2,818	....	42,491	56	31	20	107	103
	68,655,196	2,983,061	808,609	340,130	72,786,996	53,801	30,951	17,098	101,850	149

[a] Includes also loaders and shot firers.
[d] Exclusive of product of wagon mines.
[e] Gilmer and Summers.

Value of coal produced in West Virginia in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1919.						
Barbour	$2,728,886	$17,724	$54,073	$45,583	$2,846,266	$2.22
Boone	3,194,367	45,872	50,020	....	3,290,259	2.40
Braxton	843,419	62,624	14,450	....	920,493	2.41
Brooke	2,525,739	559,039	17,427	....	3,102,205	2.20
Clay	898,515	8,761	11,495	....	918,771	1.99
Fayette	19,893,854	432,989	239,181	1,314,069	21,880,093	2.72
Gilmer	164,352	4,310	8,850	....	177,512	2.23
Grant	599,076	3,994	17,174	....	620,244	2.60
Hancock	1,756	42,406	....	....	44,162	2.70
Harrison	10,534,513	133,443	76,434	6,460	10,750,850	2.23
Kanawha	11,557,281	222,830	126,218	....	11,906,329	2.35
Lewis	104,138	3,940	....	....	108,078	2.21
Lincoln	444,824	3,219	9,741	....	457,784	2.46
Logan	21,804,574	421,921	105,862	9,279	22,341,636	2.30
McDowell	40,519,725	630,725	668,895	1,680,811	43,500,156	2.59
Marion	10,911,132	118,590	346,380	186,075	11,562,177	2.33
Marshall	1,212,378	942,746	42,120	....	2,197,244	2.30
Mason	181,362	96,261	8,592	....	286,215	2.50
Mercer	7,087,890	81,984	46,863	170,060	7,386,797	2.73
Mineral	967,609	10,617	7,987	....	986,213	2.67
Mingo	6,738,443	263,348	133,558	....	7,135,349	2.45
Monongalia	5,273,767	155,883	8,471	44,366	5,482,487	2.17
Nicholas	492,382	31,701	17,578	3,975	545,636	2.65
Ohio	1,554,041	447,706	11	....	2,001,758	2.18
Preston	2,757,069	420,454	56,235	206,284	3,440,042	2.54
Putnam	699,115	8,752	28,577	....	736,444	2.38
Raleigh	19,131,849	312,383	229,241	....	19,673,473	2.85
Randolph	1,584,888	45,077	28,832	167,003	1,825,800	2.13
Taylor	2,249,457	18,847	24,028	....	2,292,332	2.35
Tucker	2,763,465	24,031	77,644	31,044	2,896,184	2.69
Upshur	1,182,462	29,600	14,248	5,162	1,231,472	2.16
Wayne	115,761	1,086	1,005	....	117,852	2.76
Webster	69,357	30,927	....	....	100,284	2.15
Wyoming	3,247,140	28,169	22,000	....	3,297,309	2.81
Other counties [a]	217,574	166,385	4,100	....	388,059	2.93
Small mines	....	103,050	....	....	103,050	2.17
	184,252,160	5,931,394	2,497,290	3,870,171	196,551,015	....
Average value per ton	2.50	2.33	2.28	2.25	2.49	2.49
1920.						
Barbour	7,428,000	32,000	96,000	152,000	7,708,000	4.07
Boone	7,215,000	88,000	67,000	....	7,370,000	4.57
Braxton	1,688,000	35,000	31,000	....	1,754,000	5.04
Brooke	4,939,000	1,679,000	20,000	....	6,638,000	3.88
Clay	1,973,000	42,000	29,000	....	2,044,000	3.94
Fayette	38,667,000	808,000	357,000	2,129,000	41,961,000	4.65
Gilmer	636,000	7,000	17,000	....	660,000	5.38
Grant	935,000	5,000	24,000	....	964,000	3.67
Hancock	17,000	28,000	....	....	45,000	4.56
Harrison	23,450,000	219,000	85,000	19,000	23,773,000	3.93
Kanawha	25,694,000	366,000	171,000	....	26,231,000	4.08
Lewis	351,000	6,000	....	....	357,000	4.88
Lincoln	1,326,000	8,000	29,000	....	1,363,000	4.66
Logan	45,306,000	1,183,000	196,000	9,000	46,694,000	4.39
McDowell	66,055,000	668,000	995,000	2,487,000	70,205,000	4.17
Marion	20,426,000	169,000	526,000	1,057,000	22,178,000	3.89
Marshall	2,909,000	1,514,000	63,000	....	4,486,000	3.58
Mason	772,000	177,000	34,000	....	983,000	4.55
Mercer	11,573,000	134,000	68,000	189,000	11,964,000	4.44
Mineral	3,458,000	30,000	31,000	....	3,519,000	5.66
Mingo	7,870,000	82,000	99,000	....	8,051,000	4.33
Monongalia	17,144,000	379,000	44,000	296,000	17,863,000	4.71
Nicholas	1,286,000	57,000	36,000	53,000	1,432,000	4.88
Ohio	4,557,000	1,097,000	....	....	5,654,000	4.06
Preston	7,465,000	255,000	57,000	923,000	8,700,000	4.35
Putnam	1,595,000	40,000	50,000	....	1,685,000	4.97
Raleigh	37,595,000	523,000	342,000	....	38,460,000	4.96
Randolph	3,195,000	55,000	61,000	372,000	3,683,000	3.58
Taylor	4,638,000	18,000	28,000	....	4,684,000	4.19
Tucker	4,043,000	45,000	105,000	69,000	4,262,000	3.58
Upshur	3,441,000	67,000	30,000	45,000	3,583,000	4.93
Wayne	320,000	....	3,000	....	323,000	4.82
Webster	168,000	49,000	....	....	217,000	5.13
Wyoming	6,721,000	35,000	10,000	....	6,766,000	4.68
Other counties [b]	497,000	141,000	3,000	....	641,000	5.16
	365,353,000	10,041,000	3,707,000	7,800,000	386,901,000	4.33
Small mines	3,102,000	43,000	....	....	3,145,000	6.05
	368,455,000	10,084,000	3,707,000	7,800,000	390,046,000	....
Average value per ton	4.40	3.41	3.58	3.44	4.34	4.34

[a] Greenbrier, Summers, and Wetzel.

[b] Greenbrier and Summers.

Value of coal produced in West Virginia in 1919–1921—Continued.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Made into coke at mines.	Total.	Average per ton.
1921.[c]						
Barbour	$2,745,000	$39,000	$58,000	$200	$2,842,200	$2.83
Boone	3,044,000	28,000	20,000		3,092,000	2.62
Braxton	337,000	83,000	13,000		433,000	2.46
Brooke	2,013,000	2,143,000	11,000		4,167,000	2.72
Clay	1,393,000	43,000	22,000		1,458,000	2.35
Fayette	18,878,000	390,000	182,000	305,000	19,755,000	3.22
Grant	427,000	2,000	10,000		439,000	2.82
Greenbrier	205,000	118,000	6,000		329,000	2.27
Hancock	3,300	5,000	200		8,500	2.53
Harrison	10,563,000	379,000	38,000		10,980,000	2.91
Kanawha	10,715,000	254,000	56,000		11,025,000	2.79
Lewis	41,000	6,000	1,000		48,000	2.05
Lincoln	604,000	3,000	5,000		612,000	2.49
Logan	28,729,000	640,000	113,000		29,482,000	2.57
McDowell	39,101,000	494,000	645,000	133,000	40,373,000	2.95
Marion	12,468,000	630,000	373,000	118,000	13,589,000	2.75
Marshall	2,256,000	1,028,000	56,000		3,340,000	3.06
Mason	102,000	90,000	12,000		204,000	2.94
Mercer	8,877,000	258,000	41,000	170,000	9,346,000	2.96
Mineral	324,000	3,000	3,000		330,000	3.23
Mingo	4,645,000	266,000	67,000		4,978,000	2.63
Monongalia	8,797,000	203,000	3,000		9,003,000	2.34
Nicholas	382,000	19,000	11,000		412,000	3.09
Ohio	3,367,100	490,500	100		3,857,700	2.67
Preston	1,379,000	547,000	28,000	20,000	1,974,000	2.87
Putman	824,000	10,000	28,000		862,000	2.99
Raleigh	21,736,000	352,000	197,000		22,285,000	3.09
Randolph	1,581,000	57,000	35,000	6,000	1,679,000	3.05
Taylor	1,319,000	11,000	17,000		1,347,000	2.61
Tucker	2,954,000	40,000	101,000	23,000	3,118,000	3.46
Upshur	1,232,000	31,000	22,000		1,285,000	2.52
Wayne	78,000	100	1,000		79,100	2.24
Webster	39,000	18,000			57,000	2.78
Wyoming	3,736,000	12,000	1,000		3,749,000	3.06
Other counties[d]	109,000	7,000	7,000		123,000	2.89
	195,003,400	8,699,600	2,183,300	775,200	206,661,500	
Average value per ton	2.84	2.92	2.70	2.28	2.84	2.84

[c] Exclusive of product of wagon mines.
[d] Gilmer and Summers.

Coal produced in West Virginia, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Increase or decrease, 1921.
Barbour	1,405,888	1,641,110	1,280,185	1,895,625	1,004,442	−891,183
Boone	910,396	1,349,585	1,371,552	1,613,709	1,180,108	−433,601
Braxton	274,071	350,215	381,867	348,017	175,779	−172,238
Brooke	875,653	1,378,492	1,408,085	1,711,712	1,531,457	−180,255
Clay	529,527	472,759	462,485	519,364	620,527	+101,163
Fayette	10,059,802	9,578,906	8,038,630	9,015,900	6,136,796	−2,879,104
Gilmer	108,576	69,202	79,532	122,793	[a] 42,491	− [a] 80,302
Grant	(b)	316,808	237,985	262,539	155,634	−106,905
Greenbrier	[b] 255,534	[b] 86,593	[b] 132,640	[b] 124,131	144,921	+20,790
Hancock	11,914	12,672	16,378	9,875	3,356	−6,519
Harrison	5,384,251	5,622,917	4,824,627	6,053,506	3,767,564	−2,285,942
Kanawha	6,515,007	6,231,431	5,068,925	6,426,044	3,955,219	−2,470,825
Lewis	(b)	52,472	48,938	73,151	23,440	−49,711
Lincoln	227,177	279,785	186,338	292,415	245,643	−46,772
Logan	9,408,917	11,268,271	9,701,320	10,627,263	11,484,117	+856,854
McDowell	20,048,712	18,662,621	16,780,056	16,819,148	13,703,496	−3,115,652
Marion	5,256,105	5,208,969	4,958,152	5,698,876	4,938,874	−760,002
Marshall	1,109,451	1,102,762	954,268	1,251,547	1,092,309	−159,238
Mason	199,176	241,277	114,353	215,812	69,395	−146,417
Mercer	3,326,727	3,174,416	2,709,405	2,692,879	3,161,510	+468,631
Mineral	879,921	857,913	369,470	621,203	102,144	−519,059
Mingo	3,380,479	3,419,583	2,908,794	1,857,471	1,893,723	+36,252
Monongalia	1,127,277	2,354,178	2,522,104	3,792,941	3,839,813	+46,872
Nicholas	200,066	183,081	206,226	293,221	133,200	−160,021
Ohio	633,685	761,274	919,639	1,392,473	1,444,604	+52,131
Preston	1,337,972	1,788,211	1,355,453	2,001,440	687,933	−1,313,507
Putnam	519,673	352,948	308,958	339,092	288,330	−50,762
Raleigh	7,239,259	7,483,829	6,896,696	7,759,703	7,200,902	−558,801
Randolph	858,029	1,016,572	859,425	1,029,226	550,001	−479,225
Taylor	1,393,313	1,348,121	974,665	1,117,092	516,849	−600,243
Tucker	1,459,137	1,401,670	1,075,600	1,189,011	901,297	−287,714
Upshur	228,164	466,264	571,397	727,160	508,974	−218,186
Wayne	63,467	72,239	42,666	67,625	35,259	−31,766
Webster	24,969	30,799	46,728	42,289	20,536	−21,753
Wyoming	1,104,381	1,236,328	1,175,435	1,447,054	1,226,353	−220,701
Small mines	84,991	61,566	47,576	520,000	....	−520,000
	86,441,667	89,935,839	79,036,553	89,970,707	72,786,996	−17,183,711
Total value	$200,659,368	$230,508,846	$196,551,015	$390,046,000	$206,661,500	−$183,384,500

[a] Gilmer includes Summers in 1921.
[b] Greenbrier includes Grant, Lewis, Summers, and Wetzel in 1917; Summers and Wetzel in 1918 and 1919 and Summers in 1920.

WYOMING.

Every county in Wyoming for which separate statistics are given by the Geological Survey showed a decrease in its output of coal in 1919 as compared with 1918. The total output for the State was 7,219,738 tons, valued at $18,751,024, a decrease of 2,218,950 tons, or 23.5 per cent, in quantity, and of $3,829,995, or 17 per cent, in value. The average value per ton, however, increased from $2.39 to $2.60. There was a decrease in the total working force, which was 7,286 in 1919, as compared with 7,554 in 1918, and the number of surface workers was reduced nearly 10 per cent. The average number of days on which the mines were in operation decreased from 268 to 221, and the average daily output per worker from 4.66 to 4.48 tons. During the year strikes involved 6,982 workers an average of 23 days each, and the total loss was 157,843 man-days.

Wyoming broke all records of the production of coal in 1920, when it mined 9,630,271 tons, valued at $28,741,000, an increase over the amount mined in 1919 of 2,410,533 tons, or 33.4 per cent, in quantity, and of $9,989,976, or 53.3 per cent, in value. The average value per ton increased to $2.98. The increase in output was shared by all counties, but Sweetwater County, the largest producer, showed the greatest gain. The number of days on which the mines were in operation rose to 264. The working force increased to 7,779, but the gain was all in underground employees. The average daily output per worker was 4.69 tons. The losses by strikes were small; only 238 men were out for an average of 11 days each, making the total loss in man-days 2,722.

In 1921 the output was 7,200,666 tons, valued at $23,358,500, which was 2,429,605 tons, or 25.2 per cent, less in quantity than in 1920 and $5,382,500, or 18.7 per cent, less in value. The average value per ton, however, increased to $3.24. Every county showed a loss in production, but Sheridan County sustained the heaviest loss, 974,454 tons, and Sweetwater came next, with a loss of 801,038 tons. The percentage loss in Sheridan County, however, was materially larger. The total number of men employed was increased by 705, or to 8,484, but there was no appreciable change in the number of surface employees. The average number of days on which the mines were in operation decreased to 167, but the average output per day per worker increased to 5.08 tons. The loss in total output is therefore directly chargeable to the decrease in the number of days worked by the mines. The losses by strike were among the smallest reported for any State; only 591 men were out for an average of 5 days each, and the total loss was 2,978 man-days.

Coal produced in Wyoming in 1919–1921.

County.	Production (net tons).				Number of employees.				Average number of days worked.
	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Underground. Miners.[a]	Underground. All others.	Surface.	Total.	
1919.									
Carbon and Uinta	548,821	21,140	23,526	593,487	439		173	612	237
Converse, Crook, Johnson, and Weston	226,716	15,315	18,962	260,993	223		60	283	222
Fremont, Hot Springs, and Park	679,095	11,681	41,437	732,213	678		160	838	239
Lincoln	1,232,899	9,976	68,074	1,310,949	1,046		259	1,305	232
Sheridan	1,393,814	17,119	11,212	1,422,145	1,075		308	1,383	154
Sweetwater	2,825,247	18,019	51,672	2,894,938	2,354		511	2,865	240
Small mines	....	5,013	....	5,013	....		......	......	....
	6,906,592	98,263	214,883	7,219,738	5,815		1,471	7,286	221
1920.									
Carbon and Uinta	699,973	22,936	21,687	744,596	307	177	155	639	277
Converse, Johnson, and Weston	229,113	16,550	19,143	264,806	96	79	60	235	283
Fremont, Hot Springs, and Park	840,006	10,820	37,671	888,497	376	315	206	897	282
Lincoln	1,388,150	11,056	74,448	1,473,654	637	312	258	1,207	290
Sheridan	1,868,029	22,518	22,176	1,912,723	944	280	223	1,447	182
Sweetwater	4,233,554	37,571	67,870	4,338,995	1,622	1,187	545	3,354	281
	9,258,825	121,451	242,995	9,623,271	3,982	2,350	1,447	7,779	264
Small mines	6,000	1,000	....	7,000	....	......	......	......	....
	9,264,825	122,451	242,995	9,630,271	....	......	......	......	....
1921.[b]									
Carbon and Uinta	549,667	19,367	24,196	593,230	277	155	122	554	186
Converse, Johnson, and Weston	109,434	11,524	13,881	134,839	90	55	41	186	174
Fremont, Hot Springs, and Park	649,514	6,659	37,343	693,516	445	306	183	934	156
Lincoln	1,224,188	10,556	68,111	1,302,855	725	363	283	1,371	224
Sheridan	898,782	23,453	16,034	938,269	899	250	172	1,321	71
Sweetwater	3,443,699	31,936	62,322	3,537,957	2,353	1,102	663	4,118	178
	6,875,284	103,495	221,887	7,200,666	4,789	2,231	1,464	8,484	167

[a] Includes also loaders and shot firers.

[b] Exclusive of product of wagon mines.

Value of coal produced in Wyoming in 1919–1921.

County.	Loaded at mines for shipment.	Sold to local trade and used by employees.	Used at mines for steam and heat.	Total.	Average per ton.
1919.					
Carbon and Uinta	$1,402,192	$67,454	$44,974	$1,514,620	$2.55
Converse, Crook, Johnson and Weston	631,237	43,160	48,002	722,399	2.77
Fremont, Hot Springs, and Park	2,018,910	43,111	95,863	2,157,884	2.95
Lincoln	3,126,870	27,089	84,126	3,238,085	2.47
Sheridan	3,552,756	40,436	24,430	3,617,622	2.54
Sweetwater	7,357,183	37,999	88,537	7,483,719	2.59
Small mines	....	16,695	....	16,695	3.33
	18,089,148	275,944	385,932	18,751,024	....
Average value per ton	2.62	2.81	1.80	2.60	2.60
1920.					
Carbon and Uinta	1,886,000	90,000	56,000	2,032,000	2.73
Converse, Johnson, and Weston	738,000	52,000	58,000	848,000	3.20
Fremont, Hot Springs and Park	3,214,000	49,000	92,000	3,355,000	3.78
Lincoln	3,966,000	28,000	164,000	4,158,000	2.82
Sheridan	5,157,000	59,000	61,000	5,277,000	2.76
Sweetwater	12,768,000	104,000	175,000	13,047,000	3.01
	27,729,000	382,000	606,000	28,717,000	2.98
Small mines	19,000	5,000	....	24,000	3.43
	27,748,000	387,000	606,000	28,741,000	....
Average value per ton	2.99	3.16	2.49	2.98	2.98
1921.[a]					
Carbon and Uinta	1,997,000	66,000	68,000	2,131,000	3.59
Converse, Johnson, and Weston	382,400	34,000	68,000	484,400	3.59
Fremont, Hot Springs, and Park	2,640,000	30,000	81,100	2,751,100	3.97
Lincoln	3,984,000	33,000	185,000	4,202,000	3.23
Sheridan	2,440,000	63,000	38,000	2,541,000	2.71
Sweetwater	10,967,000	99,000	183,000	11,249,000	3.18
	22,410,400	325,000	623,100	23,358,500	....
Average value per ton	3.26	3.14	2.81	3.24	3.24

[a] Exclusive of product of wagon mines.

Coal produced in Wyoming, 1917–1921, in net tons.

County.	1917	1918	1919	1920	1921	Decrease, 1921.
Carbon and Uinta	908,726	797,641	593,487	744,596	593,230	151,366
Converse, Johnson, and Weston	356,857	367,115	[a] 260,993	264,806	134,839	129,967
Fremont, Hot Springs, and Park	771,565	789,432	732,213	888,497	693,516	194,981
Lincoln	1,940,813	1,912,897	1,310,949	1,473,654	1,302,855	170,799
Sheridan	1,673,419	1,917,076	1,422,145	1,912,723	938,269	974,454
Sweetwater	2,920,119	3,651,238	2,894,938	4,338,995	3,537,957	801,038
Small mines	4,120	3,289	5,013	7,000	....	7,000
	8,575,619	9,438,688	7,219,738	9,630,271	7,200,666	2,429,605
Total value	$16,593,283	$22,581,019	$18,751,024	$28,741,000	$23,358,500	$5,382,500

[a] Includes Crook County.

INDEX.

U.

V.

DEPARTMENT OF THE INTERIOR

HUBERT WORK, Secretary

UNITED STATES GEOLOGICAL SURVEY

GEORGE OTIS SMITH, Director

Coal produced in the United States from 1807, the date of the earliest record, to the end of 1921.

(NET TONS.)

Year.	Pennsylvania.	Virginia.	Kentucky.	Illinois.	Ohio.	Pennsylvania.	Missouri.	Indiana.	Alabama.	Tennessee.	Iowa.	Arkansas.	North Carolina.	Maryland.	Washington.
	Anthracite					*Bituminous.*									
1807–1820	12,000													3,000	
1821	1,322														
1822	4,583	54,000													
1823	8,563	60,000													
1824	13,685	67,040													
1825	42,988	75,000													
1826	59,194	88,720													
1827	78,151	94,000													
1828	95,500	100,080	328												
1829	138,086	100,000	2,000												
1830	215,272	102,800	2,000												
1831	217,842	118,000	2,100												
1832	447,550	132,000	2,500											12,000	
1833	600,907	125,000	2,750	6,000											
1834	464,015	124,000	5,000	7,500											
1835	690,854	120,000	6,000	8,000											
1836	842,832	124,000	8,000	10,000											
1837	1,071,151	160,000	10,000	12,500											
1838	910,075	300,000	11,500	14,000	119,952										
1839	1,008,322	336,000	16,000	15,038	125,000										
1840	967,108	424,894	23,527	16,967	140,536	464,826	9,972	9,682	215	558	400	220	3	8,880	
1841	1,182,441	379,600	35,000	35,000	160,000	475,000	12,000	10,000	1,000	600	500				
1842	1,365,563	373,640	50,000	58,000	225,000	500,000	15,000	18,000	1,000	1,000	750			2,104	
1843	1,556,753	370,000	60,000	75,000	280,000	650,000	25,000	25,000	1,200	4,500	1,000			12,421	
1844	2,000,207	365,000	75,000	120,000	340,000	675,000	35,000	30,000	1,200	10,000	2,500			18,345	
1845	2,480,032	350,000	100,000	150,000	390,000	700,000	50,000	35,000	1,500	18,000	5,000			30,372	
1846	2,887,815	340,000	115,000	165,000	420,000	760,000	68,000	40,000	1,500	26,000	6,500			36,707	
1847	3,551,005	325,000	120,000	180,000	480,000	399,840	80,000	45,000	2,050	30,000	8,000			65,222	
1848	3,805,942	318,000	125,000	200,000	540,000	500,000	85,000	50,000	[illegible]	40,000	10,000			98,032	
1849	3,995,334	315,000	140,000	260,000	600,000	750,000	90,000	56,000	2,500	52,000	12,500			175,497	
1850	4,138,164	310,000	150,000	300,000	640,000	1,000,000	100,000	60,000	2,500	60,000	15,000			242,517	
1851	5,481,065	310,000	160,000	320,000	670,000	1,200,000	125,000	60,000	3,000	70,000	18,000			317,460	
1852	6,151,957	325,000	175,000	340,000	700,000	1,400,000	140,000	75,000	3,000	75,000	20,000			411,707	
1853	6,400,426	350,000	180,000	375,000	760,000	1,500,000	160,000	75,000	4,000	85,000	23,000			657,862	
1854	7,394,875	370,000	190,000	385,000	800,000	1,650,000	175,000	80,000	4,500	90,000	25,000			812,727	
1855	8,141,754	350,782	200,000	400,000	800,000	1,780,000	185,000	80,000	6,000	100,000	28,000			735,137	
1856	8,534,770	352,687	215,000	410,000	930,000	1,850,000	200,000	85,000	6,800	115,000	30,000			817,650	
1857	8,186,567	363,605	240,000	450,000	975,000	2,000,000	220,000	85,000	8,000	125,000	33,000			654,017	
1858	8,426,102	377,690	250,000	490,000	1,000,000	2,200,000	240,000	87,000	8,500	135,000	37,500			722,680	
1859	9,619,771	359,055	275,000	530,000	1,000,000	2,400,000	260,000	95,000	9,000	150,000	42,000			833,349	
1860	8,115,842	473,390	285,760	728,400	1,285,000	2,690,786	280,000	101,280	10,200	165,300	41,920	200		438,000	5,374
1861	9,799,654	445,165	280,000	670,000	1,150,000	3,200,000	300,000	128,000	10,000	150,000	50,000			287,073	6,000
1862	0,695,110	445,124	275,000	780,000	1,200,000	4,000,000	320,000	150,000	12,500	140,000	53,000		30,000	348,201	7,000
1863	11,785,320	40,000	250,000	890,000	1,204,581	5,000,000	360,000	200,000	15,000	100,000	57,000		30,000	877,313	8,000
1864	12,538,649	40,000	250,000	1,000,000	1,815,622	5,839,000	375,000	250,000	15,000	100,000	63,000		25,000	755,764	10,000
1865	11,891,746	40,000	200,000	1,260,000	1,536,218	6,350,000	420,000	250,000	12,000	100,000	89,574		20,000	1,025,208	12,000
1866	15,651,183	40,000	180,000	1,580,000	1,887,424	6,800,000	450,000	320,000	12,000	100,000	90,320		20,000	1,217,968	13,000
1867	16,002,109	50,000	175,000	1,800,000	2,092,334	7,300,000	500,000	350,000	10,000	110,000	150,000		20,000	1,381,429	14,500
1868	17,003,405	59,051	160,000	2,000,000	2,475,844	7,500,000	541,000	375,000	10,000	125,000	241,453		18,000	1,529,879	15,000
1869	17,083,134	65,000	160,000	1,854,000	2,461,986	8,750,000	550,000	400,000	10,000	130,000	285,105		16,000	2,216,300	16,200
1870	16,664,275	61,803	150,582	2,624,163	2,527,285	7,798,518	621,930	437,870	11,000	133,418	263,487		15,000	1,819,824	17,844
1871	19,342,057	70,000	250,000	3,000,000	4,000,000	9,040,566	725,000	600,000	15,000	180,000	300,000		15,000	2,670,338	20,000
1872	24,233,188	69,440	380,800	3,360,000	5,315,294	11,695,040	784,000	898,000	18,800	224,000	336,000		12,000	2,647,156	23,000
1873	26,152,837	67,200	400,000	3,920,000	4,550,028	13,098,829	784,000	1,000,000	44,800	350,000	392,000		10,000	3,198,911	26,000
1874	24,818,790	70,000	360,000	4,203,000	3,267,585	12,320,000	789,680	812,000	50,400	350,000	799,936			2,899,392	30,352
1875	22,485,766	60,000	500,000	4,453,178	4,864,259	11,760,000	840,000	800,000	67,200	360,000	1,231,547			2,808,018	99,588
1876	22,793,245	55,000	650,000	5,000,000	3,500,000	12,880,000	1,008,000	950,000	112,000	550,000	1,250,000			2,128,873	110,342
1877	25,660,316	60,000	850,000	5,350,000	5,250,000	14,000,000	1,008,000	1,000,000	198,000	450,000	1,300,000			1,939,575	120,896
1878	21,689,682	50,000	000,000	5,700,000	5,500,000	15,120,000	1,008,000	1,000,000	224,000	375,000	1,350,000			2,068,925	131,660
1879	30,207,793	45,000	1,000,000	5,000,000	0,000,000	16,240,000	1,008,000	1,196,490	280,000	450,000	1,400,000			2,132,233	142,666
1880	28,649,812	43,079	946,288	6,115,377	6,008,595	18,425,163	844,304	1,464,327	323,972	495,131	1,461,116	14,778	350	2,228,917	145,015

Year.	Michigan.	Georgia.	California.	West Virginia.	Colorado.	Wyoming.	Kansas.	Utah.	Oklahoma (Indian Territory).	Oregon.	Montana.	New Mexico.	Texas.	North Dakota.	Miscellaneous.[a]	Total.	Year.
1807–1820																15,000	1807–1820
1821																1,322	1821
1822																58,583	1822
1823																68,563	1823
1824																80,725	1824
1825																117,988	1825
1826																147,914	1826
1827																172,151	1827
1828																195,908	1828
1829																240,086	1829
1830																320,072	1830
1831																337,942	1831
1832																594,050	1832
1833																734,657	1833
1834																600,515	1834
1835																824,854	1835
1836																984,832	1836
1837																1,253,651	1837
1838																1,355,527	1838
1839																1,560,360	1839
1840															1,520	2,070,039	1840
1841																2,291,141	1841
1842																2,610,057	1842
1843																3,060,874	1843
1844																3,681,252	1844
1845																4,309,904	1845
1846																4,805,522	1846
1847																5,286,067	1847
1848																5,773,074	1848
1849																6,448,831	1849
1850																7,018,181	1850
1851																8,734,525	1851
1852																9,816,664	1852
1853																10,570,288	1853
1854																11,977,102	1854
1855																12,036,673	1855
1856																13,546,925	1856
1857																13,340,189	1857
1858																13,974,478	1858
1859																15,633,175	1859
1860	2,320	1,900													3,800	14,610,042	1860
1861	3,000	2,500	6,620													16,488,012	1861
1862	5,000	3,500	23,400													17,485,835	1862
1863	8,000	6,000	43,200	444,648												21,319,062	1863
1864	12,000	10,000	50,700	454,888	500											23,605,123	1864
1865	15,000	10,000	60,530	487,897	1,200	800										23,792,173	1865
1866	20,000	8,000	84,020	512,068	6,400	2,500										29,003,583	1866
1867	25,000	8,000	124,690	589,360	17,000	5,000										30,724,422	1867
1868	28,000	10,000	143,676	609,227	10,500	6,925										32,861,960	1868
1869	29,980	12,000	157,234	603,148	8,000	49,382	36,891									32,904,360	1869
1870	28,150	15,000	141,890	608,878	4,500	50,000	32,938	5,800							1,425	33,035,580	1870
1871	32,000	20,000	152,493	618,830	15,600	147,328	41,000								5,629,869	46,885,080	1871
1872	33,600	25,000	190,859	700,000	68,540	221,745	44,800								178,159	51,453,399	1872
1873	56,000	40,000	186,611	1,000,000	69,987	259,700	58,000								1,939,567	57,602,480	1873
1874	58,000	60,000	215,352	1,120,000	77,372	219,061	85,000									52,603,920	1874
1875	62,500	80,000	160,638	1,120,000	98,838	300,808	150,000								40,000	52,348,320	1875
1876	60,000	110,000	128,049	896,000	117,666	334,550	225,000	50,400							360,875	53,280,000	1876
1877	69,197	120,000	107,789	1,120,000	160,000	342,853	300,000	50,400							1,058,734	60,501,760	1877
1878	85,322	128,000	134,237	1,120,000	200,630	333,200	375,000	67,200							374,744	57,935,600	1878
1879	82,015	140,000	147,879	1,400,000	322,732	400,991	460,000	50,000								68,105,799	1879
1880	100,800	154,644	236,950	1,829,844	462,747	589,595	771,442	14,748	120,947	43,205	224				200	71,481,570	1880

Year																
1873	26,152,837	67,200	400,000	3,920,000	4,550,028	13,098,829	784,000	1,000,000	44,800	360,000	392,000	....	10,000	3,198,911	26,000	58,000
1874	24,818,790	70,000	360,000	4,203,000	3,267,585	12,320,000	789,680	812,000	50,400	350,000	799,938	....	....	2,899,392	30,352	58,000
1875	22,485,786	60,000	500,000	4,453,178	4,864,259	11,760,000	840,000	800,000	87,200	360,000	1,231,547	....	....	2,808,018	99,568	62,500
1876	22,793,245	55,000	650,000	5,000,000	3,500,000	12,880,000	1,008,900	950,000	112,000	550,000	1,250,000	....	....	2,126,873	110,342	60,000
1877	25,660,316	50,000	850,000	5,350,000	5,250,000	14,000,000	1,008,000	1,000,000	196,000	450,000	1,300,000	....	....	1,939,575	120,896	89,197
1878	21,689,682	50,000	900,000	5,700,000	5,500,000	15,120,000	1,008,000	1,000,000	224,000	375,000	1,350,000	....	....	2,008,925	131,060	85,322
1879	30,207,793	45,000	1,000,000	5,000,000	6,000,000	16,240,000	1,008,000	1,196,490	280,000	450,000	1,400,000	....	....	2,132,233	142,666	82,015
1880	28,049,812	43,079	948,288	6,115,377	6,008,595	18,425,163	844,304	1,454,327	323,972	495,131	1,401,116	14,778	350	2,228,917	145,015	100,800
1881	31,920,018	50,000	1,232,000	8,720,900	9,240,000	22,400,900	1,960,000	1,984,120	420,000	840,000	1,960,000	20,000	300	2,533,348	196,000	112,000
1882	35,121,256	112,000	1,300,000	9,115,653	9,450,000	24,640,000	2,240,000	1,976,470	896,000	850,000	3,920,000	25,900	400	1,555,445	177,340	135,339
1883	38,456,845	252,000	1,650,000	12,123,456	8,229,429	26,880,000	2,520,000	2,560,000	1,568,000	1,000,000	4,457,540	50,000	400	2,476,075	244,990	71,286
1884	37,156,847	336,000	1,550,000	12,208,075	7,640,062	28,000,000	2,800,000	2,260,000	2,240,000	1,200,000	4,370,566	75,000	500	2,765,617	166,936	36,712
1885	38,335,974	567,000	1,600,000	11,834,459	7,816,179	26,000,000	3,080,000	2,375,000	2,492,000	1,440,957	4,012,575	100,000	500	2,833,337	380,250	45,178
1886	39,035,446	684,951	1,550,000	11,175,241	8,435,211	27,094,501	1,800,000	3,000,000	1,800,000	1,714,290	4,315,779	125,000	400	2,517,577	423,525	60,434
1887	42,089,197	825,263	1,933,185	12,423,066	10,300,708	31,516,856	3,209,916	3,217,711	1,950,000	1,900,000	4,473,828	129,600	300	3,278,023	772,601	71,461
1888	46,619,564	1,073,000	2,570,000	14,328,181	10,910,951	33,796,727	3,909,967	3,140,979	2,900,000	1,967,297	4,952,440	276,971	250	3,479,470	1,215,750	81,407
1889	45,546,970	885,786	2,399,755	12,104,272	9,976,787	36,174,089	2,557,823	2,845,057	3,572,983	1,925,689	4,095,358	279,584	222	2,939,715	1,030,578	67,431
1890	46,408,041	784,011	2,701,496	15,292,420	11,494,506	42,302,173	2,735,221	3,305,737	4,090,409	2,169,585	4,021,739	399,888	10,262	3,357,813	1,263,689	74,977
1891	50,665,431	736,399	2,916,069	15,660,698	12,868,683	42,789,490	2,674,606	2,973,474	4,759,781	2,413,678	3,825,495	542,379	20,355	3,829,239	1,056,249	80,307
1892	52,472,504	675,205	3,025,303	17,862,270	13,562,927	46,694,578	2,733,949	3,345,174	5,529,312	2,092,064	3,918,491	535,558	6,679	3,419,962	1,213,427	77,990
1893	53,957,543	820,339	3,007,179	19,949,564	13,253,646	44,070,724	2,897,442	3,791,851	5,136,935	1,902,258	3,972,229	574,763	17,000	3,716,041	1,264,877	45,979
1894	51,921,121	1,229,083	3,111,192	17,113,576	11,909,850	39,912,463	2,245,039	3,423,921	4,397,178	2,180,879	3,967,253	512,620	16,900	3,501,428	1,106,470	70,022
1895	57,999,337	1,368,324	3,357,770	17,735,864	13,355,896	50,217,228	2,372,393	3,995,892	5,693,775	2,535,844	4,156,074	598,322	24,900	3,915,585	1,191,410	112,322
1896	54,346,081	1,254,723	3,333,478	19,786,620	12,875,202	49,557,453	2,331,542	3,905,779	5,745,697	2,663,106	3,954,028	675,374	7,813	4,143,936	1,195,504	92,882
1897	52,011,080	1,528,302	3,602,007	20,072,758	12,196,942	54,417,974	2,665,626	4,151,169	5,893,770	2,889,849	4,611,865	856,190	21,280	4,442,128	1,434,112	223,592
1898	53,382,644	1,815,274	3,887,908	18,599,209	14,516,867	65,165,133	2,688,321	4,920,743	6,535,263	3,022,896	4,618,842	1,205,479	11,495	4,674,884	1,864,571	315,722
1899	60,419,005	2,105,791	4,607,255	24,439,919	16,590,270	74,150,175	3,025,814	0,006,523	7,593,416	3,330,659	5,177,479	843,554	28,896	4,807,398	2,029,881	624,708
1900	57,367,915	2,393,754	5,328,984	25,767,981	18,988,150	70,842,328	3,540,103	6,484,086	8,394,275	3,509,562	5,202,939	1,447,945	17,734	4,024,688	2,474,093	849,475
1901	67,471,667	2,725,873	5,469,956	27,331,552	20,943,807	82,305,946	3,802,088	6,918,225	9,099,052	3,833,290	5,617,499	1,816,136	12,000	5,113,127	2,578,217	1,241,241
1902	41,373,595	3,182,993	6,760,984	32,939,373	23,519,894	98,574,367	3,890,154	9,446,424	10,354,570	4,382,968	5,904,766	1,943,932	23,000	5,271,609	2,681,214	984,718
1903	74,607,068	3,451,307	7,538,032	36,957,104	24,838,103	103,117,178	4,238,586	10,794,692	11,054,324	4,798,004	6,419,811	2,229,172	17,309	4,848,165	3,193,273	1,367,619
1904	73,156,709	3,410,914	7,576,482	36,475,060	24,400,220	07,938,287	4,168,308	10,842,189	11,262,046	4,782,211	6,519,933	2,009,451	7,000	4,813,622	3,137,681	1,342,340
1905	77,659,850	4,275,271	8,432,523	39,434,363	25,552,950	118,413,637	3,983,378	11,895,252	11,866,069	5,766,690	6,798,609	1,934,673	1,557	5,108,539	2,864,926	1,473,211
1906	71,282,411	4,254,879	9,653,647	41,480,104	27,731,640	129,293,206	3,758,008	12,092,560	13,107,963	8,259,275	7,266,224	1,864,268	....	5,435,453	3,278,184	1,340,338
1907	85,604,312	4,710,895	10,753,124	51,317,146	32,142,419	150,143,177	3,997,936	13,985,713	14,250,454	6,810,243	7,574,322	2,670,438	....	5,532,628	3,680,532	2,035,858
1908	83,268,754	4,259,042	10,246,553	47,659,690	26,270,039	117,179,527	3,317,315	12,314,890	11,604,593	6,199,171	7,161,310	2,078,357	....	4,377,093	3,024,943	1,835,019
1909	81,070,359	4,752,217	10,697,384	50,904,990	27,939,641	137,966,791	3,750,530	14,534,259	13,703,450	6,358,045	7,757,762	2,377,157	....	4,023,241	3,602,263	1,784,692
1910	84,485,236	6,507,997	14,623,319	45,900,246	34,209,663	150,521,526	2,982,433	19,389,815	10,111,462	7,121,380	7,928,120	1,905,958	....	5,217,125	3,911,899	1,534,967
1911	90,404,067	0,864,067	14,049,703	53,679,118	30,759,986	144,561,257	3,830,107	14,201,355	15,021,421	8,433,156	7,331,648	2,106,789	120	4,685,795	3,572,815	1,476,074
1912	84,361,598	7,846,638	10,490,521	59,885,226	34,528,727	161,885,488	4,339,856	15,285,718	16,100,600	6,473,228	7,289,529	2,100,819	200	4,984,038	3,360,932	1,206,230
1913	91,524,922	8,828,068	19,616,600	61,618,744	36,200,527	173,781,217	4,318,125	17,165,671	17,678,522	8,860,184	7,526,936	2,234,107	....	4,779,839	3,877,891	1,231,780
1914	90,821,507	7,959,535	20,382,763	57,589,197	18,843,115	147,983,294	3,935,980	16,641,132	15,593,422	5,943,258	7,451,022	1,836,540	....	4,133,547	3,064,820	1,283,030
1915	88,995,061	8,122,590	21,361,674	58,829,576	22,434,691	157,955,137	3,811,593	17,006,152	14,927,937	5,730,361	7,614,143	1,652,106	....	4,180,477	2,429,095	1,150,138
1916	87,578,493	9,707,474	25,393,997	66,195,336	34,728,219	170,295,424	4,742,146	20,093,528	18,986,197	0,137,449	7,260,800	1,994,915	....	4,450,046	3,038,588	1,180,360
1917	99,611,811	10,087,091	27,897,971	86,199,387	40,748,734	172,448,142	5,070,549	26,539,329	20,068,074	6,191,221	8,965,830	2,143,579	....	4,745,924	4,009,902	1,374,805
1918	98,826,084	10,289,808	31,612,617	89,291,105	45,812,943	178,550,741	5,667,730	30,678,634	19,184,962	6,831,048	8,192,195	2,227,369	1,420	4,497,297	4,082,212	1,464,818
1919	88,092,201	9,326,830	30,036,061	80,862,608	35,876,682	150,758,154	3,979,788	20,912,288	15,536,721	5,213,205	5,824,692	1,429,020	6,989	3,021,680	2,990,447	996,545
1920	89,598,249	11,378,606	35,690,762	88,724,893	45,878,191	170,607,847	5,369,565	29,350,585	16,294,099	6,062,428	7,813,916	2,103,598	11,540	4,085,239	3,757,093	1,489,705
1921	90,473,451	7,492,378	31,588,270	69,602,763	31,942,776	116,013,942	3,551,621	20,310,509	12,568,899	4,460,326	4,631,392	1,227,777	23,438	1,827,740	2,428,722	1,141,715
Total	3,180,692,867	170,652,099	432,002,759	1,542,811,188	958,943,897	3,996,557,740	156,897,454	433,173,255	387,214,669	170,922,661	244,057,087	51,174,490	520,512	206,585,635	90,260,319	32,998,887

Year																
1872														176,159	51,453,309	1872
1873	40,000	186,811	1,000,000	09,997	259,700	58,000	....	....	....	....	....	....	....	1,939,567	57,002,480	1873
1874	60,000	215,352	1,120,000	77,372	219,061	85,000	....	....	....	....	....	....	....	....	52,605,920	1874
1875	80,000	166,638	1,120,000	98,538	300,808	160,000	....	....	....	....	....	....	....	40,000	52,348,320	1875
1876	110,000	128,049	890,000	117,686	334,550	225,000	50,400	....	....	....	....	....	....	386,875	53,280,000	1876
1877	120,000	107,789	1,120,000	160,000	342,853	300,000	50,400	....	....	....	....	....	....	1,056,734	60,501,760	1877
1878	128,000	134,237	1,120,000	200,630	333,200	375,000	67,200	....	....	....	....	....	....	374,744	57,935,600	1878
1879	140,000	147,879	1,400,000	322,732	400,991	460,000	50,000	....	....	....	....	....	....	....	68,195,789	1879
1880	154,644	238,050	1,829,844	462,747	589,595	771,442	14,748	120,947	43,205	224	....	....	....	200	71,481,570	1880
1881	168,000	140,000	1,680,000	708,744	420,000	840,000	52,000	150,000	33,600	5,000	21,000	....	....	76,900	85,881,030	1881
1882	160,000	112,592	2,240,000	1,061,470	707,764	750,000	100,000	200,000	35,000	10,000	157,092	....	....	6,502,359	103,551,189	1882
1883	155,000	76,162	2,335,833	1,229,593	779,689	900,000	200,000	350,000	40,000	19,795	211,347	....	....	6,870,075	115,707,525	1883
1884	150,000	77,485	3,360,000	1,130,024	902,620	1,100,000	200,000	425,000	45,000	80,376	220,557	125,000	35,000	9,498,174	120,156,551	1884
1885	150,000	71,615	3,369,062	1,356,082	807,328	1,212,057	213,120	500,000	50,000	86,440	306,202	100,000	25,000	....	111,160,295	1885
1886	223,000	100,000	4,005,796	1,388,338	829,355	1,400,000	200,000	534,580	45,000	49,846	271,285	100,000	25,955	794,917	113,680,427	1886
1887	313,715	50,000	4,881,820	1,791,735	1,170,318	1,596,879	180,021	685,911	37,096	10,202	508,034	75,000	21,470	1,237,195	130,650,511	1887
1888	180,000	95,000	5,498,800	2,185,477	1,481,540	1,850,000	258,961	761,956	75,000	41,467	626,665	90,000	34,000	4,257,907	148,659,057	1888
1889	225,934	119,820	6,231,880	2,597,181	1,388,947	2,221,043	236,651	752,832	64,359	363,301	486,943	128,216	28,907	1,400	141,229,513	1889
1890	228,337	110,711	7,394,654	3,077,003	1,870,366	2,259,922	318,159	869,229	61,514	517,477	375,777	184,440	30,000	807	157,770,963	1890
1891	171,000	93,301	9,220,665	3,512,632	2,327,841	2,718,705	371,045	1,091,032	51,526	541,861	462,328	172,100	30,000	2,000	188,566,669	1891
1892	215,498	85,178	9,738,755	3,510,830	2,503,839	3,007,278	361,013	1,192,721	34,081	564,648	601,330	245,690	40,725	1,510	179,329,071	1892
1893	372,740	72,603	10,708,578	4,102,389	2,439,311	2,652,546	413,205	1,252,110	41,083	892,309	685,094	302,208	49,830	....	182,352,774	1893
1894	354,111	67,247	11,627,757	2,831,409	2,417,463	3,388,251	431,550	969,606	47,521	927,395	597,196	420,848	42,015	150	170,741,526	1894
1895	260,988	75,453	11,387,961	3,082,982	2,246,911	2,926,870	471,836	1,211,185	73,085	1,504,193	720,654	484,959	38,997	200	193,117,530	1895
1896	238,546	78,544	12,878,296	3,112,400	2,229,624	2,884,801	418,627	1,366,646	101,721	1,543,445	622,626	544,015	78,050	18,792	191,986,357	1896
1897	195,869	87,992	14,248,159	3,361,703	2,597,886	3,054,012	521,560	1,336,380	107,289	1,647,882	716,981	639,341	77,246	18,565	200,229,199	1897
1898	244,187	145,688	18,700,999	4,076,347	2,863,812	3,406,555	593,709	1,381,466	58,184	1,479,803	992,288	086,734	83,895	17,039	219,970,267	1898
1899	233,111	160,915	19,252,995	4,770,224	3,837,392	3,852,267	786,049	1,537,427	86,888	1,498,451	1,050,714	683,832	98,800	1,277	253,741,192	1899
1900	315,557	171,708	22,647,207	5,244,364	4,014,602	4,487,870	1,147,027	1,922,298	58,864	1,681,775	1,299,299	968,373	129,893	1,210	269,684,027	1900
1901	342,825	151,079	24,068,402	5,700,015	4,485,374	4,900,528	1,322,614	2,421,781	69,011	1,396,081	1,086,546	1,107,953	166,601	1,300	293,299,816	1901
1902	414,083	84,984	24,570,826	7,401,343	4,429,491	5,266,065	1,574,521	2,820,666	65,648	1,560,823	1,048,763	901,912	226,511	4,242	301,590,439	1902
1903	416,951	104,673	29,337,241	7,423,602	4,635,283	5,839,976	1,681,409	3,517,388	91,144	1,488,810	1,541,781	926,759	278,645	4,997	357,356,410	1903
1904	383,191	78,888	32,406,752	6,658,365	5,178,550	6,333,307	1,493,027	3,046,539	111,540	1,358,919	1,452,325	1,195,944	271,928	4,174	351,816,398	1904
1905	351,991	77,050	37,791,580	8,826,429	5,602,021	0,423,979	1,332,372	2,924,427	109,641	1,643,832	1,649,933	1,200,664	317,542	9,650	392,722,035	1905
1906	332,107	25,290	43,290,350	10,111,218	6,133,994	8,024,775	1,772,551	2,860,200	79,731	1,829,921	1,964,713	1,312,873	305,689	11,706	414,157,278	1906
1907	362,401	13,960	48,091,583	10,790,236	6,252,990	7,322,449	1,947,697	3,642,658	70,981	2,016,857	2,628,959	1,646,069	347,760	17,727	480,363,424	1907
1908	264,822	18,755	41,897,843	9,634,973	5,489,902	6,245,508	1,846,792	2,948,116	86,259	1,920,190	2,467,937	1,895,377	320,742	8,586	415,842,698	1908
1909	211,196	45,836	51,849,220	10,716,936	6,393,109	8,986,478	2,266,899	3,119,377	87,276	2,553,940	2,801,128	1,824,440	422,047	7,353	460,814,016	1909
1910	177,245	11,164	61,871,019	11,973,736	7,533,088	4,921,451	2,517,809	2,646,226	67,533	2,920,970	3,508,321	1,802,176	399,041	5,448	501,590,378	1910
1911	165,210	10,747	59,831,580	10,157,383	6,744,864	6,178,728	2,513,175	3,074,242	40,661	2,076,358	3,148,158	1,974,593	502,628	2,721	498,371,126	1911
1912	227,503	10,978	66,786,687	10,977,824	7,368,124	6,988,182	3,016,149	3,675,418	41,637	3,048,495	3,536,824	2,188,612	499,480	3,319	534,466,580	1912
1913	255,626	24,639	71,254,136	9,232,510	7,333,066	7,202,210	3,254,828	4,165,770	46,063	3,240,973	3,708,806	2,429,144	495,320	14,789	569,960,219	1913
1914	166,498	(b)	71,707,626	8,170,569	6,475,293	6,860,988	3,103,036	3,988,613	51,558	2,805,173	3,877,689	2,323,773	506,685	25,824	513,525,477	1914
1915	134,496	(b)	77,184,069	8,624,980	6,554,028	6,824,474	3,108,715	3,693,580	39,231	2,789,755	3,817,940	2,088,908	528,078	24,496	531,619,487	1915
1916	173,554	(b)	80,460,127	10,484,237	7,910,647	6,881,455	3,567,428	3,608,911	42,592	3,632,527	3,793,011	1,987,503	634,912	29,199	590,098,175	1916
1917	119,028	(b)	86,441,667	12,483,336	8,575,619	7,184,975	4,125,230	4,386,844	28,327	4,226,689	4,000,527	2,355,815	790,548	68,420	651,402,374	1917
1918	66,716	(b)	89,935,839	12,407,571	9,438,688	7,561,947	5,136,825	4,813,447	13,328	4,532,505	4,023,239	2,261,135	719,733	89,948	678,211,904	1918
1919	53,337	(b)	79,036,553	10,323,420	7,219,738	5,224,724	4,631,323	3,802,113	18,739	3,238,389	3,138,756	1,680,656	840,959	81,645	553,952,259	1919
1920	50,158	(b)	89,970,707	12,278,225	9,630,271	5,926,408	6,005,199	4,849,288	20,717	4,413,860	3,683,440	1,615,015	948,625	76,641	658,204,932	1920
1921	33,815	(b)	72,786,998	9,122,760	7,200,606	3,466,641	4,078,784	3,362,623	(b)	2,733,058	2,453,482	972,839	804,903	123,215	506,395,401	1921
Total	10,222,898	5,153,264	1,441,012,608	259,256,786	181,745,868	179,628,373	08,009,374	91,978,683	2,380,313	69,770,901	70,305,690	41,934,934	11,257,959	38,506,776	14,527,029,948	Total.

[a] From 1871 to 1888, inclusive, production reported in this column is due principally to colliery consumption, which in some years was estimated and not included in the distribution by States. Since 1888 small, irregular production from several unimportant sources has been included in this column.

[b] Included under "Miscellaneous."

Division of Mineral Resources.

Compiled by Miss LIDA MANN, Statistical Clerk, under direction of F. G. TRYON.

76571°—24 (In pocket.)