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OF
SOUTH AFRICA.

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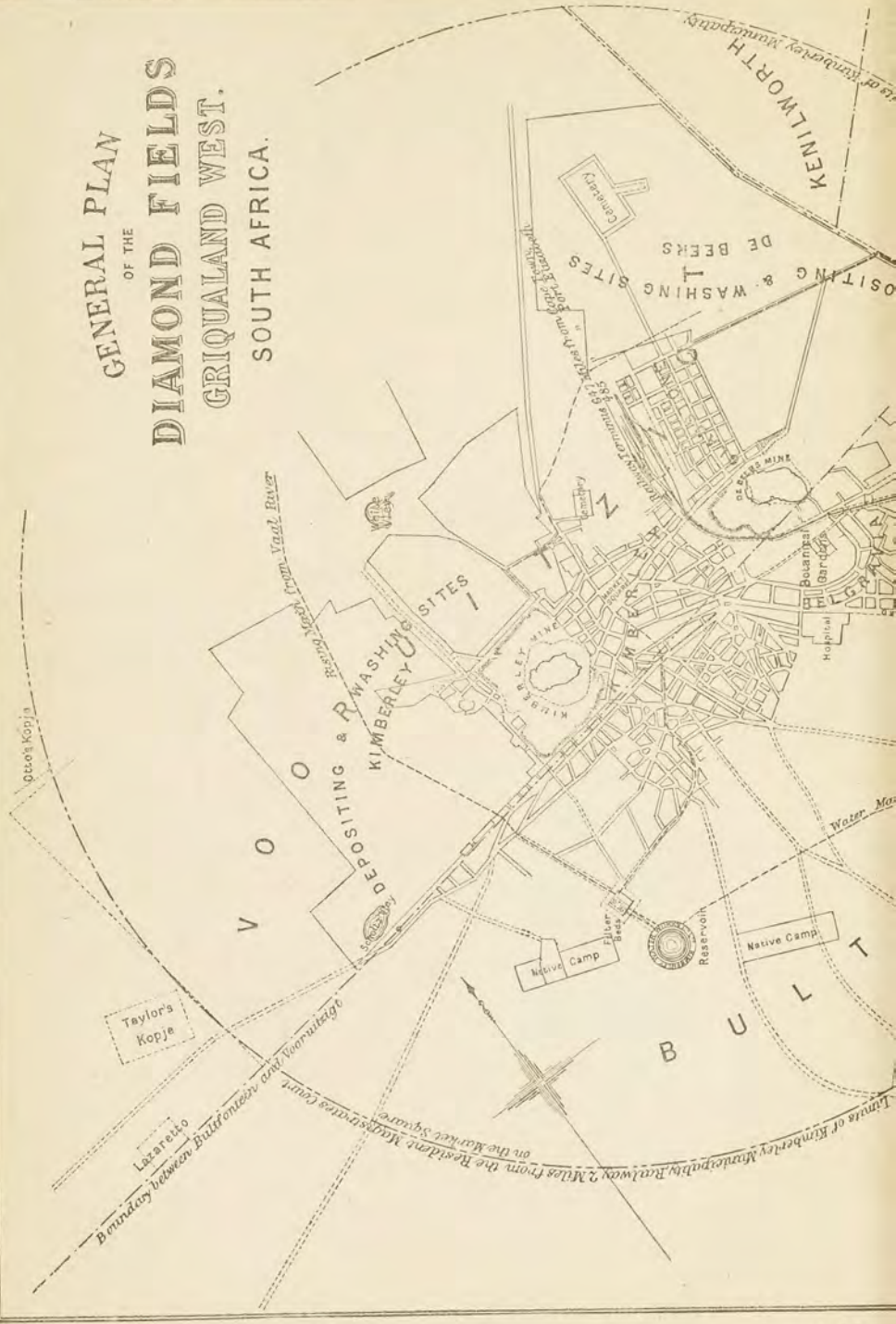
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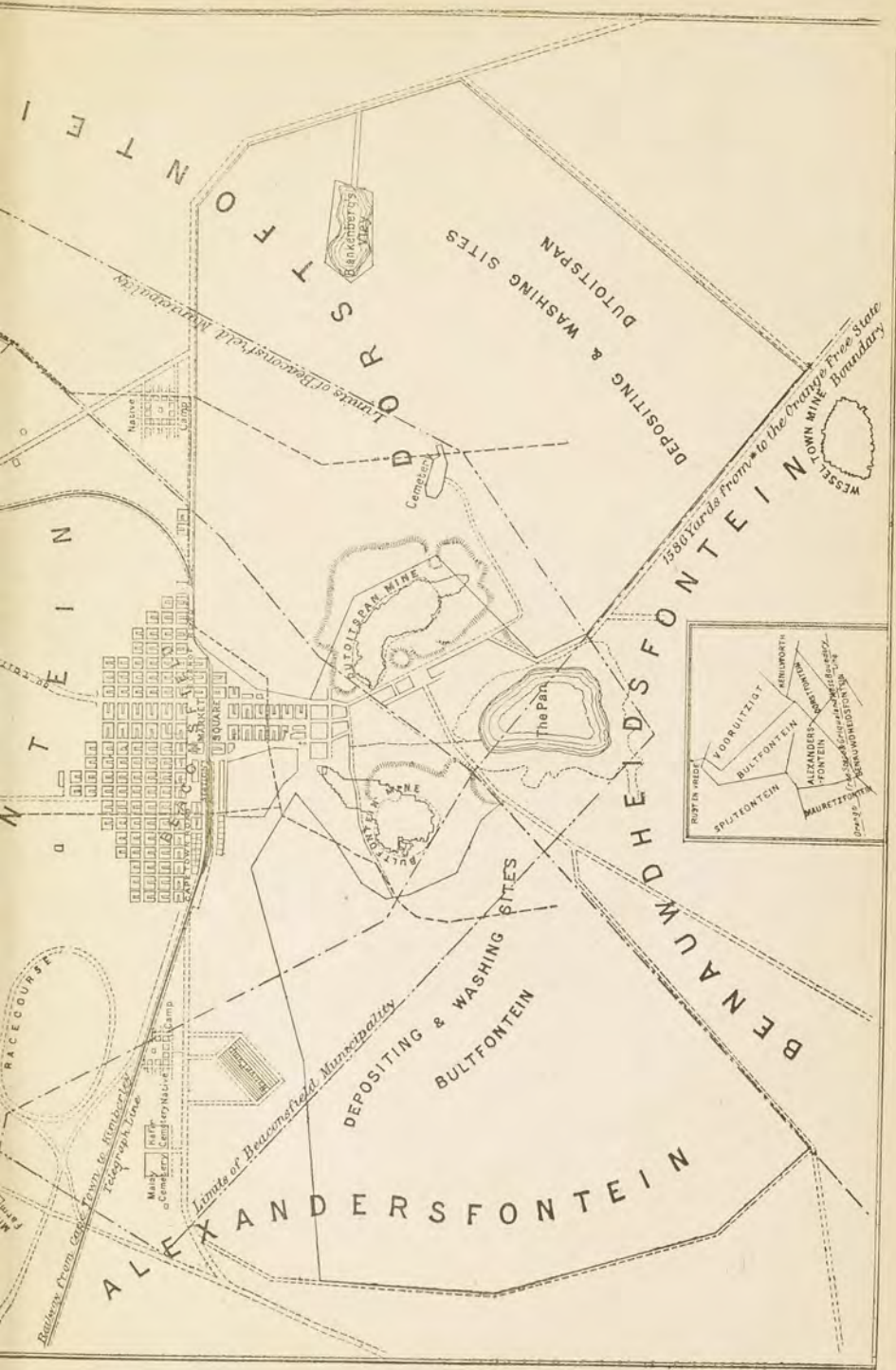
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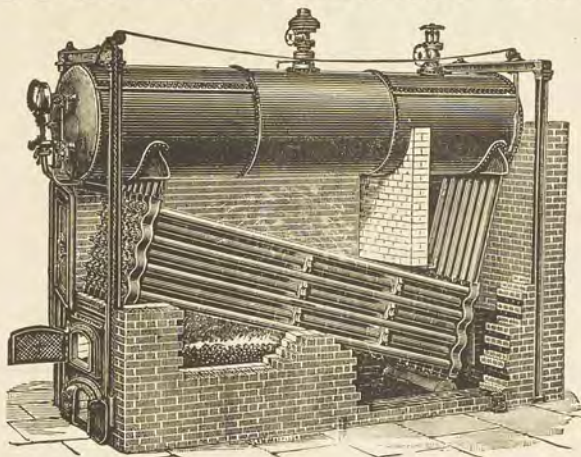
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TREASURY

THIS contribution, specially prepared for a New Edition of the Cape of Good Hope Official Handbook, is now published with a view to furnish full and accurate information to Visitors to the Kimberley International Exhibition of 1892, respecting the marvellous Diamond Mining Industry of South Africa.

The Plan of the Diamond Mines is, with permission, reduced from the Map of the London and South African Exploration Company; and the Illustrations are chiefly taken from the excellent Photographs of Mr. J. E. Middlebrook, of Kimberley.

We are indebted to Mr. E. P. Mathers for the Illustrations facing pages 35 and 40, and also for the Plan of the Buildings of the Kimberley and South African Exhibition, reproduced from 'South Africa.'

J. C. JUTA & Co.

CAPE TOWN, 1892.

Faint, illegible text, possibly bleed-through from the reverse side of the page. The text is arranged in several paragraphs and appears to be a formal document or report.

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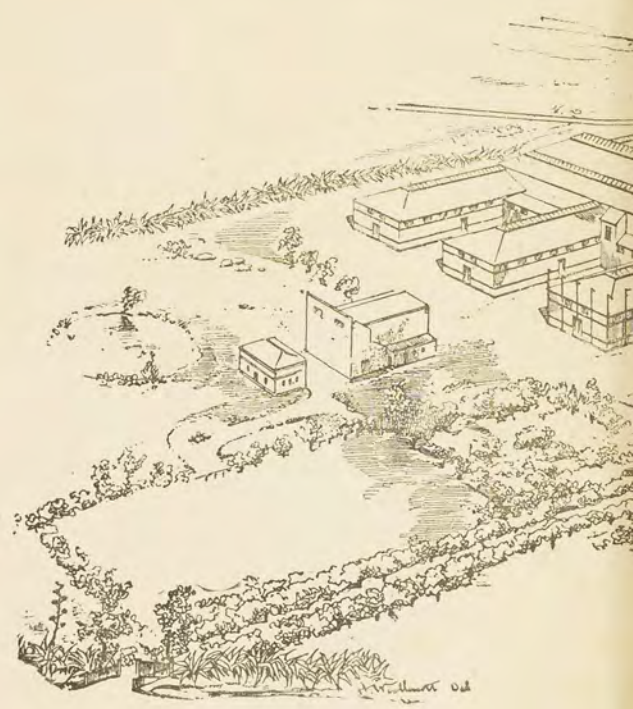
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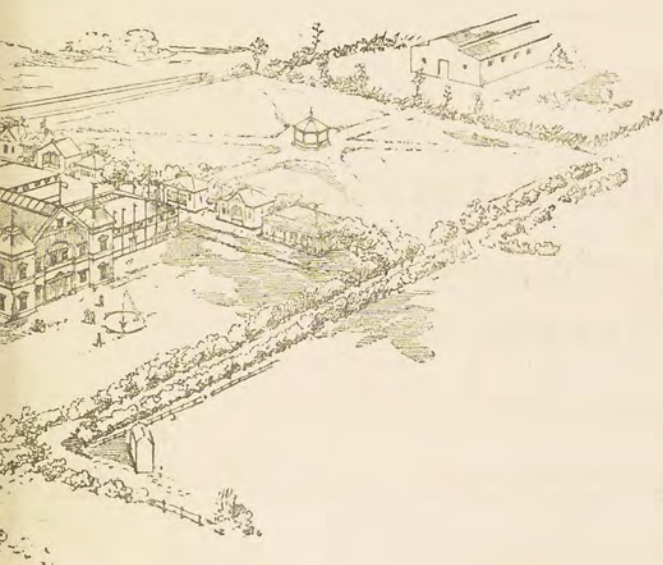
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EXHIBITION



GRS EYE VIEW

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KIMBERLEY NOV 1891

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## THE DIAMOND MINES.

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DURING the four centuries which have elapsed since the Portuguese sailors, steering south in search of the sea route to India, first sighted the Cape of Good Hope, it may safely be asserted that no more important event has happened in South Africa than the discovery of the first diamond by Mr. John O'Reilly, in the month of March, 1867. The beneficial effects of that discovery are apparent to-day in every corner of South Africa. It has spread new life and energy through all the States and Colonies, which five-and-twenty years ago were in a languishing and impoverished condition; and has converted what were the most despised possessions of Britain into sources of revenue to the mother country, and fields of ever widening enterprise for her sons.

A full review of the results which have followed the discovery of diamonds would entail writing a great part of the history of South Africa during the past quarter of a century; but amongst the most evident of these results are, the increase of trade and industry, the employment of native labour, the progress of public works, the general dissemination of wealth throughout all classes of the community, and last, but not least, the steady advance of civilization into hitherto unexplored regions.

1. Before the diamond mines were discovered, the wealth of the country was derived almost exclusively from its sheep and cattle; the total *exports* of the Cape Colony amounted to little more than two millions sterling per annum, more than three-quarters of which consisted of exports of *wool*. To-day

the exports from South Africa are six-fold that sum, to which *diamonds* and *gold* contribute more than half. Until quite recently the value of diamonds exported was far in excess of any other article we produced. For the last ten years they have formed on an average half the gross exports of the Cape Colony, but have now been caught up by our gold exports. In the year 1890 the value of gold exported from South Africa was under two millions sterling, whilst the exports of diamonds were considerably over four millions, and the exports of *wool* nearly three millions; but the steadily increasing output of Witwatersrandt has brought the production of gold up to four millions per annum, so that gold and diamonds together now form *sixty per cent.* of the total exports from South Africa.

During the period under review, the rapid development of mining industries, and the consequent influx of money and population, have increased the value of goods *imported* in more than equal ratio to the exports. In the year 1890, the imports through the four chief ports of South Africa (Cape-town, Port Elizabeth, East London, and Durban) amounted to nearly fourteen millions sterling.

2. The effect of the discovery of diamonds on the *natives* is too important to be left without a word of comment. In many other countries where European enterprise has brought to light the hidden riches of the earth, the manual labour at the mines is performed entirely by white men, before whom the aborigines have gradually vanished off the scene. But the strange persistence of the South African native in declining to disappear, but, on the contrary, increasing and multiplying, in face of the European, might have been a most serious obstacle to colonization. Luckily, however, our native races have proved themselves admirably adapted to handling the pick and shovel. They have been taught to work, instead of fight; and since the large demand for labour at Kimberley, the constantly recurring native wars have ceased to be a burden and menace to the country.

3. The need of easy and quick *communication* between the coast and the Diamond Fields has caused roads, railways, and telegraphs to be constructed on a much larger scale than would otherwise have been contemplated; thus affording

further employment for natives. Meanwhile, the increase of trade has justified extensive improvements to our harbours, and has secured us a weekly service of fast ocean steamers, and two independent lines of cable to Europe. The journey from London to Kimberley can now be accomplished, taking passage to Table Bay by the fast steamers of the Union and Castle Mail Companies, in nineteen days; about half the time it required to reach the Diamond Fields from Capetown only twenty years ago.

4. Of the *sixty or seventy millions sterling* realized from diamonds found at Kimberley during the last twenty years, probably one-half has been paid away in wages at the mines, and for other local expenses. A large amount has gone into the pockets of farmers and transport-riders; considerable sums to colonial merchants, and to the Government and proprietors for rates and licences. The profits have been chiefly earned by private diggers and shareholders resident in South Africa; so that all sections of the population have been enriched, directly or indirectly, by the produce of the mines.

5. But for the discovery of diamonds, the countries north of the Orange River would probably still have remained in undisturbed possession of the native, with a sprinkling of Boer farmers, traversed occasionally by a stray trader or hunter, whose accounts of reputed mineral wealth, and of rich pasture and agricultural lands would have continued to be received with smiling incredulity. Even after the Northern Gold Fields had been discovered, twenty years passed with only a feeble and unsuccessful attempt at exploration; and it was reserved for the energy and capital of Kimberley men to develop the wealth of the Transvaal, and to penetrate the Dark Continent north of the Limpopo.

The diamondiferous area is defined on the north, west, and south by the wide fork formed by the junction of the Vaal and Orange Rivers, the two principal rivers of South Africa. Although the first diamonds were found a few miles south of the Orange River, and alluvial diggings are still being worked on the northern bank of the Vaal, there is no evidence for believing deposits of diamonds to exist northwards of the Vaal or south of the Orange River. All the known diamond mines

and diggings are contained within the square formed by the 28th and 30th parallels, and the 24th and 26th degrees of longitude. The town of Kimberley is situated in about the centre of this square, and the boundary line of Griqualand West and the Orange Free State forms almost a diagonal across the square from north-east to south-west. It will thus be seen that the Kimberley Mines are practically in the centre of the diamondiferous area, and from these *four mines* more than *ninety per cent.* of all the diamonds exported from South Africa have been raised.

The *River Diggings* extend from Delpot's Hope, at the junction of the Vaal and Harts Rivers, to above Hebron, on the former stream, a distance of some fifty miles across country, or about seventy miles following the windings of the river, in the immediate vicinity of which all the diggings are situated. Reports are occasionally heard of diamonds being discovered as far up the river as Christiana in the Transvaal, but no one seriously believes that they come out of the soil in that neighbourhood.

There are no alluvial diggings in the *Orange Free State*, but several true mines, of which Jagersfontein is the most important, and to which reference will be made later in this article. They are comparatively insignificant, in view of the great wealth of the Kimberley mines, their total production forming not more than *six or seven per cent.* of the annual exports of diamonds from South Africa.

It is evident, therefore, that the diamondiferous wealth of the country lies almost entirely within the territory of the Cape Colony, and after five-and-twenty years of vigorous prospecting, it may be said to be all but confined within sight of the town of Kimberley.

The locality of the Diamond Fields would hardly be chosen as a desirable residence by any one not in search of diamonds, or unconnected with the industry. The region may almost be described as a desert, destitute of trees or foliage, a wide expanse of rolling plains, unrelieved by any eminence worthy of the name of hill; without rivers, or water in any shape, always excepting the Vaal, which is fourteen miles from Kimberley. Owing to the altitude (4042 feet above the sea),

and the absence of vegetation, the climate is extremely dry, and though heavy rains fall in the summer, six or eight months sometimes pass without a single shower, so that dust storms are of frequent occurrence, and the verdure of the veldt is painted an undistinguishable brown. From September to March the heat is excessive, often 100° in the shade, though on account of the dryness of the air, this temperature is much less trying than it would be at the coast, and the nights, even in mid-summer, are invariably cool and pleasant in spite of the mosquitos, which have only visited the fields since the advent of the railway. The winter climate is delicious, mild bright days and frosty nights, with very rarely a fall of snow. When every deduction is made, the wide, open country and the vast blue sky have a charm of their own which grows upon one. Notwithstanding the drawbacks mentioned, the climate is far from unhealthy, and for those able to provide themselves with the ordinary comforts of life the once deadly camp-fever has lost its terrors.

The town of Kimberley still bears marks of the old diggers' encampment out of which it has grown. The early diggers, who still speak of it as "the Camp," lived in tents; and when they migrated into nobler edifices of galvanized iron, the streets were not laid out with much regard to regularity. Indeed, the tin houses were frequently moved from one spot to another, and it is still no unusual sight to see a house being carted down the street, or carried, walls and roof intact, by a gang of natives. During the last ten years, however, comfortable brick houses have been built, furnished with every modern luxury; and since the Vaal River water has been brought into the town, gardens have been laid out, trees and orchards have been planted; so that many portions of the town and suburbs present a very bright and pleasing appearance to travellers arriving from the monotonous journey through the arid Karoo. There are no imposing public buildings in Kimberley, but many visitors have carried away a pleasant impression of the Kimberley Club and the Public Library, which are quite equal to any similar institutions in South Africa. The population in 1891 was 28,718 persons.

The township of Beaconsfield is situated two miles to the

south-west of Kimberley, with which it is connected by an electric tramway, and by the main line of railway from Capetown. The population numbers 10,478 persons.

A glance at Juta's map of South Africa will suffice to show that the railways of the Cape Colony are nearly all designed to serve the Diamond Fields; and where the primary object has not been to provide communication between Kimberley and the coast, the increased prosperity consequent on the opening of the mines has justified the expenditure, by which other industries have benefited. In the year 1871, when Kimberley Mine was discovered, the railway only extended as far as Wellington, a distance of 45 miles from Capetown, and neither the Port Elizabeth nor East London line had been commenced. There are now 1700 miles of railway open and working in the Cape Colony, and northern extensions have been made, and are still being pushed forward, from Kimberley through Bechuanaland, and from Bloemfontein to the Transvaal, whilst additional branch and junction lines are in contemplation. The natural rivalry of the three chief seaports compelled Parliament to sanction the simultaneous construction of three, or even four, main lines of railway towards Kimberley, which considerably retarded the northern advance of the locomotive. The Port Elizabeth and Graaff-Reinet line was opened on the 20th August, 1879, after which the latter town remained for some time the chief forwarding station for the Diamond Fields. In the following year, the Capetown line was opened to Beaufort West on the 5th February, the Midland line to Cookhouse on the 2nd March, and the Eastern line to Queenstown on the 5th May. The question of suitable junctions for the several systems long agitated the country, and it was finally decided to connect the Midland and Western systems between Naauwpoort and De Aar, where the opening took place on the 31st March, 1884, thus placing Capetown and Port Elizabeth for the first time in communication by rail, though only by travelling a distance of 839 miles! This junction left the Graaff-Reinet and Queenstown lines out of the running, as far as the Diamond Fields trade was concerned. The former line has not been extended beyond the terminus it had reached



twelve years ago; but the East London line has been completed to the Orange River, and two important junctions have been constructed—the one from Molteno to Middleburg Road, on the Midland system, the other from Burghersdorp, *viâ* Bethulie, over the Orange River, to join the Colesberg-Bloemfontein line. The former of these junctions is of the greatest value to Kimberley, since it will connect the diamond mines with the coal fields of the Stormberg, and later, no doubt, with those of the Indwe district. The line from Burghersdorp into the Free State will facilitate the transport of grain to the Kimberley market, and may eventually form part of the shortest route from Kimberley to East London, as an agitation is now on foot to secure a direct line from Kimberley to Bloemfontein. The De Aar Extension was opened at Kimberley on the 28th November, 1885, in the presence of Sir Hercules Robinson, the High Commissioner, and of a large gathering from all parts of South Africa.

The distance from Kimberley to Capetown is  $647\frac{1}{4}$  miles, and a daily service of trains conveys passengers to the coast in 36 hours, or once a week by the English mail in 31 hours. The distance to Port Elizabeth is  $485\frac{1}{3}$  miles, and the journey is performed in 27 hours. The up-country trip occupies 32 hours by the weekly express, or by the daily train 36 hours from Capetown, and 31 hours from Port Elizabeth. Considering that the permanent way consists of only 60 lbs. steel rails for a portion of the route, with inferior metals on considerable sections; that the gauge is only 3 ft. 6 ins., and that the entire railway is a single line with many heavy gradients, this must be regarded as very creditable travelling. The ordinary fares from Capetown are £8 1s. 9d., £5 7s. 10d., and £2 13s. 11d., for first, second, and third class; and from Port Elizabeth, £6 1s. 3d., £4 0s. 10d., and £2 0s. 5d., with return-tickets at the rate of a fare and half. But during the South African International Exhibition of 1892, return tickets to and from Kimberley will be issued at the following reduced rates:—From Capetown, £3 10s., £2 12s. 6d., and £1 15s. for first, second, and third class respectively; and from Port Elizabeth, £3, £2 2s., and £1 10s.

Passengers for the Diamond Fields invariably disembark

at Capetown, but as the goods rates are in proportion to the mileage, and the steamer freights are the same to Capetown or Port Elizabeth, all heavy merchandise goes *viâ* the latter port. The English mail trains carry only first-class passengers, and are provided with sleeping and dining cars, fitted with every convenience, for which no extra charge is made. The ordinary journey from London to Kimberley, *viâ* Capetown, a distance of 6700 miles, is completed in three weeks; whilst goods, *viâ* Port Elizabeth, can be delivered in Kimberley within five weeks of leaving London. That is about the average time formerly occupied in transport by bullock-wagon from the coast to Kimberley, the cost of which varied according to the season, from £15 to £30 per ton of 2000 lbs. The railway rates for goods from Port Elizabeth are from £6 to £8 per ton; so that some idea may be formed of the saving in time and money which the railway has secured for the Diamond Fields.\*

The influence of the railway on the fuel supply of Kimberley deserves a word in passing. Until seven or eight years ago, the only fuel available was native timber, and it is estimated that over a million large trees have been cut down to supply the Kimberley wood market. The whole country within a radius of a hundred miles has been denuded of timber, with the most injurious effects on the climate. With the near approach of the railway, Welsh steam coal began to be imported, and is now almost exclusively used at the mines. It costs £8 to £9 per ton of 2000 lbs. delivered at Kimberley. Whilst timber was the only fuel, as much as £30 has been paid for a wagon-load, and, though owing to the reduced demand, it is occasionally cheaper than coal, it would be impossible to-day to supply the Kimberley fuel-market with wood alone at a price that would not be ruinous to the consumers. Nothing perhaps illustrates the great wealth of

\* It is gratifying to know that this has not been accomplished at any sacrifice of the public money. The report of the general manager of railways for the year 1889, shows that the surplus of revenue over expenditure in that year was £822,128; of which £781,910 is credited to the Western and Midland expenses, which specially serve the Diamond Fields and the Gold Fields. This handsome profit is equal to 7 per cent. on the capital expended on the lines, including rolling stock.

the diamond mines more strikingly than the enormous prices that have been paid for fuel during the past fifteen or sixteen years.

Kimberley is not so fortunate as Johannesburg in having coal on the spot. The nearest coal mines are in the Stormberg, 300 or 400 miles away; and yet it is surprising that so many years have been allowed to elapse before placing Kimberley in direct rail communication with the colonial coal-fields. Local rivalries have been the chief cause of this delay. The junction-line from Molteno to Middleburg Road, which was opened in March, 1892, is only 87 miles long, and the distance from the Cyphergat colliery to Kimberley 335 miles. From Cyphergat to the Indwe is another 75 miles; but the latter line, though sanctioned by Parliament, has not yet been commenced.

Up to the present very little colonial coal has been used in Kimberley, but considerable quantities have been burnt on the Eastern Railway, and the relative values of the coals are therefore known. It is found that 100 lbs. of Welsh steam coal are equal to about 140 lbs. of Indwe coal, and to about 180 lbs. of Cyphergat coal. This fact alone would justify the construction of the extra 75 miles of railway to bring the superior coal into the Kimberley market, and to place it at the disposal of the colonial railways. But whilst the Cyphergat and other Stormberg mines are narrow seams, expensive to work and limited in output, the Indwe mines are thick seams that can be worked at about a third of the cost, and with the certainty of being able to supply all the markets within their reach.

Two circumstances, however, have interfered with the construction of the Indwe railway. First, the reported discovery of a western extension of the Indwe seams in the Sterkstroom district close to the main line of the Eastern system; and, secondly, the possible competition of the Free State coal mines, which will be tapped by the railway from Bloemfontein to the Vaal River.

The borings in the Sterkstroom district have so far been without result; and, as regards the Free State mines, trials of the coal have not yet been conducted on a sufficiently large

scale to determine its relative value. In any case this coal could not be brought into Kimberley without constructing a railway to Bloemfontein.

Whatever the ultimate decision may be, it is certain that in the near future Kimberley will be supplied with African coal at prices equivalent to little more than half what has hitherto been paid for the imported fuel.

To understand the geology of the Diamond Fields, it will be necessary to refer briefly to the order in which the same rocks occur in other parts of South Africa. The coarse grit, of which Table Mountain, and the various mountain ranges in the neighbourhood of Capetown are formed, rests unconformably on a base of clay slates (with intrusive granite) of the Silurian period, known in the South as the *Malmesbury Beds*, and reappearing in the *Lydenburg Beds* of the Transvaal. Above the *Table Mountain Sandstone* is a second series of slates and sandstones containing fossils characteristic of the Devonian period. These rocks, known as the *Bokkeveldt Beds*, form the base of the Witteberg, Zwarteberg, and Zuurberg Ranges, and are followed conformably by the massive white *Quartzites* (carboniferous) of which these mountain chains are built up. Resting unconformably on the quartzites is a great belt of conglomerate running due east and west on the northern bases of the Zwarteberg and Witteberg Mountains. This is the *Dwyka Conglomerate* of Mr. Dunn, who considers it identical with the glacial conglomerates of the Orange River basin, and assumes it to be the shore line of the ancient lake which once covered the greater portion of the Cape Colony, including a large part of the Free State and Natal. By many other geologists, however (Bain, Wyley, Atherstone, and Moulle), this remarkable conglomerate is assumed to be of volcanic origin. Professor Green, whilst adopting Dunn's designation, prefers to leave the decision of its origin an open question.

North of the Dwyka Conglomerate, and conformable with it, lie the *Ecca Beds*, a thick deposit of sandy clay, and quartzose sandstones, greatly contorted on its southern boundary, but gradually flattening out towards the north. Still journeying north, we come upon the *Upper Karoo Beds*, a vast extent of

undisturbed shales and sandstones, covering the whole of the Karoo from Graaf-Reinet to Colesberg, and stretching from the Roggeveld Mountains in the west to beyond Queenstown in the east, and thence in a narrower band to near Pietermaritzberg; whilst a northern extension covers the central portion of the Free State as far as Bloemfontein. To the north of the Karoo Beds are the *Kimberley Shales*, or Lower Karoo Beds, containing the diamond mines of Kimberley and the Free State; and as their second name partly indicates, they lie conformably *beneath* the shales of the Karoo proper, and unconformably above the Ecca Beds. Finally, above the Upper Karoo Beds we have the *Stormberg Beds*, extending from Queenstown to Johannesburg and Middelburg, and from near Bloemfontein across the Drakensberg. In these beds, consisting of thick bands of sandstone interlaminated with shales, occur all the coal measures of the Cape Colony, the Free State, Natal, and the Transvaal.

There is much difference of opinion as to the geological age of the Kimberley shales. Mr. Dunn describes the whole series of rocks, from the Dwyka Conglomerate to the Stormberg Beds, inclusive, as "Carboniferous to Triassic."

Mr. Hudleston judges the Kimberley Shales or Karoo Beds to be in all probability Mesozoic, and therefore more recent even than the Permian, or latest of the primary formations. Mr. Sawyer, from fossils of *Lepidodendron* and *Faoullaria*, which he found near Johannesburg in the Stormberg Beds, concludes the whole series, including the diamondiferous deposits, to be carboniferous. M. Moulle agrees with Mr. Hudleston in classing the whole of the Karoo and Stormberg Beds as Triassic.

The Kimberley Shales abut on the north against the crystalline rocks of the Transvaal, separated only by a thin band of conglomerate called by Professor Green the Basement Conglomerate of the Kimberley Shales. Both banks of the Vaal from above Potchefstroom to Barkly West, are covered by a broad sheet of volcanic rock, partly amygdaloidal, called Diabase by Mr. Dunn, and Melaphyre by M. Moulle.

A basaltic rock of more recent age, called Dolerite by Mr. Dunn, is of constant occurrence throughout the wide

stretch of country covered by the Kimberley Shales, and the Karoo and Stormberg Beds—sometimes in the form of dykes and intrusive sheets cutting through and overlying the shales, &c., sometimes as intrusive masses of trap of sufficient extent to form great hill groups.—(Green).

The red ferruginous soil which is so characteristic of the plains of the Karoo, the Free State, and Griqualand West, and the rounded stones and boulders which cover the slopes of all the hills or Kopjes, are formed from the weathering of these traps.

In many districts the red soil is replaced or underlaid by a deposit of lime, or calcareous tufa, supposed to have been formed by deposition from the underlying rocks.

The mining operations at Kimberley, which have reached a depth of over 1200 feet, have of course revealed the nature of the underlying strata, and corroborate the succession of the rocks enumerated above.

Beneath the *red soil*, which varies from one to five feet in depth, there is at several of the mines a deposit of tufaceous *limestone*, from five to twenty feet thick. This is particularly noticeable in Bultfontein Mine, and in the recently-discovered Wesseltion Mine; but in De Beers and Kimberley Mines the red soil is followed by a sheet of much decomposed *basalt* of columnar structure, varying in thickness from twenty to ninety feet. Microscopic examinations show this rock to be similar in character to the trap dykes of the surrounding country, and to the extensive trap sheets of the Stormberg and other districts. The prevailing minerals in all are plagioclase, augite, olivine, and ilmenite. Below the basalt, or in some cases immediately below the red soil, or tufa, are the characteristic *shales* of the country from 200 to 300 feet in thickness. At Bultfontein and Dutoitspan Mines the shale has not been bottomed, but it has certainly a greater thickness there than at the more northern mines of Kimberley and De Beers, whilst at the Vaal River Diggings it thins out altogether, thus confirming the supposition that the Kimberley Mines are situated at the northern rim of the saucer-shaped basin, which was once the great freshwater lake of the Karoo area. The shales are yellow, pink, and brown for a depth of thirty

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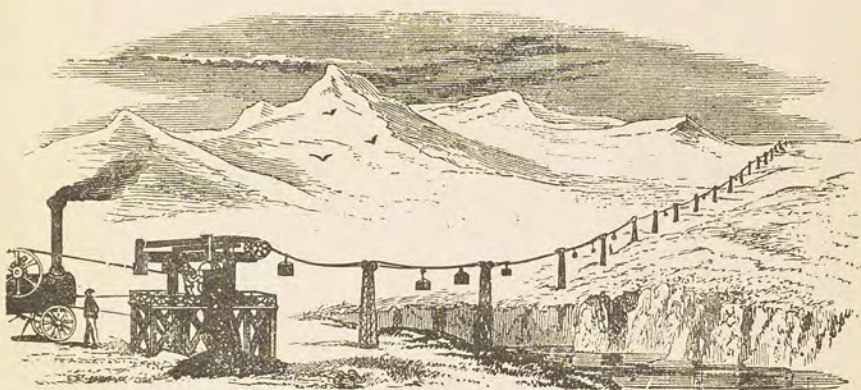
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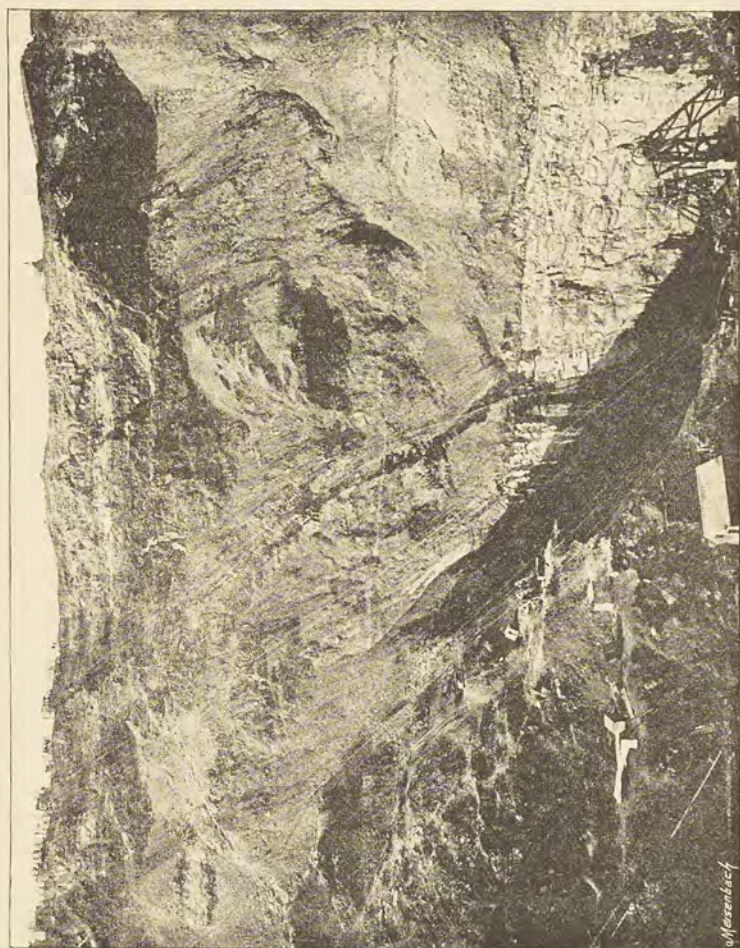
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KIMBERLEY MINE UNDER REEF IN 1866, SHOWING CRATER-LIKE FORMATION.

[To face page 13.]



to fifty feet, changing then to black, and are almost perfectly horizontal. The black shales contain much iron pyrites and carbon, and in Kimberley, Bultfontein, and Dutoitspan Mines have ignited spontaneously, and continued burning for years, giving off a strong sulphurous odour that can be smelt for miles. The combustion changes the colour from black to a brick-red and white. Occasional sheets and dykes of intrusive trap are met with amongst the shales. Beneath the shales is a thin bed of *conglomerate* about ten feet thick, composed of rounded pebbles and stones firmly cemented together. Mr. Dunn would identify this with the Dwyka Conglomerate, and Professor Green with the Basement Conglomerate, of the Kimberley shales. Underlying the conglomerate are about 400 feet of amygdaloidal trap, or *Melaphyre*, the "Hard Rock" of the miners, identical with the "Bed Rock" of the Vaal River Diggings. It is a very hard compact rock of light olive or grey colour, with numerous nodules of agate and quartz, making it exceedingly difficult and expensive to sink through. Dr. Stelzner, of the Freiberg School of Mines, has recently determined it as "Olivine Diabase," which is virtually composed of the same minerals, plagioclase, augite, and olivine, the one being granular, the other porphyritic. Underneath the melaphyre is a similar thickness of about 400 feet of greenish *quartzite*, of hard, tough texture. In the Kimberley Rock Shaft, at a depth of 1141 feet from the surface, the quartzite changed to *Metamorphic slates*, interlaminated with thin layers of sandstone, and this is the oldest rock that has so far been pierced.

The diamond mines are large pipes or funnels of unknown depth, and more or less oval shape, several acres in extent. They are probably extinct craters which have been filled from below by volcanic mud at a time when the surrounding country was under water. In support of this theory, the diamond-bearing rock filling the pipes contains fragments and boulders, or large floating masses, of all the encasing rocks enumerated above, as well as pieces of older and lower-lying rocks, such as granite or gneiss, which have not yet been pierced by the deepest shafts outside the mines. The softer rocks (shales) surrounding the pipes near the surface have their exposed

edges turned upwards, as by a pressure from below, and the funnel itself is much more conical at the surface than in the harder rock beneath the shales. Though the mines occur in groups confined within a few square miles of country, each mine differs from its neighbour, both in the appearance and composition and physical nature of the diamond-bearing rock, as well as in the quality of the diamonds themselves; and similar strongly marked differences exist even in different parts of one and the same mine, from which it would appear that the breccia filling the pipes has been deposited by a succession of upheavals. The first mines were discovered by diamonds lying on the surface in the red sand, and subsequent search disclosed numbers more in a similar position; but no diamonds were found in the surrounding country immediately outside the margin of the mines.

The evidence of the volcanic origin of the mines may therefore be regarded as complete.

The question as to the manner in which the diamonds themselves were produced is much more difficult to solve. They have evidently not been formed in the precise positions they now occupy, since fragments of broken diamonds are frequently met with; but, on the other hand, from the distinctive character of the diamonds in different mines, we must infer that their origin cannot have been very far distant from the spots where they are actually found, though they have certainly come from a very great depth. The diamond is known to be pure carbon, and before it was ascertained that the mines extended far beneath the level of the black shales, it was conjectured that in passing through these carbonaceous shales the diamonds had been formed by chemical action due to the steam generated in the volcanic rock. It is evident now that the diamonds are of older date than the rock in which they are found, but the mode of their formation still remains a mystery.

The diamond-bearing rock has been subjected to many careful analyses. The principal minerals it contains, besides the diamonds, are bronzite, olivine, mica (biotite), garnet, pyrites, calcite, ilmenite, and magnetite. It is of a tough soapy texture, of a grey-blue colour, altered to yellow near

the surface, where it is also much more friable. The miners distinguish between "yellow ground" and "blue ground," but the only difference is, that in the upper part of the pipe the rock has become hydrated by the action of the air, thus changing the colour from blue to yellow, and rendering the rock softer. The same change has been noticed as occurring in the shales. In laying the results of some interesting analyses of the Kimberley rock before the Geological Society, Prof. Maskelyne states: "They will be seen to exhibit this undoubtedly once igneous rock in the light of a bronzite rock converted (except where the remains of crystals have still survived the process of metamorphism) into a hydrated magnesian silicate, which has the chemical character of a hydrated bronzite."

The surface of the mines, in common with the surrounding country, is covered by a few feet of red sand, followed generally by a somewhat thicker deposit of lime. Underneath this the true diamond rock is reached. The yellow ground extends to a depth of 50 to 60 feet. The depth of the blue ground is unknown. It has been tested in Kimberley Mine to a depth of over 1200 feet beneath the surface, and may be regarded as practically inexhaustible, since the encasing rocks are almost vertical in the lower depths. The surface shales and basalt surrounding the pipes are called "Reef." It is important to remember that in diamond-mining this term is applied to the *casing* only, and not to the rocks carrying the diamonds. In the upper levels of the mines intrusive masses of shale and igneous rock are met with, called "Floating Reef." They are destitute of diamonds, and sometimes cover an area of several thousand square feet, but they disappear in the lower depths. Smaller dykes of igneous rock also occur. The ground is generally richer in diamonds in the neighbourhood of these dykes and intrusive sheets, or immediately beneath them.

The following is extracted from the valuable Technical Report by Mr. Gardner F. Williams, the general manager of De Beers Consolidated Mines: "In the De Beers Mine there is a dyke of igneous rock extending from the south-east part of the mine around the east and the north sides, and is

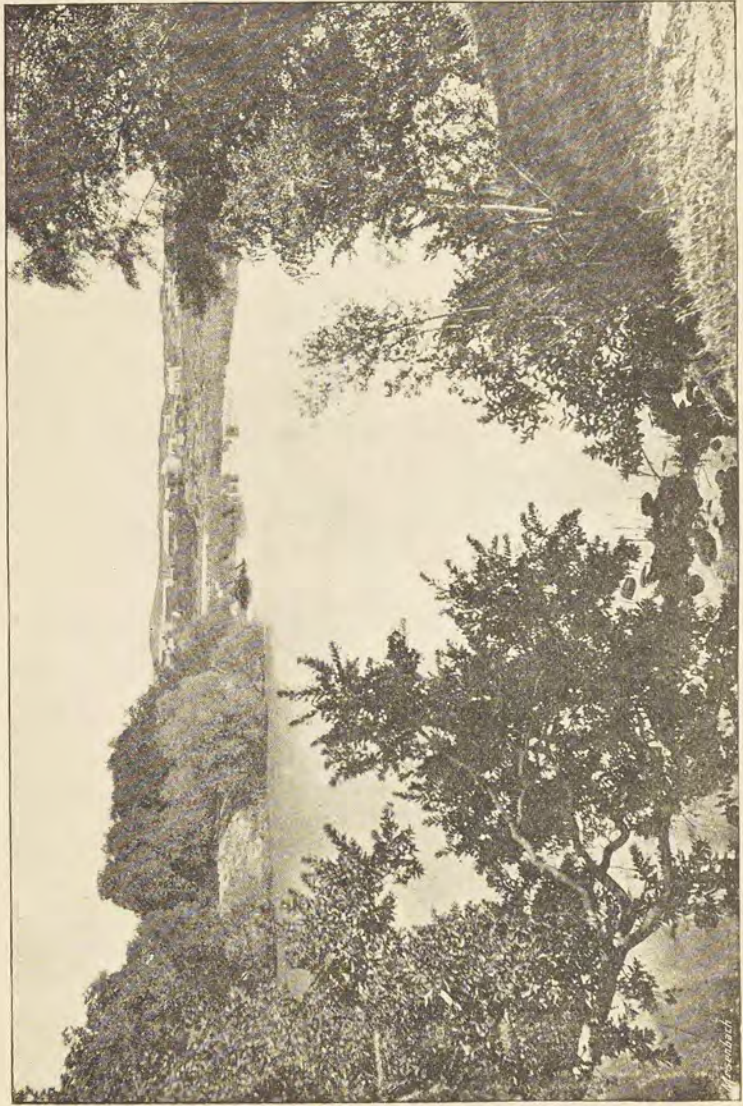
lost in the unexplored poor blue of the west end. Owing to its taking a serpentine course across the mine it has received the local name of 'Snake.' This rock has been determined (by Dr. Stelzner, Professor of Geology at the Freiberg School of Mines) to be a pikrite-porphry, consisting of a much decomposed mass wherein little olivine crystals and mica splints are imbedded. The Snake commences at or near the surface, and extends down to the lowest workings. It does not adhere to the blue ground, but separates from it very easily. It stands like a vein, nearly vertical, varying in thickness from five to seven feet. No diamonds have been found in it.

"It is not easy to determine the nature of the blue ground, owing to the difficulty in obtaining slides for microscopical observations. After a good many trials Dr. Stelzner succeeded in getting a few sections of blue ground, which revealed the most surprising fact, to wit: 'The main body of blue ground is entirely analogous to the snake rock, naturally more decomposed, but in essential points the microscopic pictures of blue ground and snake (not taking into consideration the numerous little slate fragments in the blue) are in an extraordinary degree alike. It therefore impresses upon one's mind that the "snake" is a younger eruptive formation coming from the same volcanic source as the blue ground.'"

Though the blue occurs in the mines as a hard compact mass without stratification, and requiring the use of dynamite for its exploitation, there are well-defined planes separating one portion of a mine from another which generally differ in physical character and in the number and quality of the diamonds contained. These dividing planes usually dip towards the centre of the mine, and are filled with beautiful calcite crystals.

There is a great difference in the relative hardness of the blue. That in Kimberley Mine is the softest, and pulverizes after a few months' exposure and treatment on the depositing floors, whilst some of the De Beers blue is so hard that years of exposure have no effect on it, and it has to be broken up by mechanical fine crushers before it will yield its diamonds.





BARKLY WEST, VAAL RIVER DIGGINGS.

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Some years elapsed after the finding of Mr. O'Reilly's first diamond before the true mines of Kimberley were discovered. The history of Mr. O'Reilly's discovery is too well known to need a detailed repetition. In March, 1867, he was returning from a hunting-trip across the Vaal River; and resting for the night at Schalk van Niekerk's farm, "De Kalk," in the Hopetown district, he noticed a beautiful lot of river pebbles on the table, out of which he picked the "first diamond." Neither the hunter, nor the farmer, was aware of its value. Arriving at Colesberg, Mr. O'Reilly showed it to the Acting Civil Commissioner, Mr. Lorenzo Boyes, who, finding that it *cut glass*, asked O'Reilly to let him send it to Dr. Atherstone, at Grahamstown. Several Jews at Hopetown and Colesberg had pronounced it to be a topaz, and worth nothing. Dr. Atherstone replied, "I congratulate you on the stone you have sent me. It is a veritable diamond, weighs  $21\frac{1}{4}$  carats, and is worth £500. It has spoiled all the jewellers' files in Grahamstown; and where that came from there must be lots more."

Van Niekerk's farm was soon "rushed," but no further discoveries of importance followed till two years later, when the famous "Star of South Africa" was found, a pure white diamond of  $83\frac{1}{2}$  carats, valued shortly after at £25,000.

The first true diamondiferous deposits were discovered in the alluvial drift at Pniel and Klipdrift (now Barkly West), on the banks of the Vaal River, in 1869, and pure accident led to the discovery of the Dutoitspan and Bultfontein Mines in 1870, and of De Beers and Kimberley in the following year. The Jagersfontein Mine, in the Free State, 80 miles south-east of Kimberley, was discovered about the same time.

The region of these startling discoveries, which were destined to open a new chapter in South African history, had been regarded for ages as a sort of No-Man's Land, too valueless to need a rigid definition of ownership. When its mineral wealth was suddenly revealed, rival claims to the country naturally arose, which were not definitely settled till the London Convention of July, 1876, when the Free State accepted a monetary compensation in settlement of its claims, and Griqualand West remained a Crown Colony till October, 1880, when it was formally incorporated in the Cape Colony.

The Kimberley Mines are situated on estates belonging partly to the Government, and partly to the London and South African Exploration Company.

The Plan affords a general view of the Diamond Fields, showing the relative positions of the four mines of Kimberley, De Beers, Bultfontein and Dutoitspan; also of the two townships of Kimberley and Beaconsfield; as well as the large areas set apart for mining purposes; and the boundary-lines of the farms on which the mines are situated. The Kimberley and De Beers Mines are on the Government estate of Vooruitzigt; the Dutoitspan Mine is on the farm Dorstfontein; and the Bultfontein Mine on the farm of Bultfontein; the two latter farms, as well as the adjoining farm of Alexandersfontein, being the property of the London and South African Exploration Company, Limited. The farm of Kenilworth, lying between Vooruitzigt and Dorstfontein, has recently been purchased by the De Beers Consolidated Mines. All five farms lie just within the territory of Griqualand West, the boundary-line of the Orange Free State passing through the adjoining farm of Benauwheidsfontein, lately the property of Mr. Wessels, on whose estate lies the newly discovered Wesselton or "Premier" Mine.

The boundary-line of the Vooruitzigt and Bultfontein estates passes through the centre of the town of Kimberley, whilst the township of Beaconsfield is unequally divided between Bultfontein and Dorstfontein, lying chiefly on the former estate. The local affairs of the two townships are administered by separate municipalities.

It will thus be seen that the greater portion of the Diamond Fields, including two of the mines, half of Kimberley town, and the whole of Beaconsfield, falls within the territory owned by the London and South African Company.

When the Kimberley mines were discovered in 1870 to 1871, and the river diggers left their healthy but generally unprofitable work on the banks of the Vaal, to peg out claims at Dutoitspan and Bultfontein, and subsequently at "Old De Beers" and "De Beers New Rush" (now better known as De Beers and Kimberley Mines), they naturally had no idea of the great depth of diamondiferous soil that lay under



their feet. As their limited experience was confined to *alluvial* diggings, and all diamond-mining in other parts of the world, in India and Brazil, was known to be in gravel and old river-beds, they very reasonably supposed that the primitive pick and shovel would suffice to reach the bed-rock, and they laid out their works accordingly. But it must be admitted that as the excavations went down, and after the surface red-soil and lime had been removed, diamonds still continued to be found in the "yellow ground," considerable ingenuity was displayed in providing means for carrying on the mining in those then inaccessible regions where any recognised engineering appliances were conspicuous by their absence. By a curious accident the two poorer mines were discovered first, and even De Beers was not much richer on the surface than Dutoitspan or Bultfontein. In these first mines the claim-holders had been allowed to work very much at their own sweet will, digging out big holes here, there and everywhere, as the mines were large enough to accommodate all the workers without fear of interfering one with another. But by the time Kimberley Mine was discovered in July, 1871 (then called "Colesberg Kopje," after the discoverer, Mr. Rawstone, of Colesberg, and subsequently re-named in compliment to the British Secretary for the Colonies), sufficient experience had been gained of the probable depth of the mines to render it advisable to lay out the new mine from the commencement on a proper system. Moreover, it was evident from the first that Kimberley Mine was so much richer than all the rest, that an immense rush of diggers took place, and had to be provided for.

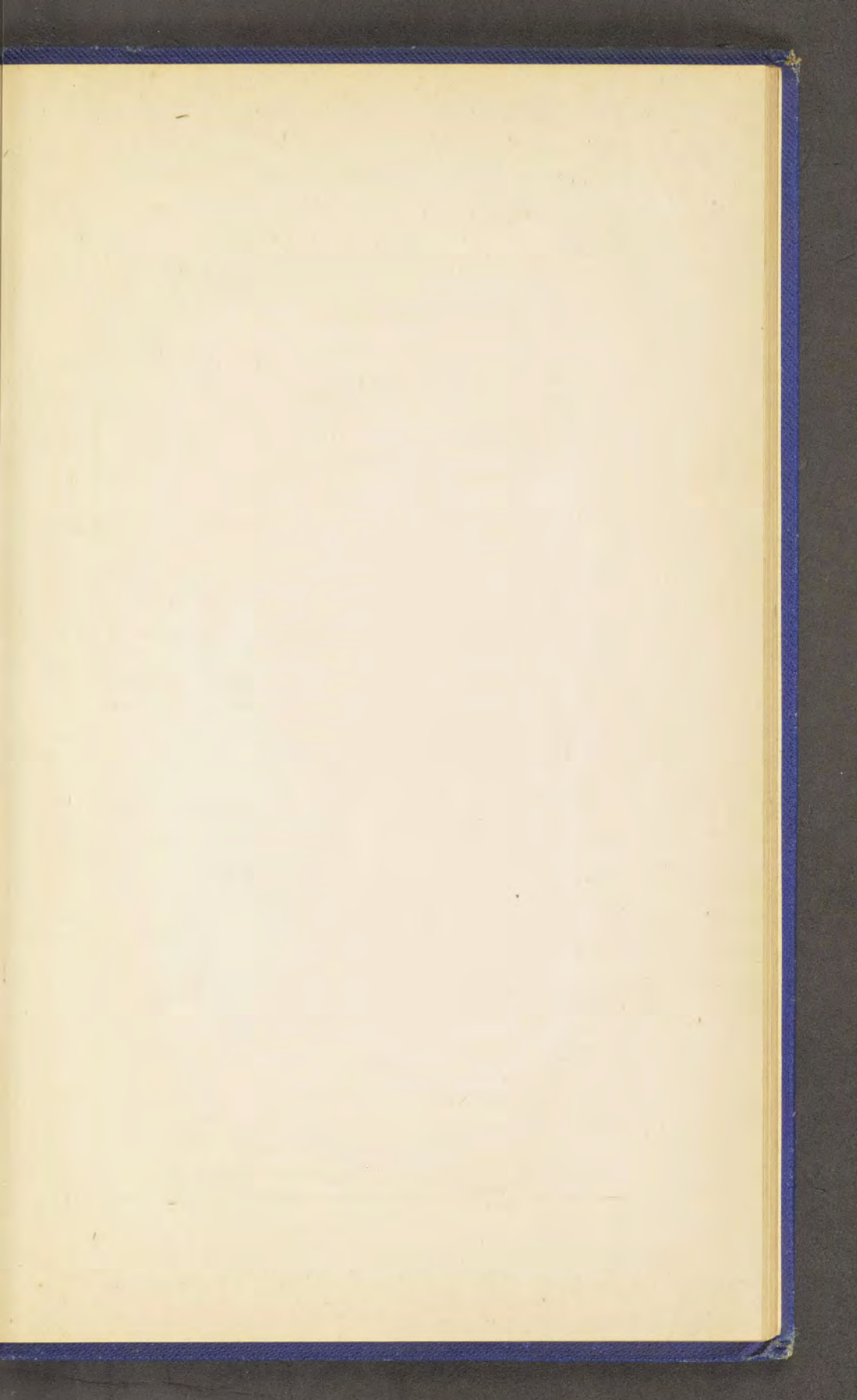
The new mine was thrown open on the 21st of July, 1871, a red-letter day in the annals of South Africa, since it practically inaugurated the era of profitable mining, on which the country mainly depends for its subsistence, and to which it owes its growing importance amongst the rising states of the world.

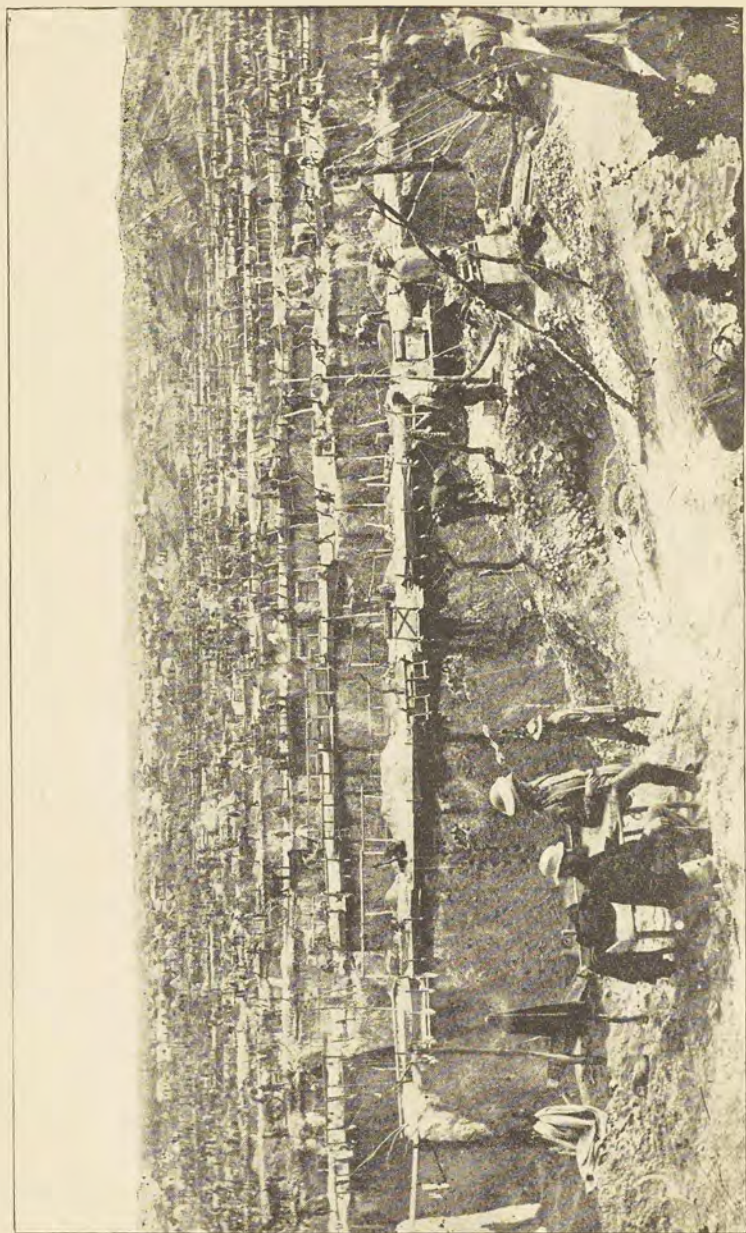
In the face of a good deal of opposition from the diggers, the Government (Orange Free State) Inspector of Mines wisely decided to lay out the mine on a different plan from that adopted at the three mines previously opened. Instead of allotting the whole area within the mine to be worked as

the diggers thought fit, he insisted on a reserve strip off one side of each "claim" being left unmined to form roadways. The size of a claim in Kimberley Mine is a square measuring 31 ft. by 31 ft., the mine itself forming an irregular ellipse, of which the major axis points approximately east and west. The roadways were made to run parallel with the claim-lines across the narrower width of the mine from north to south, and each roadway was 15 ft. wide, half of this width being taken alternately from the east and west of successive claims, leaving a space of 47 ft. between the several roads, so that each claim-holder lost temporarily a strip of  $7\frac{1}{2}$  ft. off one side of his claim, or one quarter of his holding. This loss of ground was more than compensated for by the extra facilities for working afforded by the roadway.

Though there were only about 500 claims in the mine the precise limits of the claim-ground could naturally not be determined before the mine was opened, so that a much larger number of claims was originally allotted than the mine actually contained, even on the surface, and the claims abutting on the "reef" were soon cut out by the conical shape of the mine. But the demand for claims was so great that they were subdivided, first into halves and quarters, then down to eighths and sixteenths, the latter holding comprising no more than *five square yards* after deducting the reserve for roadway. By law no individual could hold more than two claims, and the "blocking" of claims was also prohibited, so that an immense number of independent claim-holders was the result, the mine being split up into no less than 1600 separate holdings. Of course this state of things could not last long, and a process of consolidation soon began, accompanied by a rapid rise in the market-value of the claims. Many diggers who had only paid the customary licence of 10s. per month for their claim disposed of it for over £100, and the value went on increasing from month to month, as the richness of the mine became more and more evident, till ten years later claims changed hands at £10,000 to £15,000 each, and even at these prices have yielded huge profits to the purchasers.

There were fourteen or fifteen roadways in all, numbered from east to west, and the names of them still survive for con-





THE ROADWAYS, KIMBERLEY MINE, 1872.

(To face page 21.)

venience of defining different sections of the mine, though every vestige of them has long since disappeared. As early as the beginning of 1872 the roadways began to be unsafe; the working down of the claims on either side in perpendicular walls left precipitous caverns on both sides of the roads, and many were the accidents both to the workers below and to the carts and passengers along the roads before the latter began to cave in. The mine was strikingly picturesque at this period of its development; hundreds of carts and wheelbarrows careering along the hazardous narrow roads, bearing their precious freight of excavated ground clear of the mine to be sorted; down below, at all distances from the surface, a succession of rectangular ledges, representing the various working levels of different claims, where thousands of white and native labourers, crowded together on the limited working spaces, were busy picking and shovelling the ground and filling it into the original tubs and buckets of all sorts and sizes employed for conveying it to the surface, some of them being hauled up by ropes and tackle, others carried by hand up inclined planks and staircases cut in the perpendicular walls; each man worked on his own device, without regard to his neighbour, the only rule being that the roadways must be kept intact. Whether from design or accident, it frequently happened that masses of the high ground subsided, leaving great chasms in the roads which had to be bridged over by the owner to enable the traffic to go on; and by the middle of the year 1872 the number of these slips had increased so much that it became evident that some change in the system of working was needed; but whilst men were wondering what it was to be, the remaining solid portions of the roads collapsed converting the whole works into ruins. Some of the diggers were in despair, and sold out at once, thinking the mine could never recover from such a disaster. But it was only the first of a series of unanticipated mishaps that Kimberley Mine has experienced, and that almost any less rich property would have succumbed under.

It is to be regretted that no statistics have been preserved of the number of workers employed in the mine at this period. It can hardly have been less than 10,000 or 12,000, and is

estimated by many at double that number. The problem, now the roadways had collapsed, was how to work the large number of separate holdings, so as to preserve free access to each, and still let no claim-holder encroach or trespass on his neighbour's ground. As the claims deepened, a system of rope haulage had been adopted; a couple of grooved wheels being fixed, one on the surface, the other in the claim, whilst to the rope passing over these wheels the bucket was attached, which was filled with ground in the claim and hauled up and down by a handle on the upper wheel. The objection to this method was that the entire circumference of the mine did not afford frontage enough for the erection of a hauling-gear to each claim, and further that, even had the frontage sufficed, the crossing of ropes would have been a serious difficulty.

Both these difficulties were overcome by the following ingenious arrangement. A succession of tall massive timber stagings was erected round the margin of the mine. Each staging carried three or four platforms one above the other, every platform serving as an independent level from which to communicate with the claims below. Stationary ropes were then stretched from the different levels of the stagings to the claims, the ropes being anchored to the ground at both ends; the upper platforms communicated with the claims in the centre of the mine, the lower platforms with those nearer the margin. The hauling ropes were attached to windlasses worked by Kafirs on the several platforms, on which grooved guide-wheels for the ropes were also fixed, the buckets being swung from the stationary ropes by little overhead runners and crooks. The buckets most generally used were constructed of hide, as being more durable than the common iron buckets, and the ropes were often made of twisted hide, till the introduction of iron and steel wire ropes gradually superseded them. Arrived at the level of the platform, the bucket was tipped into a narrow shoot, down which the ground ran into a bag held ready to receive it, in which it was conveyed away to be sorted. The din and rattle of these thousands of wheels, and the twang of the buckets along the ropes were something deafening, whilst the mine itself seemed almost darkened by the thick cobweb of ropes, so numerous as to appear almost

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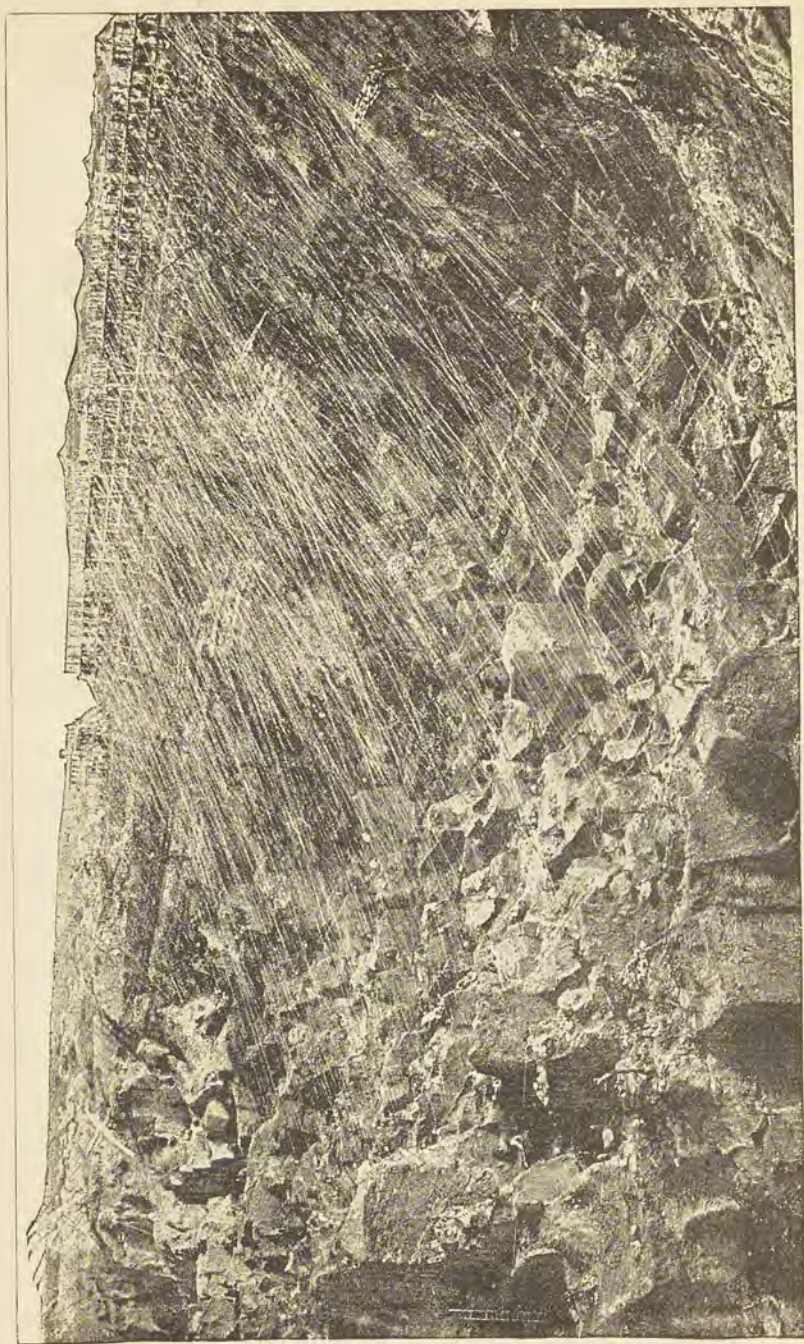
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THE KIMBERLEY MINE, WITH COVERED OF WIRE ROPES IN 1873.

[To face page 23.



touching one another. This mode of haulage, of which the illustration opposite conveys an idea, continued in vogue during the whole of 1873, and if the appearance of the mine was less picturesque than whilst the roadways existed, it was, if anything, more unique. By moonlight, particularly, it was a weird and beautiful sight.

The year 1874 witnessed the establishment of the first Kimberley Mining Board, the internal affairs of the Mine having been previously managed by a Diggers' Committee. The excavations by that time were over 100 feet deep, and with the increasing depth many unforeseen difficulties arose, which the newly constituted Board had at once to grapple with. The first of these difficulties was an accumulation of water in the lowest workings, then the encasing rock of the mines (or the "Reef," as the diggers called it) being exposed by the removal of the diamondiferous ground, began to disintegrate and fall into the mine. Claim-holders in the centre of the mine generally suffered most from the water, those near the margin were most troubled by the reef; but it soon became a recognised principle that both reef and water should be treated as common enemies, and accordingly a general rate was levied on the whole mine to deal with them. The water difficulty would never have been serious had anything like adequate pumping machinery been provided, as no strong springs were met with in the workings, and it was mainly surface drainage that had to be dealt with. Much more serious have been the reef troubles, forming a long chapter of accidents in themselves, which more than once threatened to involve the whole mine in ruin; and though all this is now ancient history, no account of the diamond industry would be complete that did not devote some space to the reef question, which was once so all-engrossing in Kimberley.

The first necessity was to provide more powerful hauling machinery than the hand-tackle hitherto employed. The "horse-whim" was introduced in 1874, a large timber wheel, some 14 or 18 feet in diameter, fixed horizontally 7 or 8 feet above the ground, with an iron hoop reaching down to the level of the horse's or mule's collar. The hauling-rope,

wound several times round the whim, had its two free ends attached to two buckets, one of which ascended from the mine as the whim revolved, whilst the other bucket was lowered down. This enabled larger tubs of 2 or 3 cubic feet capacity to be used, till the introduction of steam engines in the following year gradually replaced all other methods. It may seem strange that the advent of steam power was so long delayed, but when it is borne in mind that the cost of transit from the coast was £30 to £40 per ton, and that no one could foresee the diamondiferous ground would have extended to such an unprecedented depth, surprise on this score vanishes.

Indeed, in reviewing the history of diamond mining in South Africa, the perfectly novel features of the industry must never be forgotten. It is easy to look back and criticise, but for the pioneers of the industry there was absolutely no previous experience to be guided by. It was a perpetual groping in the dark and a necessary waiting for events, and the wonder is that with all the drawbacks of the situation so much should have been accomplished.

To deal more effectually with the reef removal the Mining Board erected costly hauling machinery at the north-east and south-west corners of the mine, at the same time sinking a large vertical shaft through the reef at the north-east corner some 200 yards back from the limit of the claim-ground. At a depth of 286 feet from the surface the hard amygdaloid rock was struck, and the further sinking of the shaft abandoned. But it is deplorable that no tunnels were driven towards the mine on the surface of this rock, as they might certainly have been used for removing a large quantity of dangerous reef from the north and east margins, which subsequently fell into the mine and had to be hauled out by the claim-holders at an increased cost after serious stoppage of payable work.

Early in the year 1878 one quarter of the claims were covered by reef; this was being hauled out at a cost to the Board of 4s. per load of 16 cubic feet. In the years 1879 to 1880 the Board's expenditure on the removal of reef, débris, and water exceeded £300,000, although the reef tariff had been reduced from 4s. to 2s. 6d. per load. At the end of 1881 the Mining Board had 7 miles of tramway in use, whilst

another 12 miles had been laid down by claim-holders. During that year the Board expended over £200,000 in reef removal, but the work had been commenced too late to be effective, the slips became even greater, so that in 1882 more than *half a million sterling* was needed to defray the cost of the reef actually removed, and still claims were covered and other slips impending. The bulk of this removal had been done by the claim-holders themselves at the Board's expense. A couple of private shafts had been sunk some years previously, one on the north (Central Company), the other on the south reef (French Company), at distances of about 450 and 650 feet respectively from the limit of claim-ground, and through these shafts a quantity of the solid reef was removed, the fallen reef from the lower claims being hauled out by the aerial trams, which consisted of four thick standing ropes (steel wire) 4 to 5 inches in circumference, each pair of ropes serving as a tramway for a large tipping-tub of 16 to 32 cubic feet capacity slung in a frame running on four grooved wheels. A third shaft, sunk through the north-east reef in the latter part of 1882, was used for lightening the top reef in that part of the mine, whilst inclined tramways cut in the reef on the west and east sides of the mine were conducting similar operations in the open. Notwithstanding all these appliances, the reef removal did not keep pace with the constantly recurring slips. The tariff had been raised again in October, 1881, to 3s. 9d. per load, and during the following eighteen months the reef hauled by claim-holders alone cost the Board over £650,000. Unable to meet this heavy expenditure by cash payments, the Board had recourse to bills, with the result that by the end of March, 1883, its books showed a deficit of over a quarter of a million sterling. The local banks refusing then to discount its reef bills any further, a financial crisis arose, causing a dead-lock in the operations of the mine. Outsiders freely stated that Kimberley Mine was ruined.

The dilemma was really a most grave one. The financial position of the Mining Board rendered a continuance of heavy reef-work in the absence of outside assistance impossible. Still less could any individual claim-holders con-

template reaching their submerged ground by means of tunnels connected with shafts sunk outside the mine; the expense of boring through the "hard rock," besides being too costly, was too lengthy an operation to afford the speedy relief that was needed. At this juncture Mr. Edward Jones, a mining engineer who had been conducting large reef contracts for some time previously, propounded a scheme which, though startling in its novelty, and poohpoohed by most practical miners at the time, was shortly afterwards carried into effect by the inventor at his own risk, and which actually enabled the mine to tide over its gravest difficulties. The question was, how to get out diamondiferous ground at once without the prosecution of further dead work.

Mr. Jones overcame these difficulties in the following manner:—A shaft was sunk *inside the mine* through the fallen reef on the "cofferdam" principle of gradually lowering a square timber box, without bottom, through the loose stuff, shovelling out the reef from the inside, and fixing on box after box to the first one, till it had sunk to the bottom of the fallen reef, forming a strong timbered shaft within the latter, and resting at last on the solid blue ground. In this mode more than fifty feet of loose reef was successfully sunk through, after which the shaft was easily extended to any desired depth into the "blue," and tunnels were driven in all directions, so as to continue the excavation of the mine underground. The great merit of the scheme was that it entailed little initial outlay, whilst as soon as the "blue" was reached, the work of opening up the galleries more than paid for itself in the value of the diamondiferous ground removed, which was reached within a few months after starting the shaft.

Jones' shaft was sunk at about the deepest part of the mine, in Claim No. 320 of the Central Company's ground, and was speedily followed by similar shafts in other parts of the mine, and though it was soon apparent this system of mining could not be carried on permanently, it met the crying need of the hour in raising a supply of blue ground in the absence of funds to continue reef-hauling on a large scale, or to sink expensive shafts through the hard rock outside the mine. In 1882 three million loads of reef had been hauled for one

million loads of blue. In 1883 only one-and-a-half million loads of reef were hauled, with the result that the greater portion of the mine remained submerged, so that in that year the output of blue fell to 350,000 loads. On the 4th of November, 1883, about the biggest fall of reef on record took place, estimated at 250,000 cubic yards,\* and in that one day half as much rubbish fell into the mine as had been hauled out during the whole year, at a cost of a quarter of a million sterling. That the mine was able to survive such a disaster was a signal proof of the marvellous richness of the property. The Inspector of Diamond Mines' Report for 1883 contains a most interesting detailed account of this great reef-fall, the first threatening indications of which were discovered fully six months previously, first by surface cracks in the red soil and in the sloping face of the reef, and subsequently by the appearance of a soapy vein or slide in a tunnel nearly three hundred feet underground. By means of an indicator fixed in this tunnel the rate of movement of the superincumbent reef was constantly measured, and was found to increase between May and October from half an inch per week to nearly half an inch per day. Then the collapse came, and the huge mass slowly subsided, surging half across the mine, where the bulk of it lies to this day.

By the end of 1882 the deepest open workings in the blue ground of Kimberley Mine were over 400 feet beneath the surface; and they never much exceeded that depth, since it gradually became evident that the task of keeping the claim ground clear of reef was beyond the means of even the wealthiest companies then owning the richest portions of the mine. Some four million cubic yards of reef had been removed in all, at a cost of something like two millions sterling, and yet the Inspector of Mines had to report that out of the 300 or 400 claims in the mine "only about fifty claims have been regularly worked during 1884." Though profitable mining was being carried on from the shafts sunk through the fallen reef, attempts were still made to revert to open

\* The "load" is 16 cubic feet of loose stuff, equal to 10 cubic feet of shale in the solid, and to 9 cubic feet of solid "blue;" so that a solid cubic yard of blue is equal to 3 loads, and a solid cubic yard of reef to about  $2\frac{3}{4}$  loads.

working, which ruined both systems, as hauling reef from the foot of the slopes caused a further subsidence, which carried away these shafts and destroyed many thousand pounds' worth of machinery and plant used in connection therewith. In each of the years 1884 and 1885, the quantity of blue ground raised from Kimberley Mine was little over 300,000 loads, which practically demonstrated that mining in the open could not be conducted below a depth of 400 feet, and that the only alternative was some system of underground mining.

The experience gained at such great expense in Kimberley Mine was naturally made use of to avoid similar mistakes in De Beers Mine, in which the expenditure on reef-work has been comparatively insignificant. For the first few years after its discovery little attention was devoted to this mine, owing to the greater richness of Kimberley Mine on the surface; but when the reef-troubles in the latter mine became so serious as to render a large amount of capital necessary for coping with them, mining at De Beers was energetically resumed. The hard basaltic rock overlying the shales stood remarkably well when exposed, so that for several years very little trouble was caused by falls of marginal or "main-reef," which was cut back in terraces as it became dangerous, thus keeping the claims generally clear of reef. In the years 1878 to 1882 inclusive, the De Beers Mining Board had removed over 215,000 cubic yards of reef at a cost of £76,000, being much less than the average cost of similar work in Kimberley Mine, where the bulk of the reef had to be hauled out after it had fallen into the claims. But as the mine grew deeper year by year, the amount of dead-work to be done rapidly increased. In each of the years 1883 and 1884, over 70,000 cubic yards of reef were removed, and yet in the early part of 1885 such considerable falls of reef took place that the Board determined to cease reef-hauling altogether, as certain in the long run to bring disaster on the mine. The deepest open workings had by that time reached a depth of about 350 feet below the surface, and the richness of the blue ground over a great portion of the mine had been proved to be almost equal to

that of Kimberley, but still there was much hesitation and timidity about resorting to underground mining.

In both mines, as already mentioned, there is a great difference in the relative value of the ground in different parts of the mines—the claims in the west end of both mines being not payable, whilst those in the east, north, south, and centre are exceedingly rich, though showing again minor variations to a considerable degree. The west end of De Beers Mine had remained a high bank of unworked yellow-ground, and a few weeks after the reef-fall referred to above, some 300,000 loads of this high yellow-ground fell in one day, filling up the whole of the lower blue-ground workings, and actually overlapping the foot of the reef, which had fallen from the east of the mine, so that for the next six months profitable work in the open was suspended till this rubbish could be cleared out.

Though the De Beers Mining Board had never any serious trouble with reef or water, individual claim-holders were hampered for many years by a great belt of "floating reef," or shale destitute of diamonds, which covered a large number of claims at or near the surface to a depth of several hundred feet, and which had to be removed at the expense of the claim-holders concerned, many of whom were ruined in the process; although it was suspected, and has since been proved, that this floating shale would disappear at a greater depth, and that rich blue-ground would be found underneath it. Some ten years ago this floating reef stood up as a high wall dividing the mine into separate "gullies," in one of which, known as the "Australian Gully," water accumulated to such an extent during an exceptionally rainy season, as to reduce the owners of some of the richest ground in the mine to the verge of bankruptcy. In the lower levels now being worked underground this floating reef has almost entirely disappeared. In the same manner a smaller mass of rock, imbedded in the blue, known as "the Island," and analogous to the melaphyre, which originally covered some three or four claims, and which has been exposed to a depth of over 700 feet, is found to be gradually reducing in area.

Prior to the great falls of reef and yellow ground in the

beginning of 1885, a move had been made towards inaugurating underground mining, on a more ambitious plan than that adopted in Kimberley Mine, by means of a large circular shaft, sunk some 1000 feet to the north of the mine. This shaft was commenced in 1884, and carried down 320 feet, and then abandoned in favour of an inclined shaft, sunk about 150 feet west of the claim margin, at an angle of  $56^{\circ}$  with the horizon, so as just to cut through the edge of the "hard rock," and thus avoid the great expense of sinking and driving through the amygdaloid. At the same time mining in the open was still proceeding, but by the end of 1886 the reef-falls had become so serious as to render a continuance of this system hopeless. By that time the greatest depth in the open workings was 400 feet, and in underground mining 650 feet, and in the course of the following year the latter system was universally adopted, and all idea given up of attempting to remove the marginal reef and high yellow ground, which have since been allowed to slide into the mine where they have long since covered every vestige of the old open workings.

A second inclined shaft, known as "No. 2 incline," was sunk from the west end of the mine, parallel to the first incline, but of larger dimensions, and a large vertical shaft was also sunk on the north side communicating with the mine at the 800 feet level. The former shaft was completed by March, 1888, and on the 11th of July of that year a most deplorable loss of life was caused through the destruction by fire of the No. 1 incline shaft. The following account is given by the Inspector of Mines of this awful calamity. "By some undiscovered means an underground timbered shaft, between the 500 and 700 feet levels, took fire, and the flames quickly travelled through a connecting tunnel—close timbered—to the No. 1 incline shaft, up which, being an up-cast, the fire tore rapidly, and within about 20 minutes that shaft was useless and practically wrecked. No. 2 incline, which had been disabled for winding purposes in the morning, through a skip running off the rails, but still available for escape, was also an up-cast, and dense volumes of smoke from the burning timber soon filled this shaft to suffocation. An old disused shaft at the eastern end of the mine, and the old tunnel into



the open mine at the 380 level, where the aerial gear formerly worked, were the only sources of fresh air. According to returns furnished after the disaster, 24 white men and 178 Kafirs were killed, mostly through being asphyxiated by the smoke. There were at the time of the outbreak of fire 67 white men and 625 Kafirs at work underground."

The formation of Dutoitspan Mine is similar to that of Kimberley and De Beers, but owing to its much greater size and the inferior richness of the ground, it has not reached the same stage of development, nearly all the work having been done in the open. The encasing rocks consist of yellow and black shales, the latter of unknown depth. For the first five or six years after its discovery this mine was only spasmodically worked, and the results were so little encouraging that in 1874 most of the diggers left Dutoitspan, to work "débris" at Kimberley, and in the following year the mine was almost completely deserted. In 1876 the débris-washers returned, took out fresh claims, and by degrees introduced improved hauling and washing machinery, so that the mine rapidly grew deeper; but as the ground was not rich enough to pay for much dead-work, a buttress of unexcavated blue-ground was generally left as a solid support against the reef, and served to stave off the evil day for a number of years. A disastrous reef-fall, however, took place on the 18th of March, 1886, by which 8 white men and 10 Kafirs were killed. Surface-cracks had been noticed in the northern margin of the mine for 18 months previously, but not sufficient attention was given to the signs of impending subsidence. On the day in question all the workers were supposed to have left the mine at noon, and the blasting had commenced, when a huge mass of reef and solid blue-ground detached itself from the almost perpendicular side of the mine, and curling bodily over, fell with a crash like an avalanche into the workings below. Unhappily a party of miners had taken shelter during the blasting in a pumping-engine house at the bottom of the mine. The house was completely wrecked by the falling rock, and the unfortunate 18 men were either crushed or scalded to death. The fallen mass was estimated at 100,000 cubic yards, of which about one-third was blue-ground. This was the first

serious reef-fall in Dutoitspan Mine, and was followed at intervals by others, till at the present time nearly all the old open workings, which by the end of 1887 had attained a depth of 400 feet, are covered with reef. In this mine, too, there are considerable masses of floating reef and high poor ground, which divide the mine into a number of gullies, in some of which the accumulation of water has at times converted a large area of claim-ground into temporary lakes.

The history of Bultfontein Mine is not unlike that of Dutoitspan. For the first ten years it was worked by means of inclined roadways and bullock-carts, but from 1880 onwards the erection of powerful hauling machinery enabled increased quantities of "blue" to be excavated, and by the end of 1887 the deepest workings had reached a depth of 460 feet, probably the greatest depth ever reached in open workings in any of the mines. A plucky attempt was made by one of the companies to avert the inevitable fall of the reef by cutting it back in terraces, but the work was commenced too late, and confined to only one corner of the mine; the forces of Nature slowly but surely prevailed over the exertions of man, and by the middle of 1889 nearly the whole of the deep claims were covered by reef, and by the end of that year only four hauling gears were still working out of more than thirty that had been at work in 1882. Bultfontein Mine has always been exempt from any troubles with water in the claims, but a considerable area is covered by large blocks of floating reef.

It has been shown how in each of the four mines the difficulties of mining increased with increasing depth, requiring constantly larger capital and more elaborate appliances for winning the diamonds. As a natural consequence the individual digger, who had held his one or two claims and been able to work them at a profit whilst near the surface, was soon compelled to sell out, or to amalgamate with his neighbours. With a laudable desire to allow as large a population as possible to acquire separate holdings in the newly discovered mines, it was originally decreed that no individual should hold more than two claims, and the "blocking" of claims was also prohibited. But as early as 1874 it was found necessary to permit as many as ten claims to be held by a single digger,

and even this restriction had soon after to be repealed, as it was found impossible in many cases, particularly in the two poorer mines, to work so limited an area at a profit. As a consequence the "original digger" gradually gave place to a comparatively small number of capitalists, who by the end of the "seventies" had acquired the richest portions of all the mines, and much of the poorer ground also. Though many of these individual claimholders and private firms, in Kimberley and De Beers at all events, were realizing handsome profits, the growing need of working on a more extensive scale naturally suggested the formation of companies with increased capital so as to deal with the large amount of dead-work which had to be carried on simultaneously with the mining in payable ground; and thus in the years 1880 to 1881 most of the private holdings in the four mines were converted into limited liability companies. In many cases the capital at which these properties were floated was fully justified by the intrinsic value of the claims. In too many others the *claim* capital was much too high, whilst the *working* capital provided was ridiculously small; insufficient, in not a few instances, to pay for the necessary machinery and initial expenses, so that many companies found themselves heavily in debt before they had fairly started work.

But a speculative mania had taken possession of the public, and mining scrip was regarded as a sure passport to wealth. One has almost forgotten the names of all the companies whose glowing prospectuses figured in the daily papers in those days of sweet but short delusion. Within the space of a few months the promise of certain fortune to investors was held out by more than a hundred Diamond Mining Companies, and it rarely happened that any of these failed to be floated, or their shares to be rushed up to a big premium. The eagerness to be "in the swim" silenced every prompting of prudence: clerks threw up their situations, merchants left their stores, and professional men their duties, to hang about street corners and dabble in stocks, of the real value of which they were generally profoundly ignorant. Three or four years of considerable commercial prosperity had made money plentiful in the colony, but it was speedily all gambled away. So great was the demand for fresh stocks that claims which were known

never to have paid for working were floated almost as easily as the richest proved properties. Nor was this speculation by any means confined to the old established mines. The number of "Kopjes," the number of "Fontains," the number of "Pans" and "Dams" that were suddenly discovered to be rich in diamonds, has almost faded from our memory. But the swift retribution which followed has not been forgotten, nor is it likely to be, by those who passed through the succeeding years of depression. We had converted all our available cash into paper, and suddenly the paper was found to be "not negotiable," and of course, when the bubble burst, the really genuine concerns suffered with the rotten ones. For the next three or four years, investors were as hard to convince of the value of our mines as they had previously been recklessly eager to buy into them.

Meanwhile, the mines themselves were labouring under manifold disadvantages. The benefits expected to accrue from the blocking of holdings were long in being realized. In many Companies the management was entrusted to incompetent hands. During the bright days of speculation the directors found the Share Market more profitable than work in the mine or the board-room. Owing to increased demand, by the starting of so many new Companies, the prices of labour, food, and material rose considerably, and, far from any attempt at co-operation amongst the claimholders, their energies were too frequently wasted in litigation, to the utter disregard of their common interests. In the flotation of many properties the obvious truth was forgotten that a poor mine may pay the individual digger working with only primitive appliances, and yet may not pay for a staff of high-salaried men. The want of funds often compelled the ground to be rushed through the washing machines before it was properly pulverized, whereby a large percentage of diamonds was lost. Indeed, the whole process of diamond-mining, which has since been reduced to a science, was carried on with little knowledge or system in those days. The simplest elements of economy were disregarded; the loosest kind of check was kept on expenditure, and even on the diamonds themselves. So it is not surprising that out of seventy Companies originally existing in the four mines, more than half either became

insolvent, or had to be wound up and passed out of existence. Several Companies in Dutoitspan and Bultfontein, which had never paid a dividend to the shareholders, were let out on tribute, and often yielded considerable profits to the lessees, who were generally hard-working men, keenly alive to the importance of giving all their time to the personal superintendence of the mine.

The immediate result of the formation of Companies was to greatly increase the output, with the aim of paying dividends on the enhanced capital of the mines. From having been little over two million carats in 1879, the production of diamonds for each of the years 1880 and 1881 rose suddenly to over three million carats, so that the mines became rapidly deeper, and the difficulties of working a single mine harmoniously by a number of different proprietors grew more palpable every year. There were constant disputes and costly law-suits between the several claimholders, or between these and the Mining Boards, often resulting in awards for enormous damages; and as early as the beginning of 1883 the Inspector of Mines, in his Report on Kimberley Mine for the previous year, informed the Government that "it is daily becoming more evident that this mine, especially, can never be worked to the best advantage until all the payable holdings have been amalgamated and the whole mine worked as a single holding." Kimberley being the smallest and deepest of the four mines, this state of things was reached there soonest, but the conclusion forced upon an impartial and competent observer of Kimberley Mine was admitted to be applicable to the other mines by those most interested in them. If this was true in the days of open workings, it left no room for doubt after the underground works had been started, which rendered it more difficult than ever for neighbouring claimholders not to hamper and hinder one another. In both Kimberley and De Beers Mines six or eight different shafts had been sunk, some inside, some outside, the mine, connected with tunnels, galleries, and passes, worked on half-a-dozen systems. In 1885 there were four different systems of underground mining in vogue in Kimberley Mine, and, apart from the inconvenience of this, the waste of money to the mine, regarded as a single property, was almost incal-

culable. The far-seeing directors, therefore, in both mines, began early to impress on their shareholders the importance and advantages of amalgamating adjoining blocks, with the ultimate view of converting the whole mine into a single company. The process, however, was both long and tedious, necessitating endless discussion as to the relative value of the different properties concerned, and it was only by slow degrees that first one bit of ground, and then another, was welded on to that of a richer neighbour, so that every year the number of separate holdings grew less and less. What a Herculean task was involved in this project will be realized when it is mentioned that by the end of 1885, after considerable progress had been made in amalgamation, there were still no fewer than 98 separate holdings in the four mines. Of these 42 were Companies, and 56 private firms or individuals. In Kimberley there were 11 Companies and 8 private holders; in De Beers, 7 Companies and 3 private holders; in Dutoitspan, 16 Companies and 21 private holders; and in Bultfontein, 8 Companies and 24 private holders. The total claim area leased in the four mines was 3238 claims, equal to only  $68\frac{1}{2}$  statute acres: yet the assessed value for rating purposes was over five millions sterling, equivalent to an average of £75,000 per acre, and the market value of course was considerably higher. The total number of claims in Kimberley Mine was 331; in De Beers, 591; in Dutoitspan, 1430; and in Bultfontein, 886. It should be mentioned that the size of a claim in Kimberley and De Beers is 31 feet by 31 feet, and in Bultfontein and Dutoitspan 30 feet by 30 feet, so that in the former two mines about  $45\frac{1}{3}$  claims go to an acre, and in the latter about  $48\frac{1}{3}$  claims.

It will be seen from the above figures that the greatest progress in amalgamation had been made in De Beers Mine, where the number of separate holdings had been reduced to seven Companies owning the whole mine, with the trifling exception of nine claims held by three private diggers. The most important of these Companies was the *De Beers Mining Company*. Founded on the 1st of April, 1880, with a capital of only £200,000, it had by degrees absorbed most of its smallest neighbours, till by the end of March, 1885, its capital stood at £841,550, on which during the last financial

year it had paid a dividend of  $7\frac{1}{2}$  per cent., the largest dividend thus far earned by the shareholders. In the three following years the policy of amalgamation was not only steadily pursued, but expanded into a broader scheme for uniting the principal holdings in all the mines into one powerful corporation, which should control the whole of the diamond industry. By the end of 1887 the amalgamation of De Beers Mine was complete, and controlling interests had been purchased in each of the other three mines. At the close of the financial year ending 31st March, 1888, the capital of the Company stood at £2,332,170, and the increased dividends that had been paid during the last three years fully justified the directors in expecting the approval of their shareholders for their bold exercise of the powers vested in them under the trust deed. The dividends for 1886 were 12 per cent.; for 1887, 16 per cent.; and for 1888, 25 per cent., in each case for the year ending 31st March. During the eight years of the Company's existence, the total dividends paid had exceeded a million sterling, being  $71\frac{2}{3}$  per cent. on the figure at which the capital had successively stood, and in addition to these dividends, 41 per cent. had been distributed in bonus shares. Two very gratifying circumstances had contributed towards the improved position of the Company: first, a very marked improvement in the value of the "blue"; and secondly, a great reduction in the cost of working. In 1881, the "blue" had only yielded  $\frac{7}{10}$ ths of a carat per load, and in 1882 only  $\frac{8}{10}$ ths carat, whilst the working expenses had amounted to 13s. 2d. per load, so that in that year it had cost 16s. 6d. to produce a carat of diamonds. In 1887, the average yield was 1.15 carat per load, and the cost of production 8s. 2d. per load, equivalent to 7s. 2d. per carat, so that in those five years the yield had improved over 40 per cent., and the cost of production been reduced nearly 40 per cent. In the former year a dividend of only 3 per cent. had been paid; in the latter year the dividend was 16 per cent. And yet in the meantime there had been a most serious drop in the selling price of diamonds, namely, from 27s. 3d. per carat in 1882 to 18s. 5½d. in 1887.

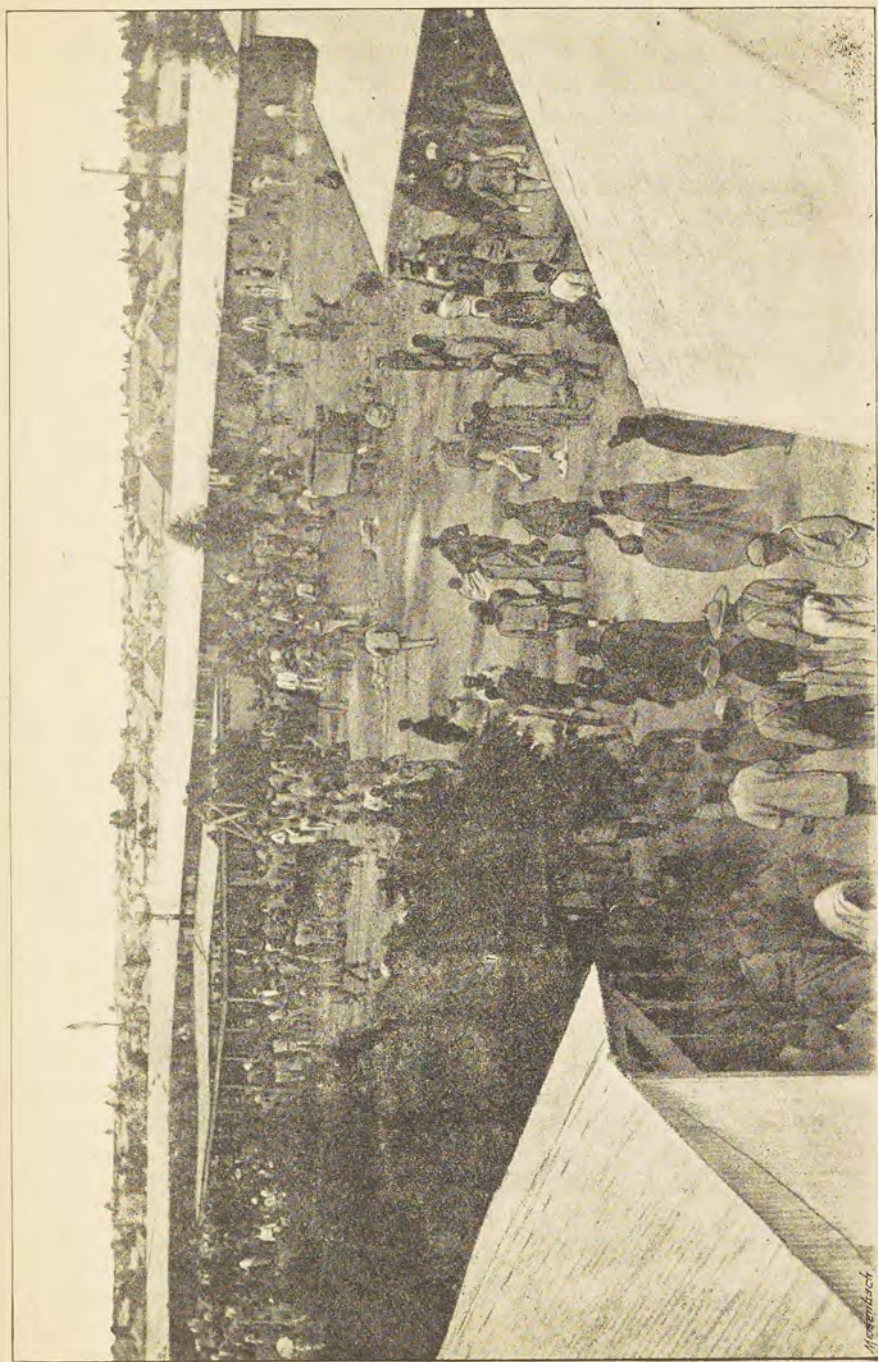
No better proof could be afforded of the benefits resulting from amalgamation than the foregoing figures. It is well

known that the mine had grown richer as it grew deeper, but this greatly improved yield was partly due to better management and to the stronger financial position of the Company, which enabled a large reserve of "blue" to be kept on the floors, thus ensuring the ground being thoroughly pulverized before it was washed. At the end of 1882 the De Beer's Company had only 3000 loads of blue on the floors; at the end of 1887 they had nearly 300,000 loads on the floors. The improved yield is also partly attributable to the better precautions taken against theft of diamonds by the introduction of the "Compound" system, which secured complete surveillance over the native labourers. The great reduction in working expenses was mainly due to the much larger scale on which operations were conducted as the size of the property increased. From having treated less than 100,000 loads in 1882, nearly 500,000 loads were washed in 1887; or, in other words, whilst the capital of the Company had been barely doubled, the amount of profitable work performed had increased five-fold.

But this satisfactory improvement in the cost of production and in output was not without its attendant dangers. In the days of open workings the mine had never been able to produce more than half-a-million carats annually. In the years 1887 and 1888, consequent on the successful inauguration of underground mining, the output of De Beers Mine rose suddenly to a million carats per annum, raised from only one shaft lifting 2500 loads (of 16 cubic feet) of blue per day of 24 hours. In his report for the year ending 31st March, 1888, the General Manager reported that two other shafts were in course of construction, each capable of hauling twice or three times as much "blue" as the above, and that the quantity of unbroken blue-ground "in sight" above the 800 feet level was over seven million loads. A similar state of things was known to exist in Kimberley Mine, and though the works in the latter mine had not reached the same stage of development, it was merely a question of time, and each of the two mines would have been able to produce as much as the total output of the whole of the Diamond Fields in previous years. An entirely new problem had therefore to be faced: How to prevent over-production?

It is unnecessary to describe the lengthy negotiations

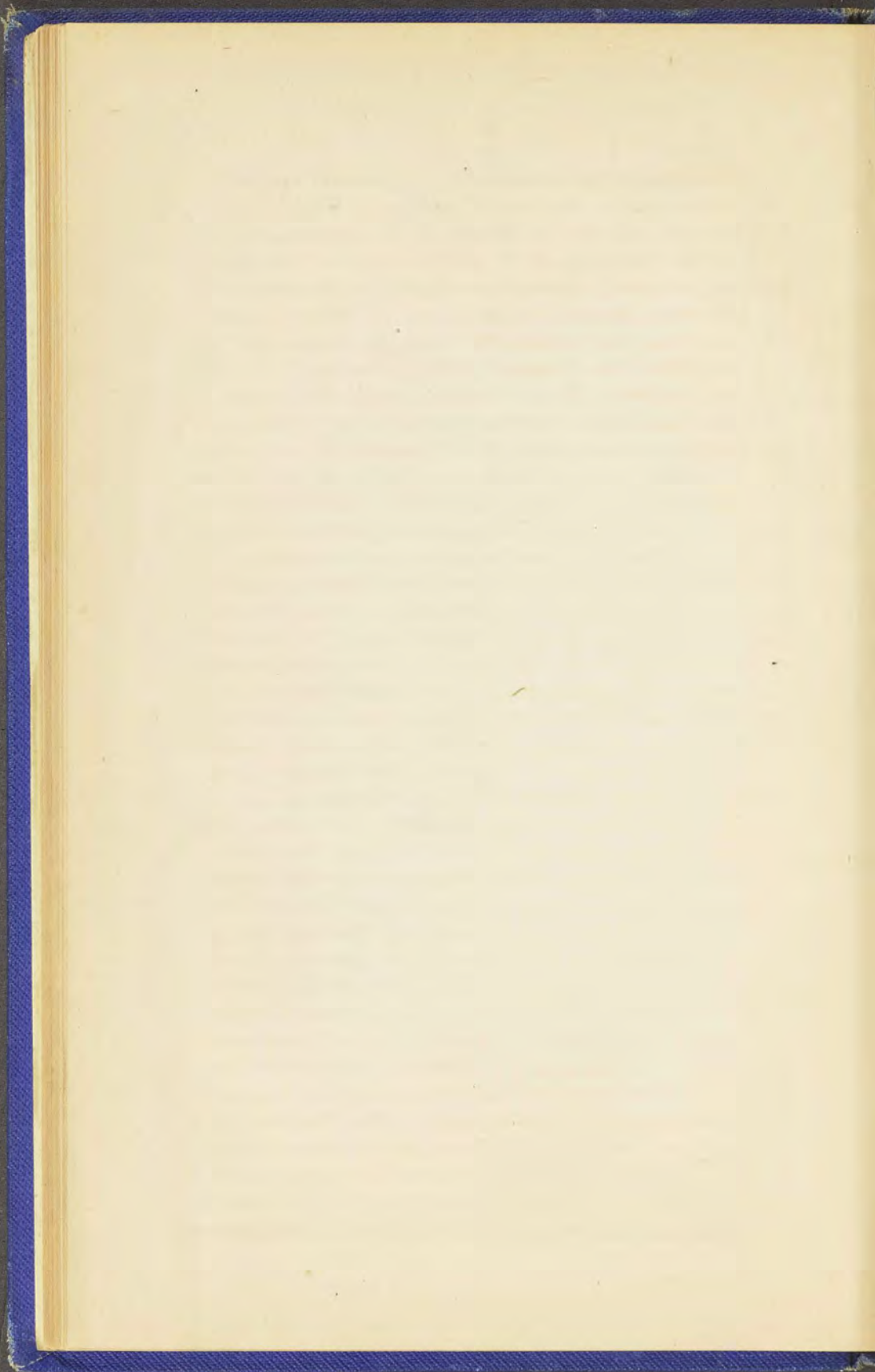




NATIVE COMPOUND, DE BEERS MINE, WITH PORTION OF KIMBERLEY.

[To face page 38.]

Meisenbach



which resulted in the formation of the powerful Corporation now known as the De Beers Consolidated Mines, Limited. Readers may refer for full details to the interesting speech made by the Chairman, Mr. C. J. Rhodes, on the 31st March, 1888, at the special general meeting of the shareholders of the De Beers Mining Company, who by their unanimous votes confirmed and adopted the whole programme for "the consolidation of the Diamond Mining Interests." On that day the De Beers Mining Company practically ceased to exist, the shareholders receiving two fully paid £5 shares in the De Beers Consolidated Mines, Limited, for every fully paid £10 share in the old Company. The Trust Deed of the new Company is similar to that of the old one, with the exception that it contains larger powers, and further that it provides for five Life Governors, who are remunerated for their services by a portion of the profits after 30 per cent. per annum has been paid in dividends, in return for which they have to keep in the Company jointly an amount of shares equal to about £750,000 at present market value. They are further bound to offer any diamond interests they may acquire first to the Company at cost, and are not allowed to promote the formation of any diamond company without the consent of their own Company. The first and present Life Governors are the Hon. Cecil John Rhodes, M.L.A., and Messrs. F. S. P. Stow, B. J. Barnato, M.L.A., and Alfred Beit.

Having thus acquired the whole of De Beers Mine from the late De Beers Mining Company, together with their interests in the other three mines, the Consolidated Mines devoted themselves to completing the task of regulating the production, and were so far successful that in their Second Annual Report, for the year ending 31st March, 1890, the Directors were able to announce "that the object with which the Company was originally started has at last been accomplished, and the four diamond-producing mines of De Beers, Kimberley, Dutoitspan, and Bultfontein are now practically under the control of the Company." The first and most important step towards consolidation was to secure the whole of Kimberley Mine, as being the greatest producing factor after De Beers. This was facilitated by the fact that the Kimberley Central Diamond Mining Company had by suc-

cessive amalgamations and purchases become possessed of the whole mine. That mine had undergone considerable transformation since the date to which our retrospect brought it some pages back (see page 28). The blue-ground hoisted through the temporary shafts inside the mine had enabled the leading companies to pay off their debts and commence paying substantial dividends, and had placed them in a financial position strong enough to bear the expense of sinking shafts outside the mine. The Central Company in an incredibly short time rushed down an inclined shaft at the west end, and the Standard Company a similar shaft at the north-east corner of the mine, and every facility was at hand for fighting De Beers in the matter of production, when Mr. Rhodes' policy luckily frustrated a ruinous competition that could have benefited nobody. Having first purchased the French Company and resold it to the Central Company (which had meanwhile acquired the Standard and many smaller companies), the De Beers Directors quietly commenced buying up shares in the Central Company till by the end of March, 1889, their interest in the Kimberley Mine was represented by 176,592 £10 shares in the Central Company, and debentures of that Company to the amount of £500,000. They were thus in a position to make advantageous terms for their shareholders for the acquisition of the whole of Kimberley Mine, which was shortly afterwards completed.

In dealing with Dutoitspan and Bultfontein a different principle was adopted, since these mines had, with few exceptions, never yielded any profit to their shareholders, but yet were serious elements as producing factors. For several years they had each produced over half a million carats annually, and though this production was rapidly declining, owing to the reef troubles described above, there was always the danger that these poorer mines might fall into the hands of rival financiers. Amongst the assets taken over from the old De Beers Company were a number of shares in the Griqualand West Company of Dutoitspan and in the Bultfontein Consolidated Company. With both these companies permanent working agreements were entered into by the De Beers Consolidated Mines, by which they obtained practical possession of the companies against payment of an annual rental. During

their second financial year they purchased the following properties in the Dutoitspan Mine:—

The Anglo-African Diamond Mining Company.  
 The Compagnie Générale (including their interest in the Conivieras Mines in the Brazils).  
 The Sultan Diamond Mining Company.  
 The United Diamond Mining Company.

And during the same period they bought in the Bultfontein Mine:—

The Bultfontein Mining Company.  
 The Spes Bona Diamond Mining Company.  
 The South African Diamond Mining Company.

|                                                                                                                                                                                                    | £          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| The total purchase price of these Companies amounted to .. .. . about                                                                                                                              | 2,564,000  |
| Besides which, payments were made in cash for sundry investments, conversion of Kimberley Central Shares, transfer fees and stamps, cost of liquidation of Kimberley Central Company .. .. . about | 211,210    |
| For British South Africa Company Shares .. .. .                                                                                                                                                    | 91,000     |
| For commission and charges raising Second Debentures, &c. .. .. . about                                                                                                                            | 81,300     |
| For cost of placing 'blue' on the floors .. .. .                                                                                                                                                   | 298,890    |
|                                                                                                                                                                                                    | <hr/>      |
| Making in all a total of .. .. .                                                                                                                                                                   | £3,246,400 |

To meet this outlay:—

|                                                                                                                                                                                                             | £          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Second Debentures, £1,750,000, were created at issue price .. .. . about                                                                                                                                    | 1,660,000  |
| De Beers Bultfontein obligations (given in purchase of the Bultfontein Mining Company) .. .. . about                                                                                                        | 745,400    |
| And 146,464 Shares in the Consolidated Company of Bultfontein Mine held by the De Beer's Consolidated Company, which were given in exchange to some of the purchased Companies at the rate of .. .. . about | 156,000    |
|                                                                                                                                                                                                             | <hr/>      |
|                                                                                                                                                                                                             | £2,561,400 |
| Leaving a balance paid out of profits for the year ending 31st March, 1890, of about .. .. .                                                                                                                | 685,000    |
|                                                                                                                                                                                                             | <hr/>      |
|                                                                                                                                                                                                             | £3,246,400 |

The actual cost of the properties controlled by the Consolidated Mines has been something like £14,500,000, but it was decided not to increase the capital of the Company beyond £3,950,000, the successive purchases being paid for by the issue of debentures and the Bultfontein obligations mentioned above. The following is the complete balance-sheet and profit and loss account for the year ending 31st March, 1891. The figures speak for themselves and will convey an idea of

the strong financial position of the Company, and of the magnitude of its operations:—

LIABILITIES AND ASSETS,

**CAPITAL:**

|                       |                   |   |   |
|-----------------------|-------------------|---|---|
| Nominal .. .. .       | £3,950,000        | 0 | 0 |
| Less unissued .. .. . | 1,045             | 0 | 0 |
|                       | <u>£3,948,955</u> | 0 | 0 |

**DEBENTURES:**

|                                         |                  |    |    |
|-----------------------------------------|------------------|----|----|
| De Beers 1st Debentures                 | £2,250,000       | 0  | 0  |
| Do. 2nd do.                             | 1,750,000        | 0  | 0  |
|                                         | <u>4,000,000</u> | 0  | 0  |
| De Beers Bultfontein Obligations .. ..  | 745,400          | 0  | 0  |
| Griqualand West D. M. Co. Debentures .. | 158,000          | 0  | 0  |
|                                         | <u>4,903,400</u> | 0  | 0  |
| BULTFONTEIN MINE SUSPENSE ACCOUNT ..    | 98,619           | 13 | 4  |
| SUNDRY CREDITORS .. .. .                | 42,868           | 15 | 4  |
| LONDON OFFICE ACCOUNT .. .. .           | 4,201            | 13 | 6  |
| INSURANCE FUND .. .. .                  | 25,000           | 0  | 0  |
| UNCLAIMED DIVIDEND WARRANTS .. ..       | 1,178            | 0  | 10 |

**INTEREST ACCOUNT:**

INTEREST DUE TO DATE ON THE FOLLOWING:—

|                                                |               |        |     |
|------------------------------------------------|---------------|--------|-----|
| De Beer's 1st Debentures                       | £20,625       | 0      | 0   |
| Do. 2nd do.                                    | 24,062        | 10     | 0   |
|                                                | <u>44,687</u> | 10     | 0   |
| Griqualand West D. M. Co. Debentures ..        | 2,765         | 0      | 0   |
| Griqualand West D. M. Co. Shareholders .. .. . | 13,034        | 11     | 0   |
| Consolidated Co. Bultfontein Shareholders ..   |               |        |     |
|                                                | <u>8,496</u>  | 2      | 0   |
|                                                |               | 68,983 | 3 0 |

**PROFIT AND LOSS ACCOUNT:**

|                                                                                                      |                    |    |    |
|------------------------------------------------------------------------------------------------------|--------------------|----|----|
| AVAILABLE BALANCE .. .. .                                                                            | 717,829            | 0  | 3  |
| Amount set aside to date for the redemption of De Beers 1st Debentures due 1st August, 1891 .. .. .  | 144,843            | 15 | 0  |
| Amount set aside to date for the redemption of De Beers 2nd Debentures due 1st January, 1894 .. .. . | 112,656            | 5  | 0  |
| Sinking Fund in connection with De Beers Bultfontein Obligations .. .. .                             | 34,704             | 16 | 10 |
|                                                                                                      | <u>292,204</u>     | 16 | 10 |
|                                                                                                      | <u>£10,103,240</u> | 3  | 1  |

31ST MARCH, 1891.

|                       |                |
|-----------------------|----------------|
| CLAIM ACCOUNT .. .. . | £7,457,888 6 2 |
|-----------------------|----------------|

**INVESTMENTS:**

|                                                                         |          |         |       |
|-------------------------------------------------------------------------|----------|---------|-------|
| De Beers 2nd Debentures (£72,000) ..                                    |          |         |       |
| 210,000 £1 fully paid shares British South Africa Company .. .. .       |          |         |       |
| 26,324 £1 fully paid shares Consolidated Company, Bultfontein .. .. .   | £527,217 | 15      | 11    |
| 20,739 £10 fully paid shares Griqualand West D. M. Company .. .. .      |          |         |       |
| 6,755 £5 fully paid shares De Beers Consolidated Mines, Limited .. .. . |          |         |       |
| Sundry Investments .. .. .                                              | 103,886  | 7       | 8     |
| Kenilworth Estate and Village .. .. .                                   | 56,735   | 6       | 10    |
| Waaldrift Farm (½ share) .. .. .                                        | 12,895   | 3       | 6     |
|                                                                         | <hr/>    |         |       |
|                                                                         |          | 700,734 | 13 11 |

**MACHINERY AND PLANT .. ..**

|                                            |  |         |      |
|--------------------------------------------|--|---------|------|
|                                            |  | 385,744 | 11 7 |
| FURNITURE .. .. .                          |  | 5,118   | 6 10 |
| STOCKS (Merchandise, Coal, and Produce) .. |  | 50,137  | 14 7 |
| LIVE STOCK .. .. .                         |  | 12,886  | 2 1  |
| PROPERTY (Offices, Stores, Compounds) ..   |  | 103,596 | 14 7 |
| SUNDRY DEBTORS .. .. .                     |  | 12,773  | 7 0  |
| DUTOITSPAN MINE SUSPENSE .. .. .           |  | 28,523  | 5 4  |
| CAPE OF GOOD HOPE BANK (in liquidation) .. |  | 12,740  | 5 5  |

**DEVELOPMENT WORKS:**

|                        |        |        |     |
|------------------------|--------|--------|-----|
| De Beers Mine .. .. .  | 68,798 | 17     | 1   |
| Kimberley Mine .. .. . | 22,479 | 5      | 3   |
|                        | <hr/>  |        |     |
|                        |        | 91,278 | 2 4 |

**SHAFTS:**

|                                            |        |         |       |
|--------------------------------------------|--------|---------|-------|
| De Beers Mine .. .. .                      | 59,000 | 0       | 0     |
| Kimberley Mine .. .. .                     | 49,637 | 3       | 5     |
|                                            | <hr/>  |         |       |
|                                            |        | 108,637 | 3 5   |
| STOCK OF BLUE GROUND .. .. .               |        | 493,431 | 16 11 |
| DIAMONDS ON HAND .. .. .                   |        | 143,122 | 11 3  |
| CASH IN HAND AND IN STANDARD BANK ..       |        | 96,082  | 1 8   |
| LONDON OFFICE—Cash and other Securities .. |        | 400,545 | 0 0   |

|  |       |             |     |
|--|-------|-------------|-----|
|  | <hr/> |             |     |
|  |       | £10,103,240 | 3 1 |
|  | <hr/> |             |     |

W. H. CRAVEN, Secretary.  
W. PICKERING, Accountant.

## PROFIT AND LOSS

**CHARGES:**

|                                    |        |    |    |
|------------------------------------|--------|----|----|
| Auditors' Fees (Two years) .. .. . | £1,200 | 0  | 0  |
| Bonus Account .. .. .              | 4,406  | 10 | 0  |
| Directors' Fees .. .. .            | 11,100 | 0  | 0  |
| Donations, Relief, &c. .. .. .     | 9,628  | 3  | 4  |
| General Charges .. .. .            | 33,717 | 2  | 1  |
| Interest Account .. .. .           | 6,901  | 6  | 7  |
| Law Costs .. .. .                  | 6,641  | 3  | 10 |
| Rents, Licenses, and Taxes .. .. . | 7,124  | 2  | 3  |

---

 £80,718 8 1
**WORKING EXPENSES:**

|                                                  |         |    |    |         |   |   |
|--------------------------------------------------|---------|----|----|---------|---|---|
| Hauling (including Maintenance Machinery .. .. . | £37,072 | 16 | 8) | 527,045 | 8 | 6 |
| Washing (including Maintenance Machinery .. .. . | 59,024  | 14 | 7) | 416,233 | 6 | 4 |

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 943,278 14 10

|                                                                             |         |    |   |
|-----------------------------------------------------------------------------|---------|----|---|
| LONDON AND PARIS OFFICE EXPENSES .. .. .                                    | 3,642   | 1  | 9 |
| MASHONALAND EXPEDITION (Expenses to date) .. .. .                           | 8,728   | 17 | 8 |
| INTEREST ON DEBENTURES and De Beers Bultfontein obligations to date .. .. . | 263,072 | 12 | 6 |
| INTEREST due to Leased Companies to date .. .. .                            | 96,392  | 10 | 0 |

---

 359,465 2 6

|                                                                                                           |         |    |   |
|-----------------------------------------------------------------------------------------------------------|---------|----|---|
| INSURANCE FUND (additional amount on Machinery and Property)                                              | 6,250   | 0  | 0 |
| DEBENTURE EXPENSES .. .. .                                                                                | 39,417  | 3  | 6 |
| CAPE OF GOOD HOPE BANK, IN LIQUIDATION—Estimated loss of 5s. in £ on our claim of £50,961 1s. 6d. .. .. . | 12,740  | 5  | 4 |
| AMOUNTS WRITTEN OFF Machinery, Property, Furniture, and Investments .. .. .                               | 209,438 | 13 | 0 |
| AMOUNTS WRITTEN OFF Blue Ground at Dutoitspan and Bultfontein .. .. .                                     | 215,000 | 0  | 0 |
| AMOUNT WRITTEN OFF Shafts and Development Works .. .. .                                                   | 92,737  | 10 | 1 |
| SUNDRY BALANCES in connection with the Purchase of Companies written off .. .. .                          | 4,353   | 4  | 8 |

---

 1,975,770 1 5

BALANCE .. .. . 1,334,408 15 10

---

 £3,310,178 17 3

|                                                          |         |    |    |
|----------------------------------------------------------|---------|----|----|
| DIVIDENDS PAID 30th June and 31st December, 1890 .. .. . | 789,791 | 0  | 0  |
| AMOUNT SET ASIDE FOR REDEMPTION OF DEBENTURES .. .. .    | 292,204 | 16 | 10 |
| AVAILABLE BALANCE CARRIED FORWARD .. .. .                | 717,829 | 0  | 3  |

---

 £1,799,824 17 1



ACCOUNT, 31st MARCH, 1891.

|                          |    |    |    |    |    |           |    |    |
|--------------------------|----|----|----|----|----|-----------|----|----|
| DIVIDENDS ON INVESTMENTS | .. | .. | .. | .. | .. | £22,450   | 13 | 10 |
| DIAMOND ACCOUNT          | .. | .. | .. | .. | .. | 3,287,728 | 3  | 5  |

---

£3,310,178 17 3

|                                        |    |    |    |    |    |           |    |    |
|----------------------------------------|----|----|----|----|----|-----------|----|----|
| BALANCE BROUGHT DOWN                   | .. | .. | .. | .. | .. | 1,334,408 | 15 | 10 |
| BALANCE BROUGHT FORWARD FROM LAST YEAR | .. | .. | .. | .. | .. | 465,416   | 1  | 3  |

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£1,799,824 17 1

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W. H. CRAVEN, Secretary.  
W. PICKERING, Accountant.

It will be seen from the above accounts that the nett profit for the year exceeded a million sterling, out of which two half-yearly dividends were paid of ten per cent. each. The actual cost of winning over two million carats of diamonds was little over a million sterling, practically ten shillings per carat, including all expenses at the mines, all office charges and expenses of management. But out of the gross profits over £500,000 were written off for depreciation under various heads, and nearly three-quarters of a million sterling expended in interest on debentures and obligations, and in making provision for their redemption. Omitting the amount of £292,000 odd set aside for redemption, the total expenses of the year were under two millions, or roughly, at the rate of eighteen shillings per carat. The diamonds found, on the other hand, were sold at the average rate of nearly thirty shillings per carat, leaving a nett profit of nearly twelve shillings per carat.

During the financial year to which the above accounts refer the Company produced 2,195,112 carats of diamonds, which realized (including the proceeds of diamonds from débris washing) £3,287,728. According to the Cape Statistical Register for 1890, the total weight of diamonds produced by all the mines in the Kimberley division during that year was 2,415,655 carats, so that apparently about ninety per cent. of the total production is in the hands of the Consolidated Mines.

To describe with any degree of fulness the gigantic operations conducted by this Company, with its elaborate machinery and mining appliances and its army of workpeople, would require a much larger space than the prescribed limits of this article will permit. A brief sketch only can be given of the modern methods employed for winning the diamonds, and those desiring further details must consult the Technical Report issued by Mr. Gardner F. Williams in 1890, and the Reports of the Inspectors of Mines for the last three years, and also the Annual Reports of the De Beers Directors.

As regards, first, the actual excavations within the mines, the miscellaneous systems of underground work that were hastily planned in the days prior to consolidation, have all

been abandoned in favour of a uniform system that is now in vogue over the whole claim area worked in both De Beer's and Kimberley Mines. The system originally adopted in the former mine was as follows: "Tunnels were driven across the mine from west to east about 120 feet apart. These tunnels were connected with each other by two tunnels running north and south, one near the west side of the mine and one midway between it and the east margin of the mine. From the east and west tunnels, short offsets 10 feet long were driven every 36 feet. At the ends of the offsets galleries were driven 18 x 18 feet in cross section. The levels were 30 feet apart. When the galleries were driven 18 feet high, there remained a roof of blue ground 12 feet thick and a pillar 18 feet thick on both sides. It was found in practice that the galleries which were driven full size from the offsets were difficult to maintain and became unsafe for the workmen.

"In order to avoid this a change was made in the system of working. The offsets are now driven to the surrounding rock, or when between two parallel tunnels, until they meet. When near the rock they are widened out into galleries, these in turn being stoped on the sides until they meet, and upwards until they break through the blue ground. The 'reef' partially fills the open space. The workmen then stand on the fallen reef, and drill the blue ground overhead. As the roof is blasted back, the reef follows. When stoping between two tunnels, the blue is stoped up to the débris about midway between the two tunnels. The upper levels are worked back in advance of the lower levels and the works assume the shape of irregular terraces.

"The main levels (or levels from which the blue is hoisted) are from 90 to 120 feet apart, with intermediate levels every 30 feet. Hoisting is done from only one level at a time through the same shaft. All the ground lying between two main levels is dumped into shoots, and passes down to the main level, where it is loaded into trucks and sent to the shaft, tipped into the skips and hoisted to the surface. The tipping arrangement at the bottom is very simple, and consists of an iron shoot without a door. While the loaded skip is being hoisted four end-tipping trucks are placed in position, and the

door catches loosened. The four doors are held closed by two natives. Directly the lowered skip is seen to pass the shoot the trucks are tipped, and the tipping is done with such rapidity that it frequently occurs that the engine-driver receives the signal to hoist before his engine has fairly stopped.

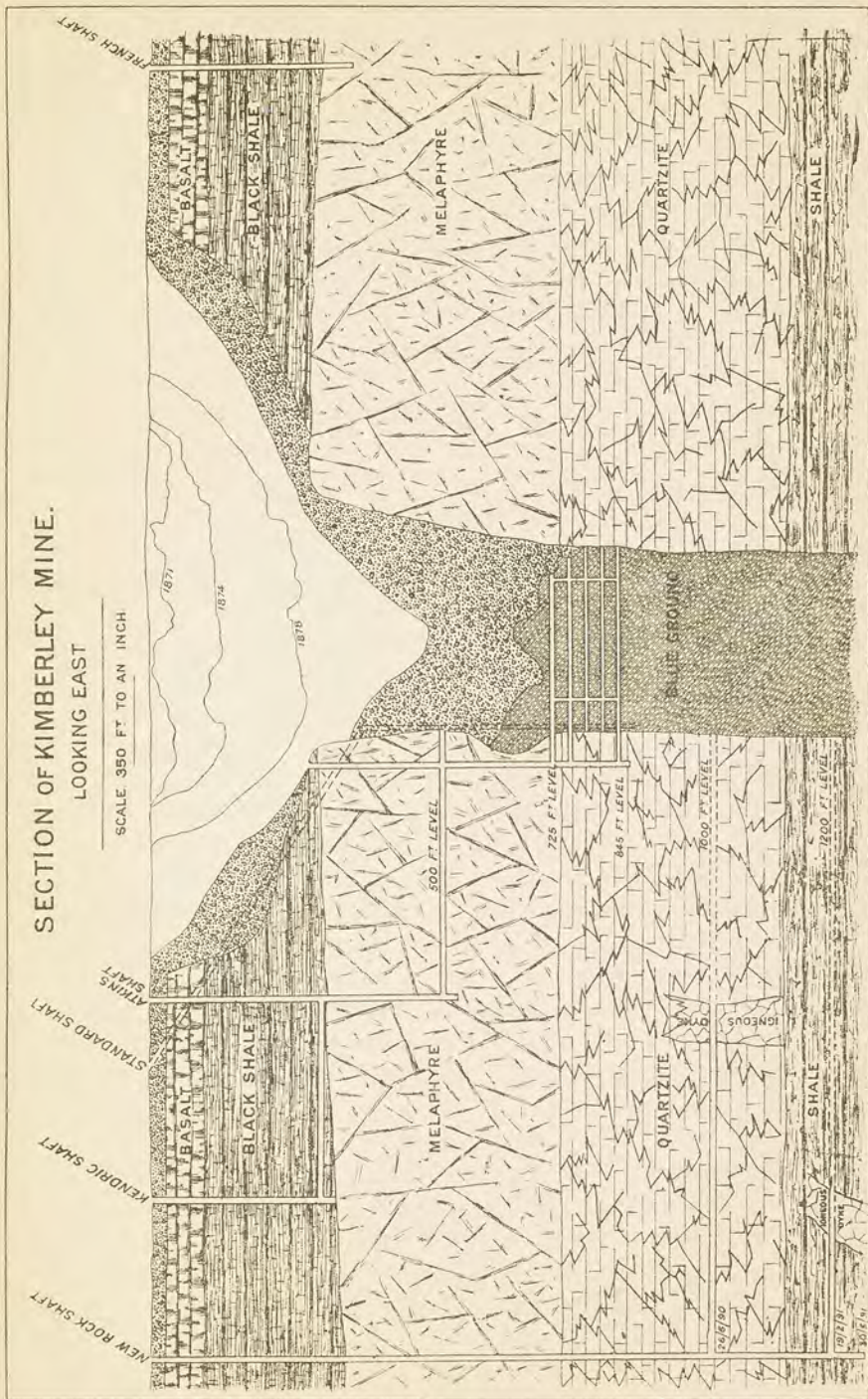
“The skips at De Beers No. 2 Incline Shaft hold 64 cubic feet, or four ‘loads’ weighing 1600 lbs. each. The amount of ground hoisted through this shaft from April 1st, 1889, to March 31st, 1890, was 1,355,089 loads, equal to 1,084,071 tons of 2000 lbs.” As much as 400 loads have been hoisted within an hour from a depth of 700 feet (or 840 feet on the incline).

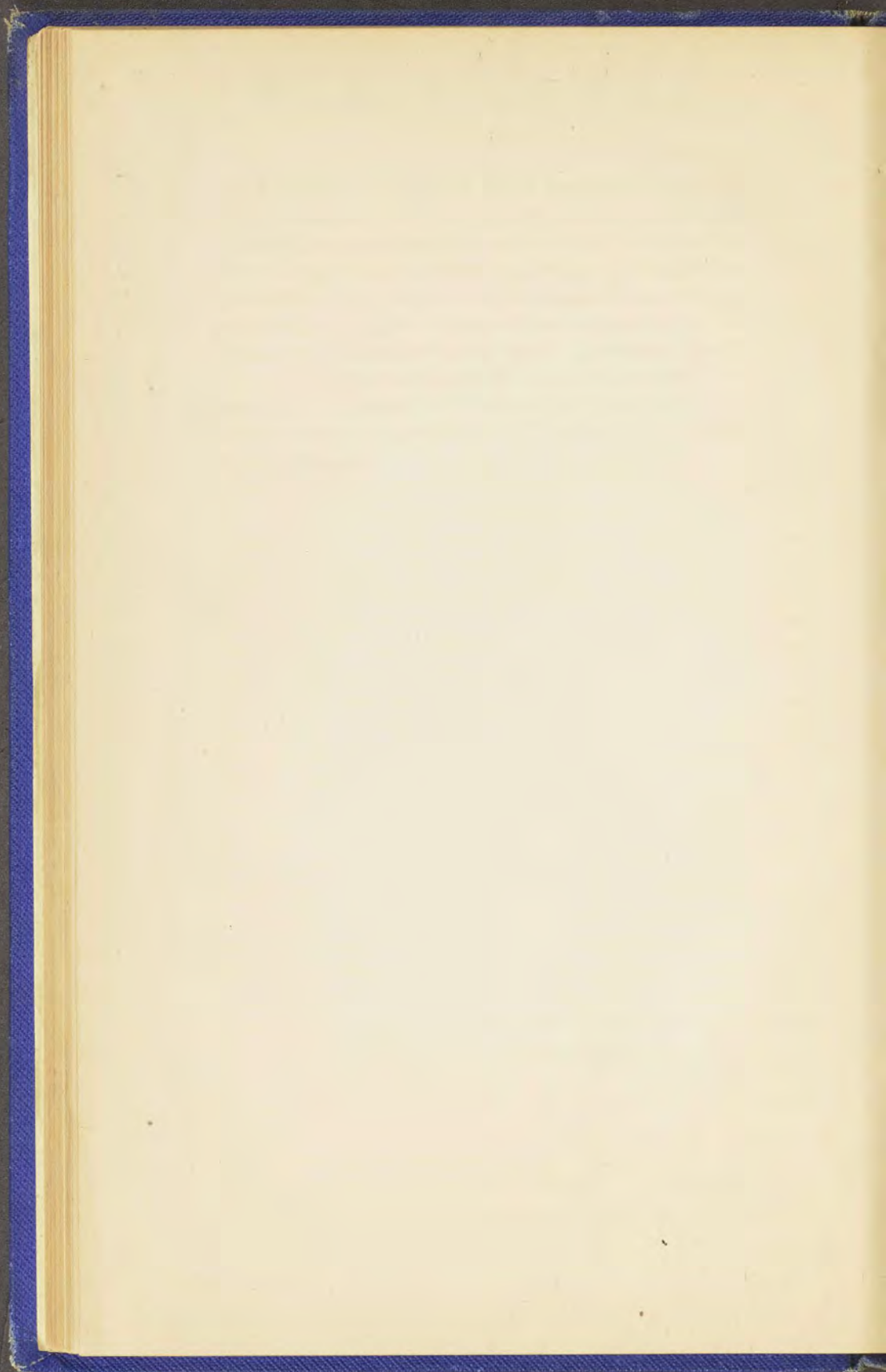
The section of Kimberley Mine reproduced herewith will convey an idea of the general formation of the diamond-bearing pipe, with its encasing rocks, and of the main shafts and workings which have been constructed therein. The New Rock Shaft on the north side of the mine was started in March, 1889, and is connected with two main tunnels, one at 1000 feet, the other at 1200 feet from the surface, the distance from the shaft to the mine being about 1134 feet. The shaft is 6 feet wide and 20 feet 6 inches long, divided into four compartments, one for pumping, two for hoisting the blue, and one for a double-decked cage to carry the white miners to and from their work.

The machinery has all been specially designed by the mechanical engineer, Mr. Louis I. Seymour, and is all of the most modern type. The pumping machinery consists of a vertical triple expansion condensing engine, driving 14-inch Cornish pumps. The hoisting is performed by a pair of vertical tandem compound condensing winding engines, with Corliss valve gear and reels for flat ropes, capable of hoisting skips holding six loads of blue ground from a depth of 1000 feet in forty-five seconds. Arriving at the surface, the skips are tipped automatically into ore-bins, from which the blue ground is filled into steel side-tipping trucks of twenty cubic feet capacity, and conveyed to the depositing floors by an endless chain haulage driven by an independent steam-engine. The tramways are all 18-inch gauge, and on the floors light locomotives are used for taking the trucks to and from the terminus of the mechanical haulage. There is a slight grade

# SECTION OF KIMBERLEY MINE. LOOKING EAST

SCALE 350 FT TO AN INCH





from the mine to the floors, which materially assists the loaded trucks on the down line bringing up the empties. On the floors of De Beers Mine a more elaborate system of endless wire rope haulage is employed, several miles in length. "The length of the main haulage is three miles, with two branches, one mile, and three-quarters of a mile in length, respectively." "The floors commence about a mile from the mine, and extend for three miles in an easterly direction and a mile in a westerly direction." "Besides the main haulage lines, there are two in use taking blue up the inclines at the washing machines, each about half-a-mile long." "The speed of the haulages varies from two-and-a-half to four miles per hour." The trucks are counted automatically as they are sent to the floors, and are also greased automatically. "The depositing floors are made by removing the bush and grass from a fairly level piece of ground. The land is then rolled and made as hard and smooth as possible. The De Beers floors on Kenilworth (a farm of some 17,000 acres, belonging to the Company) are laid off in rectangular sections, 600 yards long and 200 yards wide. Each section holds about 50,000 loads. The depositing is done by horses on portable tram lines extending at right angles from the main lines on either side of the floors." "A load of blue ground (16 cubic feet) weighs about 1600 lbs., and covers about twenty-one square feet when deposited on the floors."

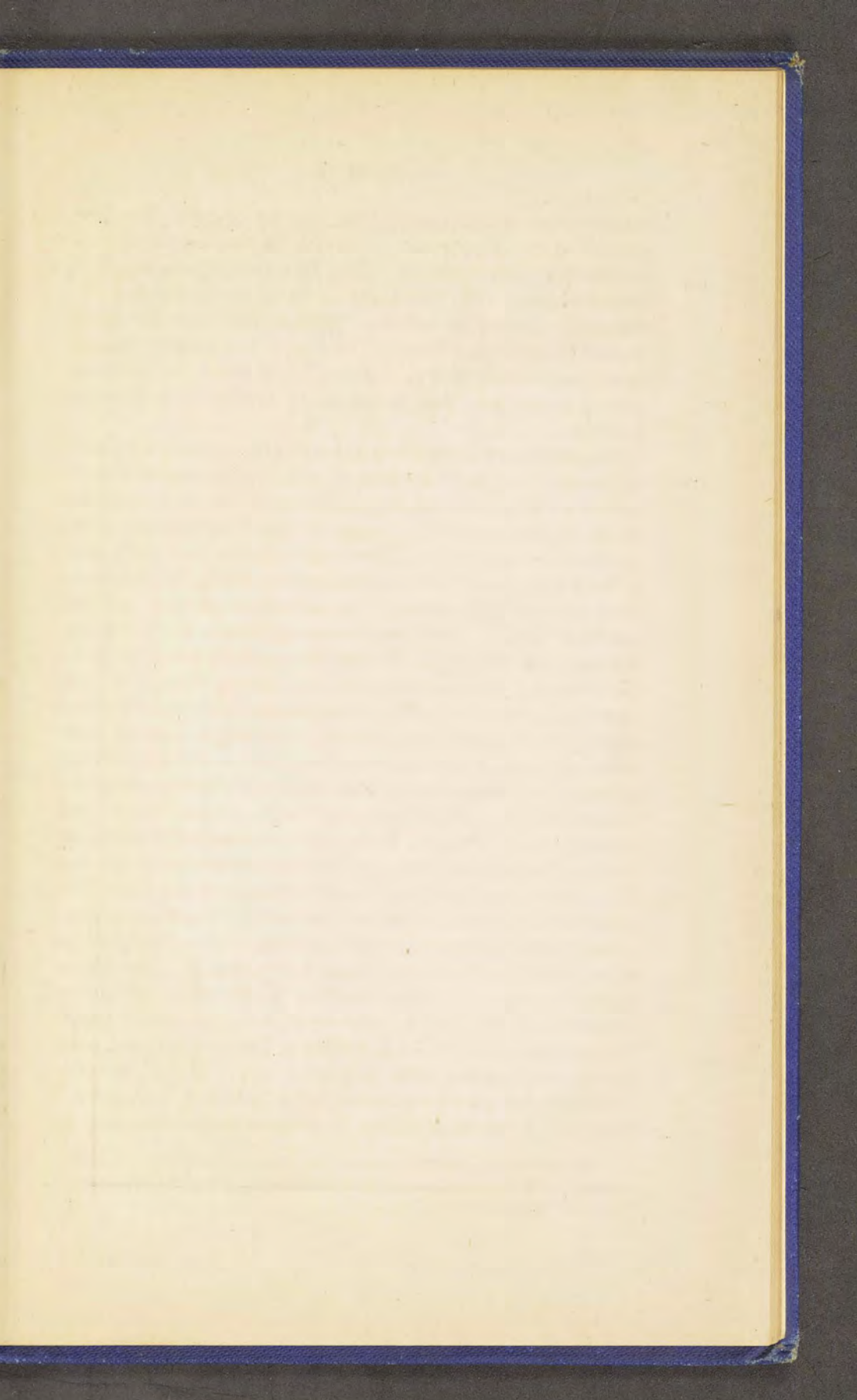
"For a time the blue ground remains on the floors without much manipulation. The heat of the sun and moisture soon have a wonderful effect upon it. Large pieces, which were as hard as ordinary sandstone when taken from the mine, soon commence to crumble. At this stage of the work the winning of the diamonds assumes more the nature of farming than mining. The ground is continually harrowed to assist pulverization, by exposing the larger pieces to the action of the sun. Spans of mules" were formerly "used for drawing the harrow to and fro, but steam traction engines with gear for drawing the harrows," on Fowler's well-known steam-ploughing system, are now employed at both Kimberley and De Beers. "The length of time necessary for the ground to be exposed before it becomes sufficiently pulverized for washing depends

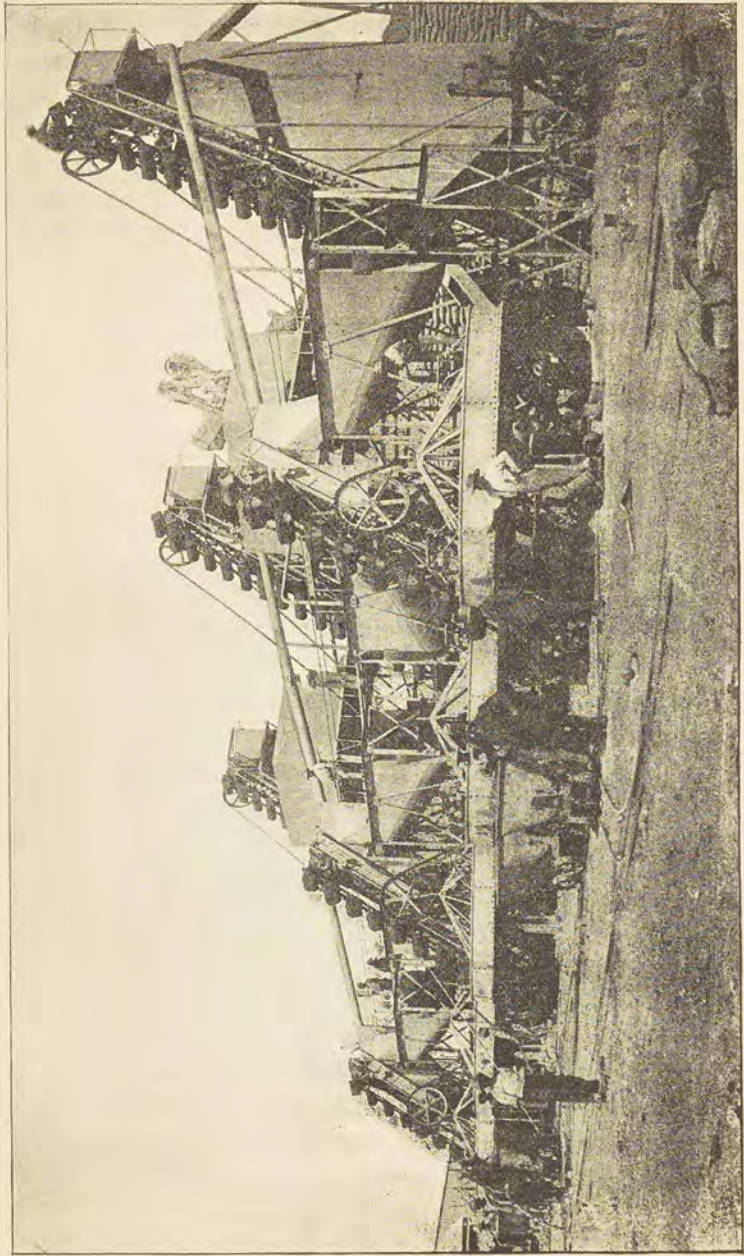
on the season of the year and the amount of rain. The blue ground of the four mines differs as to the length of time necessary for pulverization. The blue from Kimberley Mine becomes quite well pulverized in three months during the summer" (the rainy season), "whilst that from De Beers requires double that time. The longer the ground remains exposed, the better it is for washing."\* Some of the De Beers ground is so hard that it has to be broken in a Marsden crusher.

The washing gears for the treatment of the pulverized "blue" are erected on high mounds of tailings accumulated from former workings, and are very elaborate sets of machinery, the result of fifteen or twenty years of experimenting to reduce the loss of diamonds to a minimum. In the very early days of the Fields, when water was scarce and costly, the diamonds were won by "dry-sorting" the pulverized ground, and the resulting "débris," scattered over a large area of the townships, has since been nearly all washed with more or less of profit to the workers. The modern washing-machine consists of four essential parts, a hoist for lifting the dry pulverized ground from the floors, a puddling cylinder, in which it is mixed with water, an annular pan with revolving arms and teeth, and an elevator for getting rid of the tailings. The hoist is of various designs, either a "dry elevator," with endless chains and buckets, or an inclined plane with mechanical haulage, or finally a vertical lift with cages, into which the trucks are run at the floor level and tipped automatically at the top. The latter arrangement is considered the best. "The blue ground, when hoisted to the proper level, is dumped into a long feeding-shoot which has perforated pipes laid across it. The movement of the ground downwards into the revolving cylinder is regulated by the flow of water through the perforated pipes. The cylinders are 2 feet 6 inches in diameter, covered with heavy wire netting with meshes 1 inch square, or with perforated iron plates with round holes  $1\frac{1}{4}$  inches in diameter." The size of the mesh differs in different mines, according to

\* The passages in inverted commas are taken by permission from Mr. Gardner F. Williams' exhaustive Technical Report, attached to the General Manager's Report for 1890.







IMPROVED DIAMOND WASHING PLANT, KIMBERLEY MINE.

[To face page 51.

the size of the diamonds found there. "As the blue ground enters the cylinders both clear and muddy water are added. It has been found in working that diamonds separate from the mass of lighter materials much better in a properly thick puddle." "The ground which is too coarse to pass through the meshes or holes of the cylinder passes out of the lower end of same" (the cylinder or revolving screen is slightly inclined) "into trucks, and is redeposited upon the floors, where it remains for about twelve months, when it is again washed." This coarse ground is technically called "lumps" or "cylinder-lumps." The washing-machine proper consists of one or more shallow annular pans with an inner and outer rim, the latter about 12 inches high and 14 feet diameter, the former about 6 inches high and 6 feet diameter, leaving an annular space between the rims 4 feet across. A vertical shaft in the centre of the pan driven by bevil-gearing and lay shaft from below carries ten radial arms, each fitted with six or seven teeth, set so as to form a spiral, so that when the arms revolve (at a speed of about ten revolutions per minute) the teeth, which are set to almost touch the flat bottom of the pan, carry the heavy deposit towards the outer rim, while the lighter material flows towards the centre and is discharged over a weir in the inner rim, and thence into the tailing pit. The fine ground that has passed the meshes of the revolving cylinder flows down a shoot and enters the pan through a slot in the outer rim. The heavy deposit, containing the diamonds, remains on the bottom of the pan, whence it is drawn off every twelve hours into specially constructed lock-up trucks, which convey it to the Pulsator for further concentration. "The average quantity of blue ground passed through a pan is from 400 to 450 loads in ten hours. The deposit remaining in each pan, after putting the above number of loads through it, amounts to only three or four loads." "The tailings pass into tanks and are hoisted in tubs by means of aerial gears, or by means of bucket elevators, and are deposited in heaps."

"There are three pulsators in one building on the De Beers floors, where all the deposit from both De Beer's and Kimberley washing-machines is manipulated. The operation of the

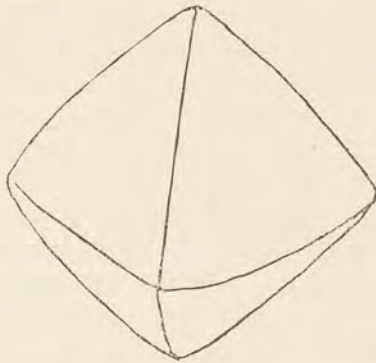
pulsator is as follows:—The trucks containing the deposit from the pans are hoisted in a cage to a platform, where the deposit is fed by means of a shoot into a long narrow inclined revolving screen or “cylinder. This cylinder is covered with iron plates perforated with four sizes of *round* holes,  $\frac{1}{8}$  inch,  $\frac{3}{16}$  inch,  $\frac{1}{4}$  inch, and  $\frac{3}{8}$  inch in diameter. That portion of the deposit which is too coarse to pass through the screens passes out at the end of the cylinder, where it is sorted. The four sizes which pass through the screens flow upon jigs; these are made stationary, the bottoms being covered with screens, the meshes of which are  $\frac{1}{8}$  inch,  $\frac{3}{16}$  inch,  $\frac{1}{4}$  inch, and  $\frac{3}{8}$  inch *square*, which are therefore a little coarser than the plates on the cylinder. Upon the screen a layer of leaden bullets is spread. These bullets prevent the deposit from passing through the screens too rapidly. The heavy deposit, with the diamonds, passes through the screens into pointed boxes below, whence it is drawn off through a pipe at the lowest point of the box and taken to the sorting-tables. The lighter material, or refuse, passes over a lip into a trough, and thence into trucks, by means of which it is hauled away and dumped upon the tailing heap. The following is the proportion of concentration:—Out of 7200 loads washed 72 loads were sent to the pulsator. Of the 72 loads 6 pass through the screens, 24 loads pass out of the end of the cylinder, and the remaining 42 loads flow over the jigs as waste. Out of every 240 loads of blue washed, 1 load, or 16 cubic feet, of gravel passes through the hands of the assorters. The assorting is done on tables, first, while wet, by white men, and then, when dry, by native convicts. The deposit is gone over as often as diamonds can be found in sufficient quantity to repay the cost of convict labour.”

“The diamond occurs in all shades of colour, from deep yellow to pure white, from deep brown to light brown, and in a great variety of colours—green, blue, pink, brown, yellow, orange, pure white, and opaque. It is the hardest of known substances, and has a specific gravity of 3.83. The stones vary in size from that of a pin’s head to the size of the cut given below. This diamond weighed 428½ carats in the rough (a carat weighs 3.17 troy grains), and is the largest

stone ever found in the four mines. It measured  $1\frac{7}{8}$  inches through the longest axis, and  $1\frac{1}{2}$  inches square. The following cut represents the size and shape of the stone as found.

“It was found in the De Beers Mine by a native, whose “brother” gave information which led to its recovery, while being taken from the mine. It was cut and exhibited at the Paris Exposition, 1889. Its weight after cutting was  $228\frac{1}{2}$  carats, having lost 200 carats in the process of cutting.

“After assorting at the pulsator, the diamonds are sent daily to the general office under an armed escort, and delivered to the valuers of the diamond department. The first operation is to clean the diamonds of any extraneous matter by boiling them in a mixture of nitrate and sulphuric



acids. When cleaned, they are carefully assorted with reference to size, colour, and purity. Parcels are then made up, and when valued are sold to local buyers, who represent the leading diamond merchants of Europe. The size of a parcel varies from a few thousands to tens of thousands of carats. In one instance, two or three years ago, nearly a quarter of a million of carats were sold in one lot to one buyer.

“In order to prevent illicit traffic, the quantities of diamonds found are reported to the Detective Department, both by the producers and by the exporters. All diamonds, except those which pass through illicit channels, are sent to England by registered post. The weekly shipments average

from 40,000 to 50,000 carats. The greatest outlet for stolen diamonds is through the Transvaal to Natal, where they are shipped by respectable merchants, who turn a deaf ear to any information from the Diamond Fields to the effect that they are aiding the sale of stolen property. The value of the diamonds stolen was at one time half a million to one million sterling per annum; this amount has been greatly lessened by means of the compounding of the natives. Illicit diamond buying (I.D.B.) is still carried on to a considerable extent, judging from the number of convictions for contravening the Diamond Trade Act." It appears from the Inspectors of Diamond Mines' Reports for 1889 that the number of cases of traffic in illicit diamond buying, tried by the Special Court in Kimberley in the years 1882 to 1889 inclusive, amounted to no less than 1211 trials, of which 831 resulted in convictions, and 380 in withdrawals and acquittals."

A few words must be added about the mines and diggings outside the control of the De Beers Consolidated Mines. This Company owns the whole of Kimberley and De Beers Mines, and the greater portion of Dutoitspan and Bultfontein, but is at present doing no work in either of the latter mines. Mining operations had to be suspended owing to reef falls, and the results of the last year's washing were not very satisfactory. The yield from Dutoitspan Mine was  $14\frac{1}{100}$  carats per 100 loads, and from Bultfontein Mine  $16\frac{6}{100}$  carats, being the average results obtained from over half a million loads washed from each mine.

In Dutoitspan Mine there are only two companies outside De Beers, viz., the *New Gordon Diamond Company, Limited*, and the *British United Diamond Mining Company, Limited*. The former Company has acquired a large number of new claims on the eastern extension of the mine, in addition to the previous holding on the north reef, and has sunk a large shaft outside the mine, with which it is connected by a tunnel at a depth of 260 feet. Some interesting light has recently been shed on the geological formation of Dutoitspan Mine. At a depth of about 300 feet below the red soil, the Gordon Company have struck quartzite in a drive and pass from their No. 2 shaft, which would appear to indicate that the melaphyre

is absent in this mine, a fact (if verified) of considerable importance to the future profitable working of the mine. The Gordon was one of the earliest companies formed in this mine some twelve years ago, and was known to possess some of the richest claims. The Company was reconstructed under its present title in March, 1891, with a capital of £410,250, and now owns 435 claims, about half of which are on the "extension," and therefore still in yellow ground. It is well equipped with machinery of modern type, including a new design of washing gear, in which it is intended to treat the maiden "blue" as it comes from the mine without previous depositing, the ground being first reduced in Marsden crushers, and then passed direct to pulsators. The operations of the Company have been much hampered by a great accumulation of water in the mine, estimated at some 60,000,000 gallons, consequent on the stoppage of work in the De Beers claims, and the question as to who shall remove this water is still under consideration by the law courts. The head offices of the Company are in London.

The *British United Company* own some 70 odd claims on the south reef which are not being worked at present owing to reef troubles. The stoppage of Dutoitspan Mine has caused considerable distress and ruin to the tradespeople and population of Beaconsfield, which was a flourishing township in the days when its two mines were in full operation. It has now sunk into the forlorn state of a deserted village, but it could hardly be expected that De Beers should work these poorer mines at little or no profit as long as it can win all the diamonds it requires from the two richer mines.

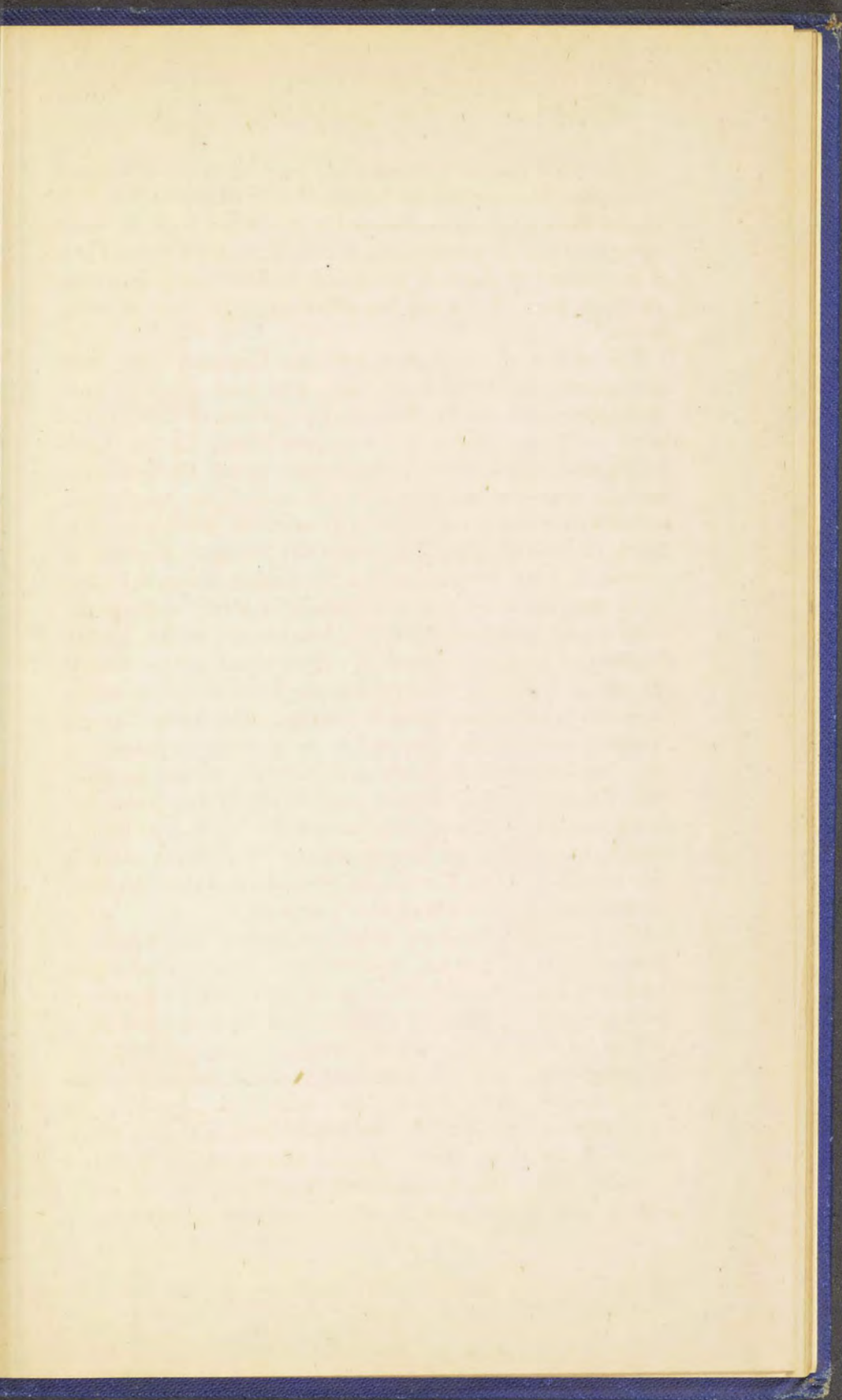
In Bultfontein Mine there are also two independent companies left, the *North Eastern Bultfontein, Limited*, and the *Compagnie Franco-Africaine des Mines de Diamants*. The former company has done a considerable amount of development, and has erected powerful machinery to work a large block of new claims taken out on the northern extension of the mine. Both these claims, and those of the Dutoitspan extension, are maiden ground, and do not appear on the old plans of the mines. Their position and extent may be judged from the general plan of the diamond fields.

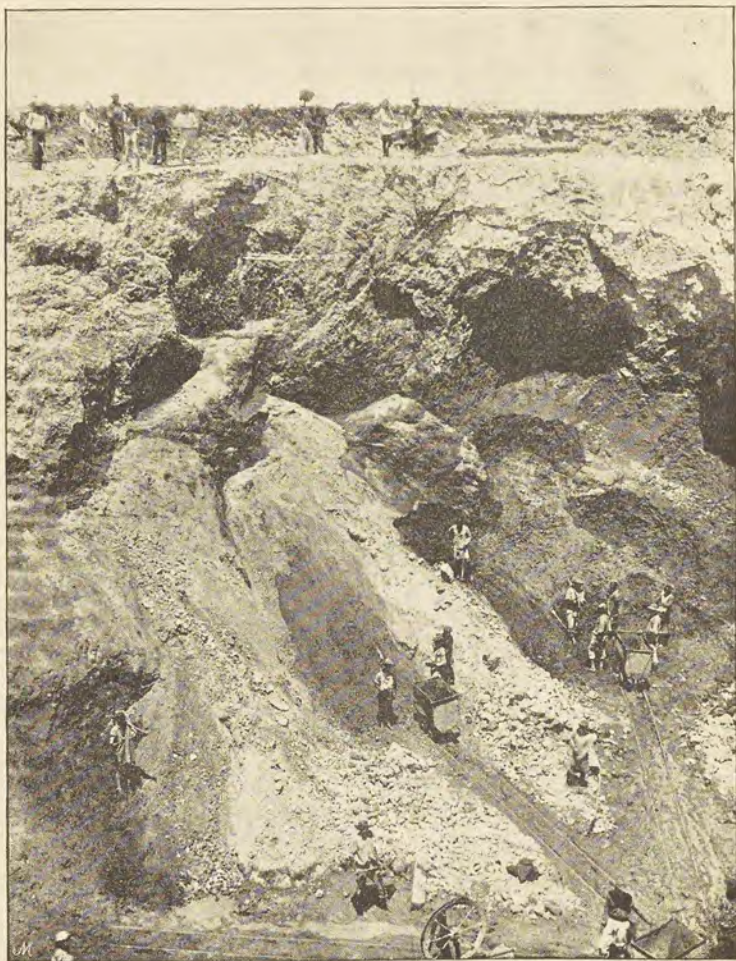
The North Eastern Company has sunk three shafts through the maiden blue ground to depths of over 500 and 600 feet. Two of these shafts are connected at the latter level, at which some 3000 feet of tunnels and passes have been opened out. A large block of claims is also being worked in the open, from which at date of writing the chief supply of blue is being drawn.

The claims of the Franco-Africaine Company have been covered with reef for several years. The head offices of both these companies are in Europe; the former in London, the latter in Paris. The drives from the North Eastern Company's shafts at the 600 feet level have struck the quartzite, but the depth of the shales is not known, nor has it been ascertained whether the melaphyre exists in this mine. The North Eastern property consists of 671 claims. The size of a claim in both Dutoitspan and Bultfontein Mines is 30 feet by 30 feet, for which a monthly rental of thirty shillings per claim is paid to the landlords, the London and South African Exploration Company, Limited. Each claim carries with it one acre of depositing floor, so that the floors of the two mines cover five or six square miles of country. The North Eastern Company derive their water supply for washing purposes from the "Pan," a natural basin which receives the surface drainage from the surrounding country, and which of late years has grown into a lake of imposing dimensions. A similar lake of smaller size, known as Blanckenberg's Vley, exists about a mile to the north of Dutoitspan Mine, from which the New Gordon Company has the right of pumping.

The *Kimberley Diamond Mining Company, Limited*, is an off-shoot of the London and South African Exploration Company, Limited, and was formed in London a couple of years ago with a capital of £100,000 for the purpose of prospecting for diamonds on the Exploration Company's property. Its chief work thus far has been devoted to opening up the *Belgravia Mine*, which lies within the township of Kimberley on the farm Bultfontein, within a stone's throw almost of De Beers Mine. The number of claims is said to be about 400. The diamond-drill has been used for prospecting, and in the process of development a quantity of







THE PREMIER (WESSELTON) MINE, 1892.

[To face page 57.]

diamonds has been found, including one stone of 58 carats. This mine will probably be floated before long as a subsidiary company.

The *Saint Augustine's Mine*, so called from the church of that name which stands on the property, was "rushed" some 12 years ago in the days of the first "boom," and is now owned by a London Company, which has erected powerful machinery and done a considerable amount of development down to a depth of 800 feet from the surface, all the mining being underground, but very little is known publicly as to the results obtained. This mine is also situated within the township of Kimberley, only a few hundred yards to the west of Kimberley Mine, and is almost hidden amongst the houses and gardens of the west-end of the town.

*Otto's Kopje* is another mine that was rushed in the "boom" of 1880, and after standing idle for many years is now the property of the Otto's Kopje Diamond Mines, Limited, a company recently reconstructed in London with a capital of £500,000, which holds some 500 acres under lease from the Cape Government, including two mines lying a couple of miles to the west of Kimberley. No. 1 Mine has been prospected by means of a shaft sunk to a depth of 1200 feet into the "blue," but the new management is devoting its energy to the exploitation of No. 2 Mine, which it is proposed to work on a large scale as an open mine in the yellow ground, for which purpose extensive machinery is shortly to be erected.

There are several other mines in Griqualand West, most of which were rushed twelve years ago and soon after abandoned, but some of them are now being reopened in the hope that they may prove payable under the cheaper conditions of working which obtain to-day. But more important than any of the outside mines mentioned above is the *Premier Mine* (Wesselton), which was only discovered in the latter part of 1890, though it lies within a mile eastward of Dutoitspan Mine, on the farm Benauwdheidsfontein, part of the Wessels Estate, which has been known for years to contain diamonds, and has been prospected right and left any time these last twenty years. The mine had been overlooked owing to the

absence of the ordinary surface indications. It lies in a slight depression, whilst most of the other mines were originally "kopjes," or slight hillocks, and the diamondiferous soil is covered by a thick deposit of 8 feet or 12 feet of surfaceous limestone. It had actually been used as a depositing site for the dry rubbish of the township of Beaconsfield. The coach road from Kimberley to Bloemfontein passes over the estate, which comprises fifteen farms of a total of 52,000 acres, and is cut in two by the boundary line of Griqualand West and the Orange Free State, only 6000 acres lying within Colonial territory; but the whole estate is held under a Free State title, which renders the minerals the sole property of the owner of the land. In spite of this the Premier Mine was "rushed" in the early part of 1891, but the rushers were subsequently turned off as trespassers and the mine reverted to Mr. H. A. Ward, who had acquired the prospecting rights on the whole estate. He has since entered into an arrangement with the De Beers Consolidated Mines, Limited, whereby the latter company have purchased the entire Wessels Estate of fifteen farms, including the Premier Mine, for the sum of £303,000. Mr. Ward's part of the bargain gives him the right to mine and wash for his own benefit 5,000,000 loads of yellow ground in the five years 1892 to 1896, out of which he has to pay back to De Beers half the above purchase price and interest on the whole at 9 per cent. per annum. He is also bound not to sell more than 20,000 carats of diamonds per month.

There are 1125 claims in the Premier Mine, which after deducting the area covered by "floating reef," will yield the prescribed quantity of 5,000,000 loads by taking out the yellow ground to a depth of about 70 feet. This will still leave a large amount of "yellow" to be treated by De Beers, besides all the blue ground, which Ward is not allowed to touch. Owing to the great facilities of working top stuff, which is hauled from the mine up inclined tramways, and tipped direct into the washing machines, the yellow ground can be treated at a cost not exceeding 1s. 6d. per load, which is a low estimate of its value and will leave a nett profit of 2s. 6d. per load, so that Mr. Ward is likely to make about half a million sterling

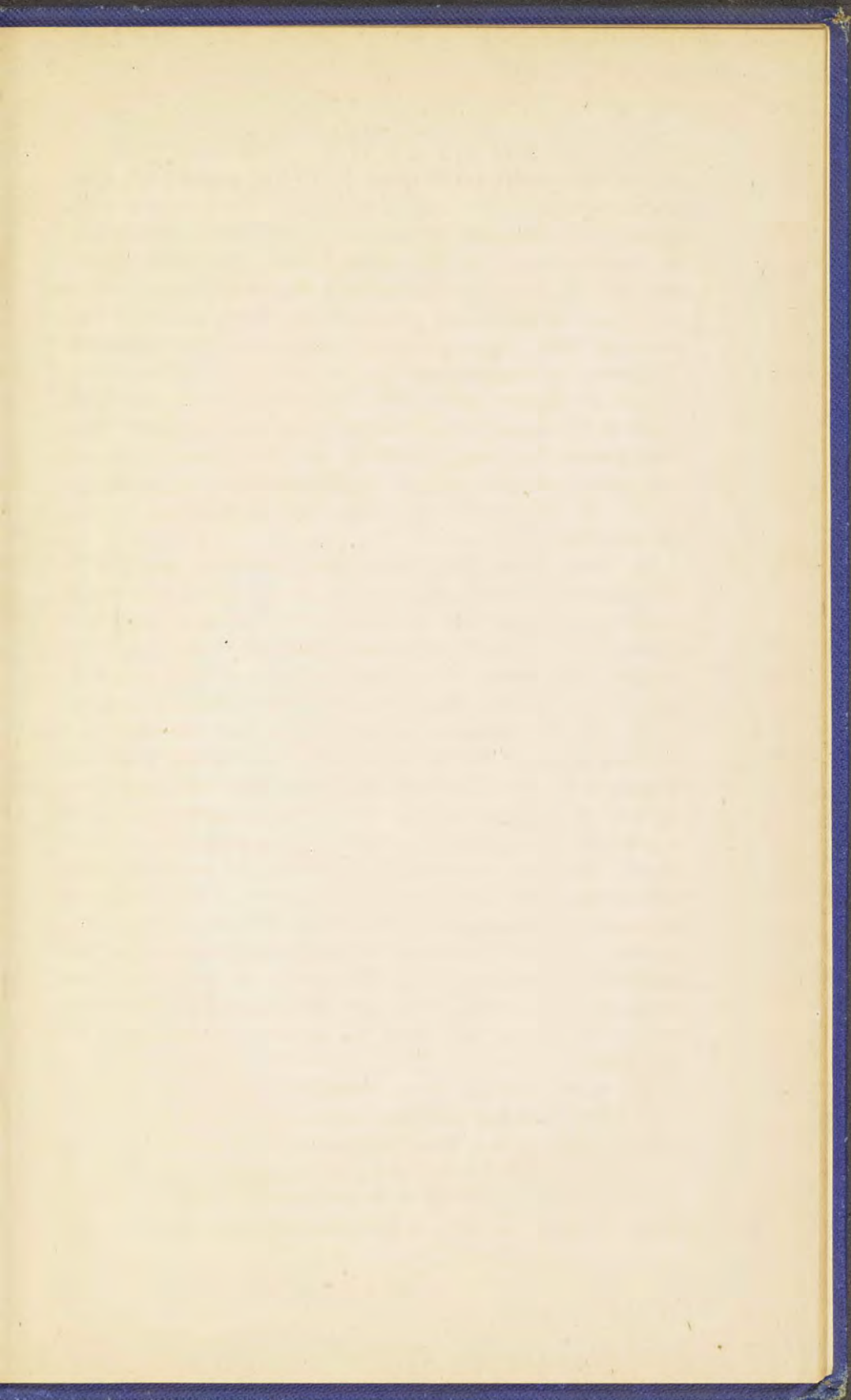
by his bargain. On the other hand, the property acquired by De Beers is remarkably cheap, and a magnificent addition to the assets of the Company. At present there is ample water in the mine for washing purposes, but the greater part of the "Pan" falls within the property, and is a most valuable water-right.

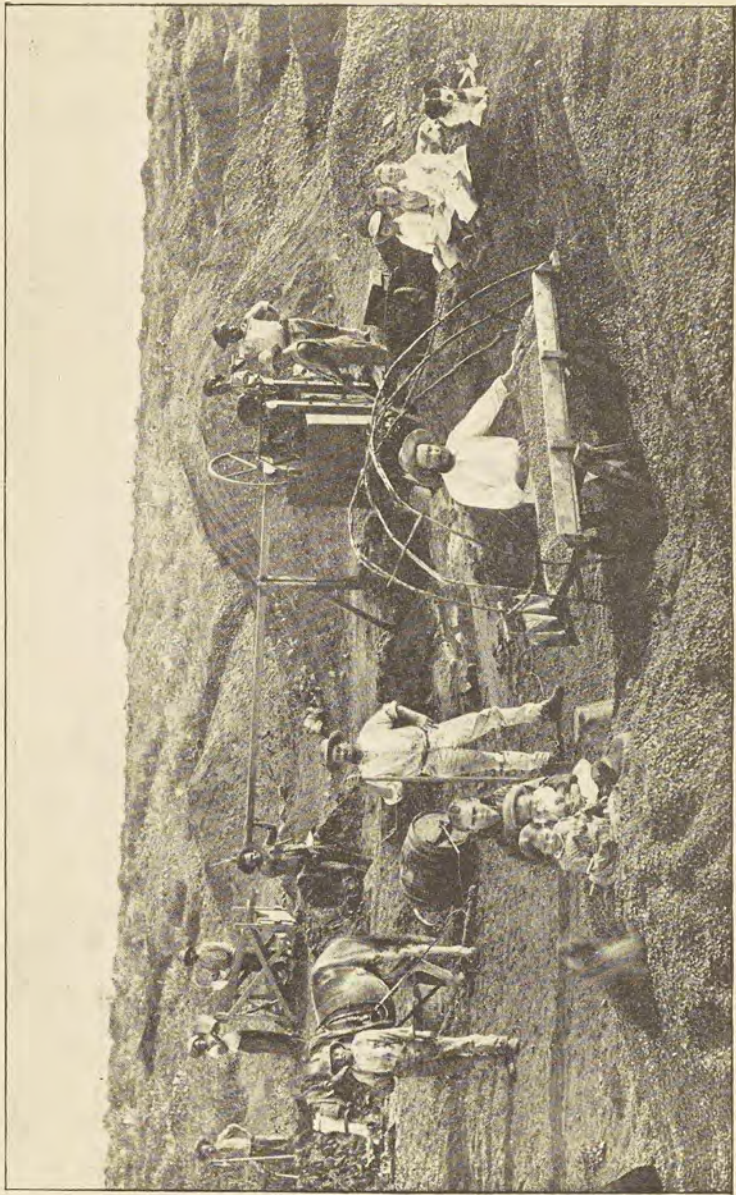
As already mentioned, there are several diamond mines within the Orange Free State, most of which have been worked spasmodically for many years past. The only mine of real importance is *Jagersfontein*, which was discovered twenty years ago, and after passing through numerous ups and downs is now the sole property of the New Jagersfontein Mining and Exploration Company, Limited. This Company was formed on the 1st of April, 1888, with a capital of £789,150, and owned 847 claims out of a total of 1135 in the whole mine. The remainder of the mine was, until last year (1891), held by the Jagersfontein United Mining Company, Limited. This Company, with a capital of £300,000, made a profit of £15,449 in the year ending 28th February, 1890, whilst the profits of the New Jagersfontein Company in the financial year ending 31st March, 1891, amounted to £24,152, with diamonds averaging 37s. 2d. per carat. The price realised by Kimberley and De Beers diamonds during the same period was 29s. 6d. per carat, so that it will be seen the Jagersfontein diamonds are nearly 30 per cent. better in quality than those of De Beers. But whilst the De Beers ground yields a carat to the load, the average yield of Jagersfontein is only about 11 carats per 100 loads. The mine has been entirely worked on the open quarry system. According to Mr. George Kilgour's report the main or marginal reef consists of about 20 feet of slaty shell formation covered by about four feet of red surface soil, and underlaid by a hard quartz rock to which, up to the present, no bottom has been found, so that the formation is peculiarly favourable to the carrying on of open working to a great depth with safety. The lowest workings are at present about 300 feet deep, and of the whole mine area less than 700 claims are being worked. A great mass of floating reef, consisting of a hard conglomerate of sand and stones, covers about 450 claims to a depth of some

50 feet, underneath which about 30 feet of unprofitable blue ground is found. The cost of removing this worthless high ground Mr. Kilgour estimates at £200,000. Meanwhile the amalgamation of the entire mine has taken place, and work is being conducted on a very cheap scale. The railway to Bloemfontein passes within thirty miles of the mine, so that cheap fuel and produce are now available. The town of Jagersfontein is six miles from Fauresmith, and about eighty miles from Kimberley, where the head office of the Company is located. The Jagersfontein Mine and Estate Company, Limited, are the owners of the farm, and draw licences from all the stands in the township, as well as one half of the claim licences collected by the Government.

The only other Free State mine deserving mention is *Koffyfontein*, situated on the Riet River, about fifty miles south-east of Kimberley, in a direct line between there and Fauresmith. The Koffyfontein Farm is owned by the London and Orange Free State Exploration Company, who bought it from Mr. Rorich in 1880 for £80,000. A number of companies were formed at that time to work the mine, but all came to grief. In November, 1889, after having remained unworked for several years, the claims were sold by public auction in Kimberley, when 1187 claims realised £70,772, 300 claims being kept in reserve by the proprietors of the farm. The mine was once more proclaimed a public digging, and several new companies set to work. The finds of diamonds registered from December, 1887, to April, 1891, amounted to 9912 carats, valued at £14,640, or an average of nearly 30s. per carat. Elaborate waterworks have been constructed on the Riet River, for which unhappily there is not much use, as the mine has again been abandoned as unpayable.

The town of Barkly West, pleasantly situated on the right bank of the Vaal River, seventy miles north-west of Kimberley, is the centre of the River Diggings, which extend up and down the river on both banks, a distance of some seventy miles from above the brow to its junction with the Harts. These diggings are very unlike the Kimberley Mines, being





SORTING GRAVEL AT WALDEK'S PLANT, VAAL RIVER.



all in alluvial soil, a heavy deposit of ferruginous gravel mixed with red sand, lime, and boulders, that has been washed into the crevices of the rocks by the action of the river, which has cut its way through a hard volcanic rock, probably diabase, which stretches for miles on either bank and extends from near Potchefstroom almost to the junction of the Vaal and Orange Rivers. There is little doubt that this rock is identical with the "hard rock," or amygdaloidal melaphyre, of Kimberley Mine. The Kimberley shales thin out and vanish as the Vaal River is approached, and the great sheet of melaphyre appears there on the surface. Whether the diamonds which the heavy deposit contains have been formed *in situ*, or whether they were brought from a distance, is still a vexed question, but the balance of evidence is in favour of the former hypothesis. Most of the diggings are very shallow, but in some cases they are nearly a hundred feet deep before the bed rock is reached. Several companies have been formed for working the deep alluvial, but they have not been very successful, and the fact appears to be that the River Diggings are poor men's diggings, which yield a fair return to hard-working individuals, but which do not justify the outlay of much capital. They are still being worked very much as they were twenty years ago, and the original digger is still to be found there with all his primitive appliances, living his free arduous life, often with but scanty fare, and occasionally diversified by a trip to Kimberley. The result of amalgamation has been to increase the activity at the River Diggings, where there are now probably nearly a thousand white men at work, in addition to their native labourers. In 1889 the Government revenue from claim licences, &c., amounted to a little over £6000, being an increase of £1000 on the revenue received in 1888, whilst in 1890 it rose to £9500. The approximate weight of diamonds found at all the River Diggings has remained pretty constant for several years past, having seldom much exceeded 30,000 carats per annum, that is, about one per cent. of the production of the Kimberley Mines, but the quality of the river stones is superior even to those of Jagersfontein, being generally about twice the value of the average price realised for Kimberley

stuff. During the year 1890 the approximate weight and value of diamonds imported into Kimberley from the Barkly Division were 28,122 $\frac{3}{8}$  carats, valued at £79,231 11s. 3d. (data supplied by the Detective Department), equal to 56s. per carat. The value of the production of the Kimberley Mines during the same period was only 31s. 1 $\frac{1}{2}$ d. per carat.

There are a number of Dry Diggings in the Barkly District, similar in formation to the Kimberley Mines, but none of them has proved payable.

It is only since the establishment of the Board for the Protection of Mining Interests in 1882 that accurate statistics have been compiled of the value of the production from each mine, and also of the imports of diamonds into and exports from Kimberley, but from the Postal and Customs Returns an approximate estimate may be formed of the production prior to 1882. Comparing all available sources of information, it may be confidently stated that we have exported to date (1892) over 50 million carats of diamonds, of a total value of nearly seventy millions sterling. As about five million carats go to a ton, the weight of diamonds exported has amounted to over ten tons. If piled into a heap, they would form a pyramid 6 feet high, with a base 9 feet  $\times$  9 feet; or they would fill a box 5 feet  $\times$  5 feet  $\times$  6 feet.

The above estimate of the total value of diamonds exported to date (1892) makes a small allowance for the diamonds known to have been exported through private and illicit channels. The Official Return of diamonds exported from the Cape Colony, compiled by the Collector of Customs, gives the total value, for the twenty years from 1872 to 1891 inclusive, at £58,110,923. To this must be added at least a couple of millions for diamonds exported prior to 1872, and a further three millions for the exports of 1892 up to the end of September, making a total of sixty-three millions sterling from the discovery of the Fields to the opening of the Kimberley Exhibition, so that the above estimate of *seventy millions* assumes only ten per cent. to have been illicitly exported, which is probably far below the actual figure.

For the past five years the value of diamonds exported has remained at between four and four-and-a-quarter millions per

annum, and this appears to be the maximum value the market can take without unduly affecting the price.

It has been shown in the previous pages how the control of the diamond industry has gradually passed into the hands of a powerful Corporation, which for the first time in the history of the Fields has enabled shareholders to depend on reasonable and regular dividends. The annual expenditure in labour, supplies, machinery, &c., may be gathered from the following statement of payments made by the De Beers Consolidated Mines, Limited, in the Cape Colony and in Europe, during the period from 1st January to 31st December, 1891 :—

|                                                                                           | Payments<br>made in the<br>Colony. | Payments<br>made in<br>Europe. |
|-------------------------------------------------------------------------------------------|------------------------------------|--------------------------------|
|                                                                                           | £                                  | £                              |
| Wages and payments to contractors .. .. .                                                 | 790,000                            | ..                             |
| Rents, licences, salaries, and incidental expenses .. .. .                                | 93,000                             | ..                             |
| Trade accounts (purchased in Colony) .. .. .                                              | 220,000                            | ..                             |
| Produce .. .. .                                                                           | 23,000                             | ..                             |
| Fuel, wood .. .. .                                                                        | 15,000                             | ..                             |
| Plant and mechanical stores, <i>plus</i> railage on this and }<br>imported stores .. .. . | 75,000                             | ..                             |
| Railage on coal .. .. .                                                                   | 115,000                            | ..                             |
| Dividends :—                                                                              |                                    |                                |
| Paid in Colony .. .. .                                                                    | 300,000                            | ..                             |
| Paid in Europe .. .. .                                                                    | ..                                 | 588,000                        |
| Interest on debentures :—                                                                 |                                    |                                |
| Paid in Colony .. .. .                                                                    | 3,000                              | ..                             |
| Paid in Europe .. .. .                                                                    | ..                                 | 253,000                        |
| Interest paid to shareholders of companies leased }<br>by us .. .. .                      | 35,700                             | 58,000                         |
| Material purchased in London, such as machinery, &c.                                      | ..                                 | 66,000                         |
|                                                                                           | £ 1,669,700                        | 965,000                        |

Meanwhile there is no doubt trade and population have declined from what they were some years ago; but it must be borne in mind that many causes have been at work, in addition to the amalgamation of the mines, which largely account for this shrinkage. The northern extension of the railway is one cause, the rise of Johannesburg and the transfer of the share market from Kimberley is another.

The permanence of the leading industry of the Colony, how-

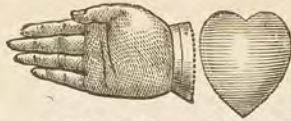
ever, is now assured, and, with a yearly expenditure of about a million sterling at the mines, there will always be steady employment for a large number of men at good wages, and a considerable amount of trade. Local trade has no doubt suffered by the "compounding" of native labourers, and the building of Kenilworth village for the white employés of De Beers ; but visitors to the Exhibition, when they have inspected the "Compounds," which provide the native with wholesome food and healthy quarters, and protect him alike from incentives to theft and to drinking poisonous liquor ; and when they have seen the model village of Kenilworth, with its pretty houses and gardens surrounded by lofty trees, and its many provisions for the comfort and recreation of the miners, they will certainly regard the "Compounds" as not only a just conserving of shareholders' interests, but as a humane institution for the benefit of the natives themselves ; and they will rejoice at the shady retreat from the dust and ugliness of the mines which Kenilworth affords, and will carry away the impression that it is an "oasis" in the desert.

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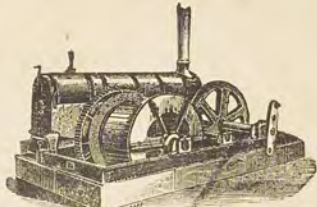
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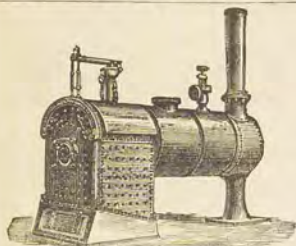
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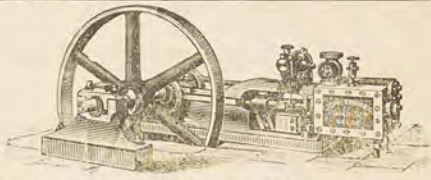
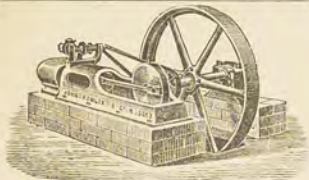
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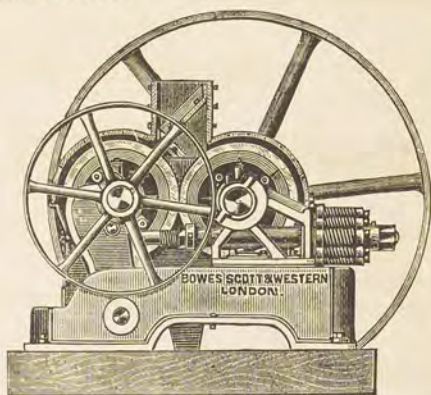
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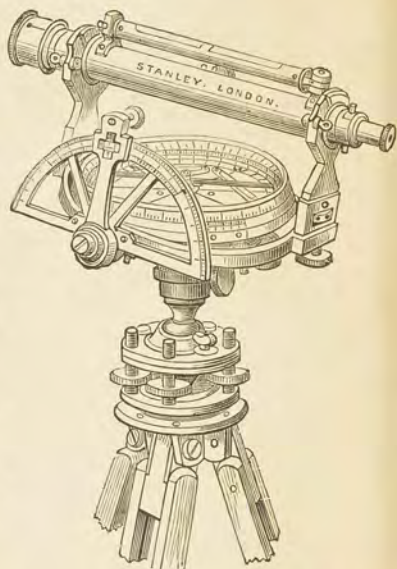
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