THE DIAMOND MINES OF SOUTH AFRICA

VOL. II
THE DIAMOND MINES OF SOUTH AFRICA

BY

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GENERAL MANAGER OF DE BEERS CONSOLIDATED MINES, LTD.

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CHAPTER XII

WINNING THE DIAMONDS

It has been shown how resourceful engineering mastered the problem of the extraction of the diamond-bearing deposits swiftly and systematically, without injury to the mines. It was no less essential to advance and perfect the process of the winning of the diamond from the mass of extracted blue ground with corresponding speed and efficiency. For the handling of the mammoth bulk of breccia, through which the tiny, precious crystals were sprinkled in a proportion so infinitesimal, there was a practical call for every feasible stretch of invention in transportation, concentration, assorting of sizes, and final separation of the gems. The indispensable reconciliation of thoroughness in extraction with rapidity in working over the ground made the task greatly perplexing. It was only through years of experimenting and progressing from imperfect to improved designs that the present great diamond-winning plant of the mines was evolved. If this is still short of ideal suitability to the work, it is simply fair to observe how vast is the stride that has actually been made in a few recent years in diamond-winning methods, from the primitive Indian wooden shovels and drying mats, and the water holes and shaking plates of the Brazilian.

As fast as the blue ground is dumped automatically from the skips into the ore bins, it is carried away in trucks by an endless wire rope haulage, driven by steam, to the depositing floors. These floors are made by removing the bush and grass from fairly level stretches of ground. After clearing the face of the ground, it is hardened and smoothed with heavy rollers until it
is fit for use. Receiving grounds are laid out separately for each of the diamond mines on the four farms, and cover an area of several thousand acres. The most extensive of any are the De Beers floors, which are laid off in rectangular sections, six hundred yards long and two hundred yards wide, on the farm, Kenilworth, adjoining the mine. They begin about a mile from the mines and extend for three miles in the easterly direction and a mile to the west.

The main tramway line from the mine is three miles in length, with two branches, one mile and three quarters of a mile in length respectively. The speed of the running trucks ranges from 2.5 to 4 miles an hour, and they are counted and greased automatically as they are sent on to the floors. There is a slight down grade from De Beers and Kimberley mines which is of material service in lightening the drag of the loaded trucks. When the trucks reach the floors, they are drawn by horses or mules over auxiliary tram lines at right angles to the main haulage line to any desired point of deposit. A full truck contains about 16 cubic feet of blue ground, weighing 1600 lbs. approximately; but it was found more convenient to supplant these end-tipping trucks by 20 cubic feet side-tipping trucks. The
DETAILS OF 16-CUBIC-FEET TRUCK.
old unit of measurement, 16 cubic feet, has been retained, and the automatic counters are so geared that every time four 20-cubic-feet trucks pass them, five truck-loads are registered. Each of the rectangular sections of the De Beers floors holds about 50,000 loads. The Kimberley floors are nearly as large, and substantially the same method is employed in covering them. On the depositing ground a truck-load is spread out to
cover about 21 square feet. So over the miles of floor surface is outstretched an enormous carpet of “blue” somewhat less than a foot in thickness, and sprinkled with invisible diamonds. It may appear to the reader that the word “invisible” is used to convey the idea that the diamonds are very small, but such is not the case, for many of the diamonds lying buried are as big as filberts, and it is not unusual to find them as large as walnuts. What is meant is that the diamonds contained in the blue ground are invisible to one walking casually over the floors even after the ground has pulverized. During the fifteen years of my charge of De Beers mines I have never found a diamond on the floors.

It will be seen that no pains have been spared to hasten and cheapen the flow of ground to the floors. After the blue ground has been spread out, it is necessary to wait patiently until the sun and the rain have contributed their service in disintegrating the breccia. The effect of the exposure of this curious compound to heat and moisture is very remarkable. Large pieces of blue, which are as hard as sandstone when freshly taken from the mine, soon begin to crumble on the depositing floors. To hasten the disintegration, the bed of blue is harrowed several
times to turn up the bigger lumps and expose fresh faces of the ground to the sun. Spans of mules were originally used to

De Beers Floors.

drag the light harrows used in those days, but steam traction engines are now employed to draw wheeled harrows with huge

Kimberley Floors.

teeth to and fro across the floors. So the great spread of the floors looks like some vast ploughed farm where the laborers are preparing the soil for seed.
The length of time required to effect the desired degree of pulverization depends on the season of the year and the amount of rainfall. It is curious to note, also, that there is a marked difference in the rapidity of disintegration of the blue ground in each of the four mines. The blue from Kimberley mine becomes well pulverized in six months with heavy rains in the summer season, while the De Beers blue requires double that time. The longer the exposure, the more complete the pulverization, and the better for washing. The long continuance of droughts, which are of frequent occurrence, causes very costly delay. During a period of more than eight months in 1897 there was not sufficient rain to wet the blue ground. The lack of rain water was offset, in a measure, by artificial means; but as the blue ground upon De Beers and Kimberley floors covers 2000 acres of land,
the difficulty of any approach to complete watering may be readily imagined. Under normal conditions soft blue ground becomes sufficiently pulverized in from four to six months, but it is better to expose it for a longer period, even for a whole year.

A certain percentage of the blue ground is not affected by exposure on the floors. This intractable ground, which is called hard blue, makes up about 5 per cent of the product of De Beers mine. The large pieces of hard blue are removed from the floors to be crushed in rock breakers and rolls, and large, worthless boulders and stones embedded in the blue, as well as large pieces of basalt and shale which fill the open mines, and
have become mixed with the blue ground during the process of mining, are picked out to be thrown away. Then the well-

disintegrated blue ground is taken from the floors in trucks by endless rope haulages to the washing machines and put through the first stage of concentration.

The ground is dumped from the trucks into hoppers, at the bottom of which are small revolving tables upon which the ground is divided and fed automatically into two revolving cylinders. This automatic feeder, which was devised by Mr. Robeson, late mechanical engineer to De Beers Company, not only divides the ground equally between two rotating washing machines, but delivers it regularly, so that the machines cannot become overcharged, which would result in loss of diamonds.
After leaving the automatic feeders, the ground is mixed with puddle (the name applied to the thick muddy water which flows out of the washing pans) and a quantity of clear water is added.
This mixture serves to bring the fresh supply of blue ground in the pans to the proper consistency for washing, for experience proves that diamonds and the heavy minerals with them separate from the mass of lighter material much better in a fairly thick puddle than in comparatively clear water. From the chutes below the feeders the mixture flows into a revolving cylinder covered with perforated steel plates with holes $\frac{1}{4}$ inches in diameter. All lumps larger than the holes pass out of the end of the cylinder, and are carried by a pan conveyor to crushing rolls for further treatment. Worthless stones carried in the ground are picked out by hand as the lumps move along on the conveyor.

The pulverized ground which passes through the screen holes of the cylinders is fed into shallow circular pans, divided so as to form an annular space, four feet in diameter, between the outer and the inner rim (see figures on pages 13-14). Here the ground is swept around by revolving arms attached to a vertical shaft, and carrying wedge-shaped teeth (see figure). These teeth are set to form a spiral which forces the diamonds and other heavy minerals to the outer side of the pan, while the lighter
material flows out of the discharge situated upon the inner rim. Fifty per cent of De Beers ground, when well pulver-
ized, will pass through a screen with holes \( \frac{1}{16} \) of an inch square, and 66 per cent of Kimberley ground will pass through the same screen. The big pieces of hard rock, which were brought out of the mines only a few months before, have crumbled almost to dust, which, during every working day in the year, passes through the pans in a flowing stream for ten hours a
day, leaving its treasure behind. When the bare statement is made that nearly five million truck-loads, or more than four million tons of blue ground, have been washed in a year, the mind only faintly conceives the prodigious size of the mass that is annually drawn from the old craters and laboriously washed and sorted for the sake of a few bucketfuls of diamonds. It would form a cube of more than 430 feet, or a block larger than any cathedral in the world, and overtopping the spire of St. Paul's,

WASHING MACHINE.

while a box with sides measuring two feet nine inches would hold the gems.

When the day's work is completed, the pans, through each of which three hundred loads have passed, are emptied or "cleaned up," and the concentrated deposits of diamonds, mingled with the other heavy but valueless minerals, are then
Washing Machine with 18 Pans. Capacity, 6000 Loads, equal to 4800 Tons, in Ten Hours.
sent to the Pulsator in trucks with locked covers, where they are sized by passing through a cylinder covered with steel sieving with holes from one-sixteenth to five-eighths of an inch in diameter. The five sizes which pass through the cylinder flow upon a combination of jigs, termed at the mines the pulsators, and the name Pulsator, which originally applied to the one set of jigs only that did all the work for the De Beers Mining Company in 1886, is still applied to the large concentrating plant and machinery where the final concentration is done and the diamonds sorted from the worthless minerals with which they are associated.

Before tracing the diamonds through the Pulsator, it is desirable for the sake of clearness to sketch the treatment of the hard blue ground taken direct from the depositing floors. For the handling of this portion of the product of the mines an elaborate and costly plant was erected on one of the old tailing heaps. The driving power of the crushing mill is a compound vertical engine of 1100 horse-power. The whole plant is divided into four sections, and provided with friction clutches so that any portion of the machinery may be stopped without interfering with the running of the rest of the mill.
An endless wire rope haulage carries all the refractory ground to the mill, where it is put through a series of crushing machinery. The first or "comet" crushers reduce the ground so that the largest pieces will pass through a two-inch ring. From these crushers the ground passes through revolving screens which separate the finely crushed from the coarse pieces. The fine size is conveyed to the washing pan, and the coarser ground passes from the end of the screen to revolving picking tables, where diamonds of the larger size may be seen and removed without risk of crushing by further pulverization. From the picking tables the ground is scraped automatically into two sets of rolls, and the pulverized product screened again and graded into three sizes. The finest size, passing a half-inch screen, goes to the washing pans, and the two coarser sizes to jigs. Large diamonds which have been separated from their envelope of blue are retained in the jig. The ground still holding the smaller diamonds passes out of the end of the jig and then through a series of rolls, screens, and jigs until the finished product is drawn from the bottom jigs into locked trucks running on tramways to the pulsator for further concentration and sorting.

From beginning to end of this process the crushed ground is carried by water, and the plant requires a flow of 400,000 gallons an hour. After leaving the last jig the water is separated from the fine ground by a revolving screen and the tailings are taken away in trucks to the tailing heap. Within the past three years the ordinary rotary pans have supplanted the jigs, and are found to be more economical.

The coarse ground, which passes out of the end of the revolving cylinders of the washing plants, is called "lumps." As the lumps leave the end of the cylinders they fall upon a conveyor and are taken to the end of the washing machines, where they are reduced by a similar, though smaller, crushing plant, with the exception that pans only are used for saving the diamonds.

Thus the screened and sized product from the washing pans and the crushing machines reaches the final stage of concentration in the Pulsator. This is a combination of jigs with station-
ary bottoms covered with screens with square meshes. The meshes are a little coarser than the perforated plates of the cylinders that size the concentrate for the jigs. Upon the jig screens a layer of leaden bullets for the finer sizes and iron for the coarser sizes is spread, forming a bed that prevents the deposit from passing through the screen too rapidly. The heaviest part of the deposit with the diamonds passes through the screens into pointed boxes, from which the deposit is drawn off and taken to the sorting tables. The lighter material or refuse flows over the ends of the jigs into trucks, which are hauled away and dumped on the tailing heap.

Only one per cent of the total amount of ground washed, or one in a hundred loads, goes to the Pulsator in the form of concentrate. Eight and a half per cent of this passes through the screens below the five-eighth inch size, thirty-three and a half per cent is above that size, and the balance, fifty-eight per cent, flows over the jigs as waste. Formerly, for every hundred loads washed, five-twelfths of a load passed over the sorting tables,
ordinary wooden tables covered with steel plates. Here the diamonds were picked out by hand, first by white men while the deposit was wet, and later, when dry, by native convicts. The concentrate was worked over as long as the cost of handling was repaid by the gleaning of diamonds. The size of the stones which reached the sorting tables ranged from one-sixteenth of an inch to one and one-eighth inches.

Mixed with the diamonds in the concentrates are a number of other minerals of high specific gravity, and some of notable beauty though they have no marketable value. Among these are the rich red pyrope, the flesh-colored zircon, the blue disthene, bright green chrome diopside, pale green rhombic pyroxene, and olivine occasionally in large, polished pebbles. Some of the garnets are of fine quality, and one was recently cut which resembled a pigeon-blood ruby, and attracted an offer of £25. The complete list of minerals found on the sorting tables includes: (1) pyrope, having a specific gravity
of 3.7 and containing from 1.4 to 3 per cent of oxide of chrome; (2) zircon (specific gravity 4.41 to 4.7), in flesh-colored grains and fragments, but no crystals—this mineral is commonly known on the Diamond Fields as Dutch boart; (3) disthene, or cyanite (specific gravity 3.45 to 3.7), discernible by its blue color and perfect cleavage; (4) chrome diopside (specific gravity 3.25 to 3.5), in fragments bright green in color and containing, according to Knopp, over two per cent oxide of chrome; (5) enstatite or bronzite with pale green rhombic pyroxene (specific gravity 3.1 to 3.3); (6) mica (specific gravity 2.7 to 3.1); (7) magnetite (specific gravity 4.49 to 5.2), occasionally found in octahedron crystals; (8) non-magnetic iron ore (specific gravity 4.5) containing chrome and titanium in varying quantities; that is to say, sometimes it is chrome iron, and sometimes titanium iron ore: according to analysis by Knopp, it contains from 13 to 61 per cent of oxide of chrome and from 3 to 68 per cent of titanic acid; (9) hornblende (specific gravity 2.9 to 3.4); (10) barite (specific gravity 4.29 to 4.3); (11) calcite (specific gravity 2.7); (12) pyrite (specific gravity 4.83 to 5.2); (13) olivine (specific gravity 3.3).

The work of picking out the diamonds by hand from the concentrate on the sorting tables was, of course, necessarily slow and tedious. It was the only division of diamond mining and winning which seemed beyond the application of blind and unconscious machinery. But men to-day are not inclined to admit that anything greatly worth doing is impossible.

A series of experiments was initiated by me with the object of separating the diamonds from the heavy valueless concentrates with which they are associated. An ordinary shaking or percussion table was constructed, and every known means of separation was tried without success. One of the employés of De Beers, Mr. Fred Kirsten, was in charge of the experimenting, under the supervision of the late Mr. George Labram, the manager of the large crushing plant, and afterward mechanical engineer to the company. Notwithstanding the fact that the specific gravity of the diamond (3.52) was less than that of several of
the minerals associated with it, so that its separation would seem a simple matter, it was found in practice to be impossible owing to the slippery nature of the diamond. The heavy concentrates carried diamonds, and diamonds flowed away from the percussion table with the tailings. When it seemed that every resource to do away with hand sorting had been exhausted, Kirsten asked to be allowed to try to catch the diamonds by placing a coat of thick grease on the surface of the percussion table with which the other experiments had been made. Kirsten had noticed that oily substances, such as axle grease and white or red lead, adhered to diamonds when they chanced to come into contact, and he argued to himself, if these substances adhered to diamonds and not to the other minerals in the concentrates, why should not diamonds adhere to grease on the table and the other minerals flow away? In this way the remarkable discovery was made that diamonds alone of all minerals contained in the blue ground will adhere to grease, and that all others will flow away as tailings over the end of the percussion table with the water. After this was determined by
WINNING THE DIAMONDS

thorough experiments, more suitable shaking tables were constructed at the Company's workshops. These were from time to time improved upon, until now all the sorting (except for the very coarse size) is done by these machines, whose power of distinction is far superior to the keenest eye of the native. Since the discovery of the affinity of grease for diamonds, experiments have been made with rubies and sapphires from Burma, and it was found that grease caught these gems with the same certainty that it catches diamonds.

After a thorough trial a number of these unique diamond-catching tables (see cut, p. 20) were constructed, and are now working on De Beers concentrates. Each shaking table is made of corrugated cast-iron plates in five sections, with a drop of about an inch from one division to another. Thick grease is spread on the plates to cover them to the top of the corrugations.

The concentrates are conveyed from the jigs upon a conveyor belt and deposited into hoppers, where the load is elevated to revolving cylinders covered with perforated steel plates. Through the graded screens of these cylinders the concentrates pass into small hoppers, one above each table, fitted with automatic feeders,—cast-iron cylinders with grooves corresponding to the graded sizes of the concentrates,—and are distributed evenly across the upper portion of the shaking tables, and carried down by a flow of water from a trough fixed behind the feeders. During the time the table is working it is rapidly shaken from side to side by an eccentric placed on a shaft under the table.

Strange to relate, the descending diamonds stick on the face of the grease while all other minerals pass over it. Only about one-third of one per cent of diamonds is lost by the first table, and these are recovered almost to a stone when the concentrates are passed over the second table. The discrimination of this sorter is surely marvellous. Native workers, although experienced in the handling of diamonds, often pick out small crystals of zircon, or Dutch boart, by mistake, but the senseless machine is practically unerring. It will catch rubies, sapphires, and emer-
alds as well as diamonds, but so far as it has been tested, it will not cling to anything but a precious stone. The grease which is used loses its power to catch diamonds after a few hours' work, owing to its becoming more or less mixed with particles of water. It is then scraped off the tables, together with the diamonds adhering to it, placed in a kettle made of finely perforated steel plates, and steamed. The grease passes away to tanks of water, where it is cooled and is again fit for use. The diamonds, together with small bits of iron pyrites, brass nails from

The Manager of the Pulsator, Mr. James Stewart, through whose Hands £3,000,000 to £4,000,000 Worth of Diamonds pass every Year.

the miners' boots, pieces of copper from the detonator used in blasting, which remain on the tables owing to their high specific gravity, and a very small admixture of worthless deposit which has become mechanically mixed with the grease, are then boiled in a solution containing caustic soda, where they are freed from all grease. The quantity of deposit, from the size of five-eighths of an inch downwards, which now reaches the sorting table, does not exceed one cubic foot for every 12,000 loads (192,000 cubic feet) of blue ground washed. As already stated, one-twelfth of one per cent of the whole mass of blue formerly passed to the
£60,000 PARCEL OF DIAMONDS.
sorting tables; or, from 12,000 loads, which is about the daily average of the quantity washed at De Beers and Kimberley mines, 160 cubic feet had to be assorted by hand.

The first question usually asked by visitors is, What is the cause of this amazing discrimination? This is a very difficult question to answer with positive assurance. It is possible that the secret of the affinity may lie in the fact that water adheres to or enters into all minerals composing the concentrate except precious stones. These present comparatively dry faces to the grease and quickly adhere to it, while the wet stones flow over the table. The grease has no affinity for a piece of glass, which, when dropped on the table, flows away in the tailings.

From the sorting tables the diamonds are taken daily to the general office under an armed escort and delivered to the valuers in charge of the diamond department. These experts clean the diamonds of any extraneous matter, such as small particles of adhering blue ground, by boiling them in a mixture of nitric and hydrochloric acids (aqua regia), or, still better, in fluoric acid. When the stones are cleaned, they are carefully assorted with reference to size, color, and purity, and made up in parcels for sale, formerly to local buyers, who represented the leading diamond merchants of the world. For several years past De Beers Company has sold in advance its annual production to a syndicate of London diamond merchants who have representatives residing in Kimberley.
In the open workings the imminent hazard of maiming and death by reef slides was ever hanging over the heads of the miners. In view of the rashness with which the pit sinking was pressed, it was a marvel, indeed, that the actual loss of life was, on the whole, so small. No complete or accurate records were ever kept of the men injured or killed in prosecuting the work before the advent of systematic mining.

In the journals of the Diamond Fields the most noteworthy casualties were recorded, and it is seen that in the years immediately following the undertaking of underground mining, the principal loss of life occurred from the falls of loosened pieces of blue ground or reef. This is expressly noted in the report of the Inspector of Mines at Kimberley to the Assistant Commissioner of Crown Lands on August 27, 1885. Underground mining operations in Kimberley and De Beers mines were then, he observed, becoming very hazardous. In both mines, but especially in the Kimberley mine, "some of the underground working places in diamantiferous ground are huge caverns of from 25 to 52 feet in height and 20 to 30 feet in width. The roofs of these workings, from exposure to atmosphere, shocks of blasting, and inherent weakness of the blue or diamantiferous ground, are becoming extremely unsafe; occasionally pieces of the ground or rock fall from the high roof or sides, to the imminent danger of persons working on the floors. During the last and current months there have been three deaths in underground working places directly due to the dangerous operations
in the mines," and in view of this danger and loss of life, the inspector urgently recommended the limitation by the government of the height and width of the underground workings.

"Main tunnels to be used only for traffic not to exceed 8 feet in width and 8 feet in height.

"Working chambers or stalls from which the blue or diamantiferous ground is excavated in bulk, not to exceed 18 feet in width by 20 feet in height to the highest point.

"Partitions or pillars not to be of less thickness than half the width of the contiguous chambers or stalls.

"The roof of ceiling between one level and the next above to be not less than 20 feet in thickness at the highest point of the lower workings."

This recommendation had in view obviously the precautions enforced in the working of coal mines, and would doubtless have afforded an increased measure of protection, but the method of working proposed was not well suited to the development of the diamond-bearing ground, as was later conclusively determined. The slaking and crumbling of the diamond-bearing breccia upon exposure to air and moisture make roof falls and slips from the sides especially frequent and disastrous. The ground is full of soapy seams, and pieces of considerable size drop without a moment's warning, so that it is necessary, in places, to keep the tunnels timbered as near the working face as possible. Risk from this cause cannot be wholly obviated in such mining, but the introduction of the new system adopted for the working of the mines, shortly after they came under my management, has greatly diminished this peril, and the resultant loss of life or injury to the workmen. By the new system the levels are worked back from the surrounding hard rock or reef in sections, formerly 30 feet, now 40 feet apart, as before particularly described, in a series of terraces, extracting the ground from the uppermost level downward in succession. This method did away with any danger of collapse in the underground works, and by successively robbing out the roof and sides of the tunnels on each descending terrace, the caving of
the unstable ground was systematically anticipated and restricted. No feasible care in the direction of men working in such shifting ground can entirely do away with casualties. Some are scarcely to be avoided, but most are attributable, more or less, to the miners' heedless disregard of the warnings of overseers and proper precautions.

There was another serious risk in mining in the upper levels of the mines, where shale is heavily impregnated with bituminous matter, and no device could wholly prevent the gathering of carburetted hydrogen, which, mingling with air, forms the "fire damp" that has been so deadly a peril to miners. When sinking shafts or driving tunnels in the shale, miners are prohibited by the strictest injunction of the management, and the formal regulations of the Government Inspector of Mines, from carrying any lighted candle into passages where there is any possibility of this gas having gathered; but no prohibition has ever been able to prevent an occasional stretch of recklessness on the part of some careless miner. Locked safety lamps are provided abundantly for testing the atmosphere in such parts of the mine workings, but neglect of this precaution has caused startling explosions, scorching and striking men down, and in a few cases causing death. In 1883 there was a slight explosion of accumulated gas in the reef workings of the French Company, Kimberley mine. Here thin bands of coal had been struck in the black shale, and in an upward drive to meet a pass, some gas had collected in the interval from Saturday to Monday. A naked flame set fire to this gas and caused the explosion. Prior to this time two other cases were on record, in both of which workmen were severely injured. Perhaps the most notable instance of the gathering of this gas was in a heading of the workings of the Gem Company in De Beers mine in July, 1885. One of the workmen had his face and hands badly scorched by an explosion at the end of the heading, and a second explosion occurred shortly afterward, when the managing director and an overseer attempted to examine the heading, taking candles to light their way. The director,
Mr. George McFarland, was severely burned by this blast of gas, which was described as a “fizz” almost noiseless. Since the workings have been carried down below the level of the shale, there has been no danger from fire damp, and the accidents from this cause have ceased to occur in the deeper mines.

The strictest precautions are enjoined in the storing and handling of explosives used in the diamond mines, and the need of such stringency was signally emphasized in the destructive explosion that wrecked a dozen magazines near the compound of the Victoria Mining Company on October 31, 1884, three years before I took the management of De Beers. The shock was felt from Dutoitspan to the farthest limits of the west end of the camps, and terror-stricken people rushed out of their houses to see a vast heaving cloud of smoke rising hundreds of feet into the sky.

The magazines were dashed to pieces, as the Kimberley papers reported, by the terrible power of the explosives. In most instances the galvanized iron was broken into tiny atoms as if by myriad hammers, and cartridges were scattered far and wide through the débris, exploding in volleys or scattering blasts for many minutes after the explosion. One large stone was thrown as far as the Central Company’s offices, a distance of two miles, and smaller ones to the West End, three miles from the magazines. In the most distant parts of the camp there was a startling breakage of windows, lamps, and chandeliers, and the hotel bars and canteens were so heavily pelted that “the floors were swimming with what we might call dynamite cocktail, composed of every liquor under heaven from Cape Smoke to Heidseck and Pommery.” Witnesses of the explosion thought that hundreds had been killed and injured, but almost miraculously, as it seemed, only two persons were killed, one a white, the other a black, both bodies being horribly mutilated. A third sufferer was taken up and tenderly cared for, a poor native deeply gashed and with broken ribs.

No other accidents in the mines have ever approached in loss to life the terrible disaster from the outbreak of fire in De
Beers mine in July, 1888. When the Consolidated Mines took over the property of De Beers Mining Company, nearly all the blue ground was hoisted from the 500-foot level, through the first large working shaft constructed, known as No. 1 west end incline. In July, 1888, another shaft, No. 2 incline, had just been completed to the 700-foot level, and skips in the 7-foot compartment were used in hoisting the ground broken on this level. In addition to these working shafts a small vertical prospecting winze, called the Friggin's shaft, had been sunk from the 500-foot to the 700-foot level. When a tunnel connection was opened between No. 1 and No. 2 inclines on the 700-foot level, the prospecting winze was no longer needed, and it stood abandoned except as a ladderway. There was a small disused engine room on the 500-foot level a short distance from the winze. With the sinking and connection of both working shafts on the 700-foot level, the output of the mine increased until a total of 104,089 loads was attained during the month of June, 1888.

On the 9th July following, large skips in No. 2 incline began carrying blue ground from the 700-foot level, and continued hauling until the morning of the 11th, when one of them jumped the rails, either because the hoisting was being done at too rapid a pace, or from some obstruction in the shaft. Examination showed that both skips were off the rails, and that the shaft timbers had been considerably damaged. In bringing up one of the small skips in the manway, this was also derailed by the debris in the shaft. The necessary work of repair was begun at once and continued during the day. During the changing of the shifts in the evening, the
mine manager, Mr. Lindsay, reported that the work was progressing as fast as practicable and that the shaft would be in running order within a few hours.

At about half-past six o'clock in the evening Lindsay and six miners went down the shafts in one of the small skips. A few minutes later an alarm of fire was given just as I was about to drive to my home from the works. It was reported to me through the telephone that the Friggin's shaft was on fire. It is probable that one of the native miners had sneaked off to the disused engine room on the 500-foot level, and placed a lighted candle so carelessly that the flame ignited the timbers, perhaps while the lazy savage was snoring on the floor. The precise cause of the fire was, however, never determined, but from the time of its starting, it spread with such swiftness that it could not be stifled.

Within a few minutes after the outbreak of the fire both of the incline shafts were filled with dense smoke, as both shafts were upcasts, and the passage of any of the men through these exits from the mine workings was hopelessly shut off. When the alarm was given, there were 685 men at work in the levels below the fire, and our anxiety for their safety may be readily conceived. At the first warning of danger two men were sent
down No. 2 incline to notify Lindsay and his companions of the outbreak of the fire, but the smoke came up through the shafts so heavily that both were driven back gasping for breath, and barely reached the surface before they fell on the floor completely exhausted. For several minutes there was a tension of waiting for some signal to hoist from Lindsay, or one of his party, but none was given. Lindsay and his comrades must have been close to the skip in the shaft when the fire started, and a signal bell wire ran through the shaft close at hand. There was time enough for one of the party who went down the shaft in the skip with Lindsay to climb up the shaft by means of the timbers, a distance of 150 feet, and in view of this, the failure of these men to get into the skip and ring a signal to hoist is inexplicable. Seeing at once that ascent through No. 2 incline was probably hopelessly blocked by the outpouring smoke, I hastened to the mouth of the other shaft (No. 1 incline shaft). The smoke was also streaming out of this shaft in dense volumes.

The signal to hoist men by ringing three bells was repeatedly given, but I hesitated to give the order to hoist the skip, which was at the 600-foot level, as the risk of hoisting a skip-load of men through the stifling smoke was appalling. On the other hand, it was impossible to know at the surface in what desperate straits the men might be on the 600-foot level. So, before giving the signal to hoist, I took measures to revive the men who would be overcome by the smoke in ascending the shaft, and water was provided to dash on them if they came up with their clothes on fire. It was a moment when no balancing of probabilities could determine the decision. There was a desperate chance of safety in the swift pulling up of the skip. I could not let the piteous appeals go on apparently unheeded. I gave the signal to hoist at top speed in response to the last pleading signal. When the skip was about 300 feet from the surface, the wire winding rope parted. The broken end came whizzing up through the shaft, but the skip with its load of four poor victims fell crashing down to the sump at the bottom of the shaft, a
little below the 600-foot level. When the rope was examined, it was found that the flames from the burning timbers had made it so hot that the tension of the skip drew out the wires to fine needle points which snapped under the strain. When the first signal to hoist was given, there were ten or twelve men in the skip, but the majority left it when the signal to hoist met with no response. It was impossible for the men at the 600-foot level to know that the shaft through which they wished to be hoisted was on fire a hundred feet above them, nor could we on the surface know what was happening 500 feet below.

The mine was ventilated at the time through an outlet into the old open workings, and through the Gem shaft on the east side of the mine. The Gem shaft was a small, old working shaft that had been sunk from a terrace in the blue ground. Unfortunately it had been partially closed by a recent ground slide in that part of the mine. It was, however, still sufficiently open to be of invaluable ventilating service at this crisis, and it could have been opened for the rescue of the men in the mine if there had been no other means of escape through the outlet into the open workings. During the hours of fearful anxiety that followed the closing of the two main shafts, the outlet from the mine to the open workings was intently watched, and daring parties penetrated far within it in the hope of communicating with miners escaping from the range of the fire. Almost all of the men in the mine were well acquainted with this passage to the surface, and it was confidently hoped that many, at least, would contrive to grope their way upward through this outlet to safety. Fortunately the air draught through this passage was downcast, and the inrush of air cleared the passage from smoke.

To the immeasurable relief of all, so anxiously expectant, one white man and six native miners came climbing through this passage into the open workings at about ten o'clock on the night of the fire. This showed that a practicable way of escape from the mines was open, but many hours of fearful suspense followed throughout that night and the following day, while the
miners were groping their way to the surface through the same opening. Forty-two white men and 441 native miners were thus rescued, but 24 whites and 178 natives lost their lives in levels and passageways charged with deadly smoke. The downcast draught through the Gem shaft was the salvation of the greater part of the rescued men, who spent this fearful night on the level close to this shaft, which was free from smoke. During the afternoon of the following day, July 12, a party of heroic men penetrated far into the mine through the entrance in the open workings, and rescued a number of natives who were cowering stupefied by the smoke, or paralyzed by fear. In this rescuing party were some who had passed the night in this frightful prison, but who were, nevertheless, among the first to volunteer to go down again in the desperately hazardous venture to save their comrades.

No. 1 incline was completely burned out and caved in during the night of the fire. During the night of the 12th No. 2 incline caved in also for a distance of about 40 feet, near the junction of the shale with the hard rock, shutting off all communication with the mine. Before the latter shaft could be
WAITING FOR NEWS FROM THE MINE
July 15, 1938
WAITING FOR NEWS FROM THE MINE,
July 12, 1888.
GENERAL VIEW OF PIT-HEAD FRAME AT NO. 2 SHAFT AFTER THE FIRE OF JULY 11, 1888.
reopened, the water in the mine rose to a depth of 20 feet, filling all the tunnels on the 700-foot level.

Several days after the fire I went down the shaft accompanied by Captain Hambley, Assistant Inspector of Mines, and one of the overmen. I arranged to lower the skip gradually down the incline to make the first inspection. As we went down, an insulated signal wire was lowered, and provision was made so that I could keep the bell ringing continually, and instructions were given to haul up the skip at the moment the ringing stopped, for I feared that we might drop into foul air so suddenly that we would not be able to signal in the usual manner. So we went down in the skip slowly to a point about 150 feet above the crushed ground in the shaft. At this point, some 250 feet below the surface, we saw the body of one of the men who went down with Mr. Lindsay just before the breaking out of the fire. We did not stop, for the moment, but kept on signalling until the skip was lowered to the ground which closed the shaft. Our search for any further trace of the lost miners was fruitless, for we could find no more bodies. Mr. Lindsay and his remaining companions were buried beneath the débris when this part of the shaft caved in. Finding that the further descent of the skip was cut off, I then gave the signal to hoist, and on reaching the surface, gave instructions for men to go down and remove the body seen in the shaft. The poor man had climbed up to the point where he died, in a desperate effort to escape. The other men, as well as the skip in which they went down, were buried deeply under the mass of crushed ground.

The work of repairing No. 2 incline could not be begun until July 19th, for the smoke and heat from the mine made work in the crushed portion of the shaft unendurable. Even then it was only practicable to advance very slowly, and the shaft was not opened until the 3d of August, when the large skips were at once employed to bail out the water. Eight days later the mine was drained, and the reopening of the workings could be undertaken.

It was originally intended that the large skips in No. 2 in-
WAITING FOR NEWS FROM THE MINE.
cline should be used in hauling blue ground from the 700-foot level only, as there were ample facilities in No. 1 and in the 7-foot compartment of No. 2 for hoisting all the blue ground taken from the 600-foot level and the levels above. Consequently no stations had been made ready for the larger skips on the latter level. It was necessary, therefore, to open tunnels, sink passes, and put in chutes to connect the 600-foot level with the surface, besides excavating a pump chamber and erecting new pumps, before the regular output of blue ground could be resumed. During the month of August only 8613 loads were hauled, and this was mostly of poor quality from excavations of the west end of the mine. During September the output was increased to 57,408 loads, in October to 87,225; but it was not until the following month of November that the output reached 104,285 loads, or approximately the same amount as in the month before the fire.

This brief sketch may serve to show to the general reader something of the terror, the peril, and the disaster which an outbreak of fire in any great mine may cause. As soon as practicable after this fire, the previously designed systematic and thorough opening of the mine was advanced. In addition to No. 2 incline, the rock shaft (elsewhere particularly described) was completed and connected with the mine by a tunnel on the 800-foot level. A vertical escape shaft was sunk from one of the terraces in the open mine to the 700-foot level. It had a ladderway and a single cage compartment, and was connected with seven levels in the mine. The Oriental shaft, situated on the east side of the mine, was connected with it at the 500-foot level, from which all parts of the mines were reached by ladderways. This shaft served to ventilate the mine, and as an important passage for escape in case of need. Besides these four shafts there was a tunnel into the open mine, which was connected with the lower workings by a double ladderway. The Oriental shaft and No. 2 incline were upcasts. The rock shaft, escape shaft, and the tunnel into the open mine were downcasts.

The first consideration in working a mine is to have a safe exit for the workmen, in case a fire breaks out or the mine
becomes flooded by suddenly tapping a large quantity of water, and at the diamond mines this precaution is strictly carried out. In the early days of underground mining, when many of the levels had exits into the open mine, it was necessary, in providing numerous escapes for the workmen, to guard against sly sallies of natives when there was no danger, because they could leave the mine with stolen diamonds, or could go out for the purpose of obtaining intoxicating drink, and bring back bottles of Cape brandy, called “Cape Smoke,” into the mines with them. Although the numerous escapes from the mine were guarded by watchmen, the dusky Kafirs would come, at times, in squads, and overpower the guards and make their escape. An ingenious device was invented by our electrician, Mr. Drummond, by placing a small copper rod directly above the iron rungs of the ladders, and connecting both with a battery. Then when a man placed his hand or foot upon the copper rod, it bent down, completing the circuit, and rung an alarm bell in the mine and on the surface. The natives could never quite understand why they were always met by a posse of white guards at the particular place where they were trying to escape.

In later years, since the mines became deeper, all workmen are taken in and out of the mines by means of cages. There are double ladderways in the shafts which may be used in case of emergency, but there is always a sufficient number of white men employed about the tops of these shafts to prevent the escape of natives.

In view of the responsibility resting upon me from my acceptance of the General Managership of De Beers Mines in the year preceding this great disaster, and the common duty of all connected with the mines to do everything practicable to save life, to prevent the outbreak of fire, and to guard against all contingencies, it is proper to note the warmly appreciative recognition accorded by the presiding chairman, Mr. Barnett Isaacs Barnato, at the adjourned first annual meeting of the shareholders of the De Beers Consolidated Mines Limited. Mr. Barnato said in his address to the shareholders:—
MEN ESCAPING THROUGH TUNNEL MARKED + AT THE 380-FOOT LEVEL.
"I suppose you all remember about the sad calamity by which so many poor fellows lost their lives. At this point I feel I must pay a tribute of respect to the brave men who worked and risked their lives on behalf of those poor fellows who perished in the disaster. I remember on that sad occasion, which will never be effaced from my memory, and from the memories of many who lived in Kimberley at the time—I remember seeing our respected and able general manager, Mr. Gardner Williams, a gentleman to whom I believe no person can attach the least blame, working night and day, and doing all he possibly could for the relief of the sufferers. That calamity was an act of God, or at least we must conclude so, for on the very day of the disaster there was an accident in No. 2 shaft, which blocked it up to some extent, and the Gem escape shaft gave way only a week previously. I, therefore, think that calamity was an act of God, and I hope a similar disaster will never again be witnessed in Kimberley or elsewhere. In paying a tribute of respect to Mr. Williams, who worked all through the night when the fire broke out, and to the brave men who went into the mine, to try and save their fellows, we must not forget that those men risked their lives, that they went down into the mine, when millions and millions of loads of reef were hanging over them, to open up the shaft so that the men might escape. And the result of their work, we know, was that out of about seven hundred men in the mine, five hundred escaped. Therefore, in passing this tribute of respect to Mr. Williams and the men, I feel sure that it will be universally indorsed by the shareholders. [Applause.] No more need be said about this matter, except that the state of the mine after the calamity necessitated a considerable expenditure of money. I think it took us three months to get the mine in proper working order, and we lost three months' labor, at a cost of something like £250,000. The balance sheet only shows about £30,000, but by the loss of blue, etc., the loss to the company was, as I have stated, not much short of a quarter of a million of money."

Providentially, and by the exercise of every feasible precaution,
there has been no serious spread of fire in the mines since the occurrence of this great disaster.

The chief peril to life and damage to the workings of the mine, for a number of years, has come from the destructive "mud rushes," as the miners call them. There is no water in the blue ground or the mine itself, but the water flowing into the mine from the surrounding reef makes a muddy mixture of the disintegrated shales, decomposed basalt, floating reef, and low grade blue ground, which had fallen into the worked out section of the open mines. At times the tremendous pressure of the shifting ground above forces this mud in vast quantities into the working levels of the mine, and the miners do not have time to escape this inrushing mass even by instant flight. On several occasions tunnels in the mine have been filled to the extent of thousands of feet by these rushes in a few minutes. As the work in the mines reached the deeper levels, these rushes became so frequent that the working of the mines was seriously interfered with, and no watchfulness could avert the loss of life.

In June, 1897, one of the worst mud rushes known in the record of the mines occurred in De Beers mine, filling up almost instantly a large number of tunnels on the 1000-foot level. Two native miners were overtaken by the rush, and shut up in a drainage passage that was in progress to tap the water in that section of the mine. For a stretch of 28 hours they were held fast in this narrow prison chamber, momentarily dreading a further rise of the mud that would bury them alive. Meanwhile the most daring efforts were made to rescue them from their stifling prison, and two heroic men, Thomas Brand and John Brown, finally burrowed through 200 feet on the top of the mud, and brought the two natives out safely at an appalling risk to their own lives. The rescue was barely in time, for the next morning another rush followed, filling up the tunnels again still further, and rising to the top of the passage that had given breathing room to the imprisoned men. For this signal heroism medals of the Royal Humane Society were very fitly given to Brand and Brown.
THE SURVIVORS COMING UP THE TERRACES IN THE OPEN MINE, ON THE MORNING OF JULY 12, 1888.
In May, 1898, there was another great mud rush through the 1120-foot level, from which a whole gang of native workers barely escaped alive. On this occasion "Jim," one of the best of the "baas" boys, was almost buried alive with his gang of 15 men. The rush shut this working party up in a narrow passage on this level for more than 64 hours. When the men were rescued at length from their stifling quarters, where they were imprisoned for more than two and a half days, without a morsel of food to eat or a drop of water to drink, all were greatly exhausted, as might be supposed. But in spite of his sufferings, the brave leader, Jim, went back at once into the mine to grope back over the mud in search of one of his gang whom he supposed was missing, and he would not return to the surface until he learned beyond doubt that all had been rescued.

The endurance of the native miners under such circumstances is remarkable. In July, 1898, a Basuto boy, "Joseph," was almost buried in a mud rush, and was completely shut in the "dead end" of a tunnel, on the 960-foot level. The attempt to clear a passage to rescue him was begun at once, and the work was pushed without a respite night and day, but it was late on the third day before the place of his entombment was reached. He was found lying crouched beneath some timbers resting on an overturned truck, around which the mud had risen to the depth of two and a half feet. The rescue party had given up all hope of finding him alive, and were about to blast the enveloping mud in order to pull out the truck, when a faint cough was heard, apparently coming out of the dense mass of mud. The natives at work were badly frightened at this weird sound, and called up the contractor in charge, who finally succeeded in digging out the poor Basuto boy nearly lifeless. One of his legs had been pinned beneath the truck so heavily that the circulation of the blood was stopped, and mortification set in, necessitating its amputation. The boy bore the operation with the characteristic fortitude of his race, and is stumpimg about to-day with a wooden leg. He had been shut up for more than three days in a little hole in the ground wholly without food and drink,
and with only a few cubic feet of compressed stagnant air to breathe.

When a tunnel is being driven there is only one way of escape, and the working face is called a dead end, though not on account of its deadly nature in cases of a mud rush, for it is a common term in miners' parlance. In point of fact these dead ends are the safest places in the vicinity of a mud rush. The mud, which first fills the mouth of the tunnel, forces the air ahead of it, and compresses it to such an extent that it checks the advance of the mud. Hence, if a native is hemmed in, he has sufficient air to breathe until he can be rescued. On more than one occasion when natives have been caught in the rush of mud, their narrow cell would not have held sufficient air to keep them alive had it not been that a large quantity of air was compressed into the small space.

On one occasion two natives were shut up in the dead end of a tunnel for ninety-five hours. They had no food, but managed to obtain a small quantity of water as it trickled down from the roof and sides of the tunnel after finding its way through the blue ground from the level above. These men had more air space than is usually the case, and the temperature in the ends of the tunnels ordinarily ranges from 75 to 90 degrees. When rescued they were greatly exhausted, but after a few days of medical treatment they were quite fit again, and resumed their work in the mine. At another time, when natives were shut in for nearly two days, they swallowed small balls of soft mud, and when rescued it took a considerable time to bring their digestive organs back to their normal condition. On several occasions the white miners have been victims to similar experiences, and now and again a white miner has lost his life by being overtaken and enveloped in the mud. The longest period of time that a white man has been confined in the end of a tunnel is about two days, and there were a dozen or more natives with him. By giving the usual miners' signal of tap-tap—tap-tap-tap, on the walls of the tunnel, we knew he was alive, and it
may be imagined that no time was lost in extricating him and his men from their perilous position.

Of recent years the measures described in Chapter XI have proved effective in freeing Kimberley mine from this peril. The water which finds its way into De Beers mine has not yet been entirely taken up, but by driving tunnels around the mine to tap the water the danger has been minimized. On the 1st of October, 1899, six natives were overcome by a mud rush and killed. Wherever there is the least sign of mud, the workmen are withdrawn, and the places fenced off until the mud has come out or the water is drained off, leaving the places safe for the miners to reenter them.

As there have been from ten to twelve thousand men employed in the mines and workshops and on the depositing floors, three-fifths of whom are underground workers, who are to a greater or less extent raw and untrained natives, the percentage of deaths and injuries has not been excessive.

In the painstaking and valuable reports of Dr. C. Le Neve Foster, H. M. Inspector of Mines, he compares the returns of casualties in the South African mines with the like statistics of mines in which trained Englishmen are employed. This comparison bears hardly in its application to the diamond mines, in view of the fact that the great majority of the native workers in these mines are "raw hands." There is probably a change of half the workers in the mine every year, and the men coming in to offset the outflow are mostly natives who have not worked in the mines, and are familiarly known as "green hands." In time these men are trained to a fair measure of proficiency, but it is to be expected that the proportion of accidents to the numbers of such workmen will be greater than the average in English mines.

From the carefully prepared statistics of Sir Frederic Augustus Abel, covering the loss of life in English mines, it appears that the greatest loss occurs from falls of the roof and sides

1 Supplement to Forty-fifth Annual Report of the Registrar General of Births, Deaths, and Marriages in Great Britain.
of mine workings, amounting to 40.77 of the total. The loss of life from explosions comes next, with a showing of 23.17 per cent. In the records of fires in mines from all causes, it is shown that only a very small percentage of men are actually burned to death, fully 90 per cent of the deaths resulting from suffocation.

Contrary to the popular impression, it has been shown by Dr. C. Le Neve Foster, that the ore miner has nearly as dangerous an occupation as the coal miner; and in Cornwall and some other metalliferous districts the average losses from accidents were higher than in coal mines. Dr. Ogle has pushed this comparison farther by his statistical demonstration that, in spite of accidents, the death rate of coal miners is not high. In comparative mortality these miners ranked only thirtieth in a list of ninety-four occupations; but the mining in Cornwall, at the time of this report, was exceptionally perilous, standing ninety-first on the list. In other words, only three of the ninety-four occupations exceeded the mining in this district in deadliness. This peculiarly high mortality was ascribed to inadequate ventilation and excessive climbing of ladders from deep mines. These conditions, of late years, have been bettered.

1 Supplement to Forty-fifth Annual Report of the Registrar General of Births, Deaths, and Marriages in Great Britain.
GENERAL MANAGER, DE BEERS CONSOLIDATED MINES LTD, AND HIS STAFF. (See key on opposite page.)
KEY TO PLATE OF GENERAL MANAGER AND HIS STAFF

1. Seymour Dallas,
   Manager, Kimberley Mine Compounds.
2. W. Austin Knight,
   Manager, Bultfontein Floors.
3. T. R. English,
   Chief Buyer.
4. J. H. Murphy,
   Assistant Buyer.
5. S. Tidd-Pratt,
   Manager, Workshops Compound.
6. J. Swanson,
   Manager, Premier Mine Compounds.
7. C. E. Hopley,
   Sub-Manager, Stables Compound.
8. D. Canty,
   Acting Manager, De Beers Mine Compounds.
9. A. E. Rogers,
   Assistant Manager, Premier Mine.
10. C. M. Henrotin,
   Assistant Manager, Kimberley Mine.
11. W. Tudor,
    Assistant Manager, De Beers Mine.
12. J. Lindell,
    Mechanical Engineer.
13. W. Newdigate,
    Chief Land Surveyor.
14. James Stewart,
    Manager of Pulsator.
15. A. F. Brigham,
    Chief Mine Surveyor.
16. C. L. Porter,
    Underground Manager, Premier Mine.
17. Capt. A. J. Garrett,
    Manager, Bultfontein Mine Compound.
18. R. Archibald,
    Manager, De Beers Floors.
19. W. McHardy,
    Manager, Kimberley Floors.
20. A. F. Williams,
    Assistant General Manager.
21. Gardner F. Williams,
    General Manager.
22. P. A. Robbins,
    Consulting Mechanical Engineer and Electrician.
23. W. Nichol,
    Manager, De Beers Mine.
24. T. J. Woodhouse,
    Manager, Kimberley and Bultfontein Mines.
CHAPTER XIV

THE WORKERS IN THE MINES

NOWHERE else on the face of the earth is there an assemblage of workers of such varied types of race, nationality, and coloring as are to be seen in the South African Diamond Fields. There is hardly a nation of Europe or Colony of the British Empire that has not some representatives. There are adventurers from the United States, Mexico, and South America; and white men from all the Colonies of South Africa mingle with the masses of native Africans of every shade of dusky hue shown by the tribes that range from the Cape to the equator. Even the American Indian is not unknown in the fields, one specimen at least having resided there for many years. Add to this motley throng a sprinkling of dark East Indians, Malays, and Chinese, and the kaleidoscopic shifts and coloring of this babel in the Diamond Fields may be dimly conceived.

Only about a sixth of the workers in the mines are whites, and the larger part of these are employed above ground on the floors, in the workshops, and in the offices of the mining companies. The majority of the white miners are of English descent, largely coming from the hematite mines of Cumberland, and the tin, lead, and copper mines of Cornwall. They come to the fields in search of employment, which is given as occasion arises. Experience in other kinds of mines is soon adapted to the conditions in the Diamond Fields, and the men in the De Beers mines show a high average of efficiency. The nationalities
of the mechanics, engine-drivers, and others working about machinery are Scotch, English, and colonial, with a sprinkling of Americans and other nationalities. Those working on the floors and about the washing machines are largely of colonial birth—English and Dutch,—the balance being mostly home-born Englishmen.

The majority of the white workers above and below ground have their homes in Kimberley and the other neighboring min-

![Image](image.png)

The Engineers, Mechanics, and Workmen who built De Beers Crushing Plant.

ing towns. Wages paid to European day laborers on the surface range from 10s. to 15s. a day; mechanics receive higher pay, which ranges from 16s. 8d. to £1 per day, and white miners are paid the same rate. Miners who prove their competence are given contracts for specified work, by which their earnings are usually materially increased. Since 1892 all underground work has been done by the men working eight-hour shifts. The length of the working day above ground varies with the class of work done. Engine-drivers and men employed in general service at the mines work from ten to twelve hours daily.
On the depositing floors work begins in the summer at six o'clock in the morning; time is given for breakfast, which is brought to the men, an hour's rest is allowed at noon, and work generally ends between 5 and 5.30 in the afternoon. All mechanics work 54 hours in the week, stopping at 1 o'clock on Saturday, at which hour all work on the surface ends for the day. Sunday is a full holiday above and below ground for every one except those in charge of pumping engines, pumps, boilers, man cages, etc., which must have attention on Sundays as well as week days, and a few hands employed underground on necessary repair work to the shafts and mines, which cannot be done during the week while the mines are in full work. Extra time is allowed mechanics, miners, and others working under exceptional conditions. The pay of the men enables them to live comfortably in the mining towns, and as they are little given to dissipation, the thrifty are enabled to add to their savings yearly, as the work, except for the interruption by the war, has been continuous and regular.

Employés' houses in Kimberley are scattered through the town, and many of them own their own homes. Some of the miners' houses cost £500 or over. They are commonly made of brick, or with corrugated iron sides and roofs—the division walls being of unburnt brick and the outside walls being of the same material. The rental of a house in town ranges from £4 to £8 per month. The price of board at the boarding houses is about 25s. per week. The price of meat has commonly been about 6d. or 7d. per pound, although since the war, and owing to the devastation caused by rinderpest, the price of beef has nearly doubled. To supply the urgent demand for cheaper meat, the De Beers Company has erected large cold-storage plants at Cape Town and Kimberley, and is now importing meat for sale to butchers at Kimberley.
Beef and mutton make up the bulk of the meat sold. From March to August the markets are well supplied with game, chiefly springbok, stembok, guinea fowl, partridges, bustards, korhaan, and sand-grouse. Vegetables of all kinds are fairly plentiful and to be had at reasonable prices. For potatoes the current charge is from 15s. to 30s. per sack of somewhat less than 200 pounds. Cabbages, cauliflower, beets, beans, parsnips, carrots, onions, sweet corn, and celery are among the vegetables chiefly sold. Melons and fruits of all kinds are also plentiful in season. All vegetables and fruit brought from the neighboring farms to Kimberley for sale are taken to the market square and sold under the supervision of the market master to grocers, East Indian hawkers, and the public generally. Flour has nearly a fixed value, being cheaper when the production in Basutoland and other grain-producing districts is plentiful, but never exceeds a certain price, fixed by the competition for imported flour upon which the government levies a duty. The flour chiefly used by the natives and by many of the white people as well is what is called Boer meal, which makes a brown bread, for only the bran has been removed. There are a number of roller mills in the country that produce flour which compares favorably with
THE GAME OF THE COUNTRY—A SIX DAYS' "SHOOT" WITH FIVE GUNS.
imported flour. There is an understanding between the Government, the local dealers, and De Beers, that De Beers Company shall only sell the necessaries of life to the natives in the compounds, and that the price shall range about the same as local prices in town. Any profits derived from these sales is to be distributed among public institutions and charities.

In the mines operated by the De Beers Company alone, more than eleven thousand African natives are employed below and above ground, coming from the Transvaal, Basutoland, and Bechuanaland, from districts far north of the Limpopo and the Zambesi, and from the Cape Colony on the east and the south to meet the swarms flocking from Delagoa Bay and countries along the coast of the Indian Ocean, while a few cross the continent from Damaraland and Namaqualand, and the coast washed by the Atlantic. The larger number are roughly classed as Basutos, Shanganes, M’umbanes, and Zulus, but there are many Batlapins from Bechuanaland, Amafengu,
and a sprinkling of nearly every other tribe in South Africa. Many travel hundreds of miles, and some more than a thousand miles, in order to reach the Diamond Fields, and many of these arrive half starved, and so weak and emaciated that they are almost worthless as laborers for weeks afterward. The natives, as a rule, are generally muscular, sinewy men, but not fleshy. Their feet are broad and flat, but their legs and arms are commonly well rounded, and their thigh and shoulder muscles are large. The living skeletons who come in from the far interior districts of Africa gain flesh, as rapidly as lean cattle do in green pastures, when they reach a field flowing with meat and porridge. In the early years of the mines, the raw recruits were hooted at and sometimes pelted with stones by their kinsmen at the mines, as before noted, but of late years this rough greeting and hazing has very largely passed away.

For the lodging and feeding of this great force of native Africans, special provision is made by the erection of large walled enclosures, called compounds, at the mines and on depositing floors. There are seventeen of these compounds on the Diamond Fields, twelve of which are owned by the De Beers Company. The largest of all is the one at De Beers mine, and the description of this will serve for all, as they are essentially alike, except in size.

Fully four acres are enclosed by the walls of De Beers Compound, giving ample space for the housing of its three thousand inmates, with an open central ground for exercise and sports. The fences are of corrugated iron, rising ten feet above the ground, and there is an open space of ten feet between the fence and the buildings. At the northern end of the compound there is an entrance gate. Iron cabins fringe the inner sides of the enclosure, divided into rooms 25 feet by 30 feet, which are lighted by electricity. In each room twenty to twenty-five natives are lodged. The beds supplied are ordinary wooden bunks, and the bed clothing is usually composed of blankets which the natives bring with them, or buy at the stores in the compound, where there is a supply of articles to meet the sim-
DE BEERS COMPOUND, SHOWING SWIMMING BATH IN CENTRE.
THE WORKERS IN THE MINES

DE BEERS COMPOUND.
ple needs of the natives. Besides these stores there is a hospital and dispensary, where any needed medical attention is promptly given, and a church for religious services, conducted by missionaries delegated by the various church denominations. During week days this church is also used as a school for the instruction of the natives. Compartments, with entrances opening through the walls, are set apart for latrines, and cared for with strict attention to sanitation. In the centre of the enclosure there is a large concrete swimming bath, in which most of the natives are at times found diving and swimming, as is vividly shown in the accompanying illustrations (see also page 449). If any fail to show the necessary regard to cleanliness, they are compelled to keep themselves clean.

A competent manager is in charge of the compound, and his assistants are intrusted with the charge of preserving order and enforcing the compound regulations. The natives look upon the manager as their great white chief. He settles any disputes which may arise among them, and in conjunction with the mine manager investigates any complaints in reference to the amount of pay which has been allowed them, or any punishment or ill treatment by their white "baases," which, needless to say, is contrary to the regulations.

The compound is lighted by electricity, arc lights being hung within and without the enclosure. When a newcomer or a number of natives, for they usually come in little troops, apply at the gate of the compound for employment, the applicants are admitted into the compound only by the immediate direction of the manager or his assistants. As soon as they enter, their clothes are searched to prevent the smuggling in of liquor, playing cards, or other forbidden articles; then the officer in charge of the dispensary examines each separately and carefully. No diseased man is given work, and any suffering from contagious diseases are sent at once to a quarantine building outside the compound, where a temporary provision for such cases has been made. Within twenty-four hours, a second examination of every one admitted who shows any symptoms
of disease is made by a physician in the employ of the company, who daily visits the compound.

To enter the service of the company, each applicant must sign a written contract, binding himself to live in the compound and work continuously and faithfully for a period of at least three months, or longer if he so desires. At the expiration of a contract, the applicant may leave if he chooses, or his contract may be renewed indefinitely. Some of the natives in De Beers Compound have been employed continuously for ten years or more in the service of the company, for the more industrious prefer the certainty of wholesome food and steady pay to the
PAY-DAY IN DE BEERS COMPOUND.
THE WORKERS IN THE MINES

DE BEERS COMPOUND, SHOWING THE COVERING OF WIRE NETTING TO PREVENT DIAMONDS BEING THROWN OUTSIDE THE COMPOUND.
shifting to any other occupation that is open to them, or to return to their old savage life. All contracts are filled out in behalf of the natives by an officer delegated for this purpose by the Registrar of Natives, a Government Official, in order to keep a record of all additions to the inmates of the compound, and provide assurance that the contract is signed with a full understanding of its provisions. In consideration of this service the native pays a registration fee of a shilling, and a shilling per month during the term of his employment. All receipts from this source, except the registration fee, go to the Kimberley Hospital Fund for the care of sick and wounded natives. As the company provides for the natives in its own hospitals, where free medical attendance and nurses, as well as free food, are furnished, the Kimberley hospital receives a very large monthly contribution without being at any expense for the care of sick natives in the compounds. After his signature or mark has been affixed to this agreement, a native cannot leave the compound until the specified term has expired, except by the permission of the compound manager, which is rarely given because of the opportunities that would be opened for taking out diamonds.
Underground work in the mine is carried on both day and night by three shifts, under the supervision of the mine manager and overman and three assistant overmen, one of whom is detailed to take charge of each shift. The shaft is reached through an underground passage leading from the compound, and a partition in this passage gives separate entry and exit ways to and from the mine. All laborers are taken up and down the shafts in cages. Each "boy" wears a number on his wristband for easy identification, and when he passes into the mine his number is taken by a guard, and a tally machine records each native as he leaves the compound to go to work; on his return, daily, he brings a ticket noting in what working gang he was employed and what pay he had earned for the day. The natives commonly work for the contractors, who mine and tram the diamond-bearing ground at a price per load which is arranged by tender, and the natives are paid a fixed wage per diem; but a worker must drill a certain number of feet of holes for blasting, which in soft ground is about twelve feet, or he must load a fixed number of trucks, in order to earn his daily pay. The natives usually work in the mines in gangs numbering from ten to thirty men and boys. The limit of age
for the employés in the mines is fixed by government regulation, which provides that no boy under twelve shall be employed. Another regulation prohibits the employment of females in mining work. It is further provided that no native shall be employed underground, or in any of the compounds, except under the responsible charge of a white employé of the company. The handling of the dynamite cartridges used in blasting is intrusted solely to white employés, and all work done by the native gangs is laid out and directed by white overseers.

The drilling in the blue ground is done for the most part with long hand drills,—jumpers,—which are sharpened at both ends, and which the natives readily learn to use effectively; where the blue rock is hard, the natives use single hand hammers. Their sinewy frames and powers of endurance enable them to
labor day in and out without any apparent injury to their health. As a matter of fact, nearly all gain strength and flesh in the mines. All the "drill boys" in De Beers mines are now natives, and are scattered through the mines on various levels while working, the number at any one point depending upon the size of the working face or stope of blue ground. At points half a dozen boys may be working together with drills, industriously pecking away at the diamond-bearing ground. Natives are also employed in clearing away the excavated ground, and loading the trucks, which run on tramways to the hoisting shafts.
when working on a main level, or to chutes on the intermediate levels. If the roofs of the levels were transparent and a view were possible of the workers, — whites and blacks, — toiling day and night in these underground passages and stopes, gleaming with the white rays of electric lamps, or plunged in darkness, only relieved by the flickering yellow flame points of straggling candles — this vast underground hive of workers would be a greatly stirring and impressive sight. As it is, some conception

of the great mine may be built up piecemeal in the mind's eye by combining the illustrations of the men at work which artists in the mines have been able to make, some of which are given in the pages of this work.

There is a certain racial resemblance in the temperament, character, and often in the speech of all these native miners, but there are also marked tribal distinctions. The natives are clannish, and it is rare to see members of two different tribes lodging together. "Boys" of the one tribe always prefer working together, and this natural liking is humored to some extent in
selecting gangs to work, although the mixing of the tribes in the mines is inevitable, and often desirable. The Zulu, sprung from the warlike tribes moulded by Chaka, is one of the best of the native workmen, tall, straight, and erect in bearing, proud of the tribal traditions of the Amazulu, “the people of the sky,” and, but for an exceptional fit of passion, a good-tempered, cheery, and ever willing and capable worker. The Amashangaans, coming chiefly from Portuguese East Africa, are closely akin to the Zulus, and resemble them in form, temperament, and working efficiency. The Transvaal Basutos rank with the other two as workmen, for they are industrious and capable, and form the most obedient class of native laborers, and nearly all become skilled in drilling. The men of most of the native tribes range over 5 feet 8 inches in height. Many are fully 6 feet tall, and several
of the old hands are from 6 feet 4 inches to 6 feet 6 inches in height. To this high range the Batlapins from Bechuanaland are the most notable exception, for they often are not much larger than the dwarfed Bushmen of the Kalahari desert. They are not favorites at the mines with the other tribes, or with the whites, for they are often impudent and meanly selfish, and difficult to instruct in underground work.

The ordinary dress of the natives in the compound is a woolen shirt, trousers, and shoes. They rarely wear any underclothing, and when at work in the mines, a pair of ragged
trousers, a blanket, or old breech cloth will often be their only covering. Occasional visitors to the mine are startled by the native disregard for cover; but the natives are commonly alert to pass the word “umfas” (woman) from one to another when a lady visitor is seen in the mines, and then the native workers on the level ahead scramble for cover or hiding.

When any injuries happen to the men from accidents in the mines, the suffering natives show remarkable fortitude in bearing pain and enduring the necessary surgical operations. Their blood is warm and pure, and cuts in their flesh, or bruises, heal very rapidly. They suffer most from diseases of the lungs, especially phthisis and pneumonia, which are common maladies of the native tribes outside of the mines, as well as within the compounds. They can readily obtain fresh vegetables and fruit, but the common choice of food, such as mealie meal and meat, exposes them to attacks of scurvy. In spite of the careful and repeated medical examinations before men are admitted to the compound, cases of leprosy are occasionally found. In such cases provision is made at once for the isolation of the sufferers. The Government officials are notified, and the diseased men are transferred to Robin Island, where the Government has a permanent leper station. Outbreaks of other contagious or infectious diseases are met by the isolation of the patients in a special lazaretto outside of the town, which is under the supervision of the board of health. Natives suffering from
any disease that is not infectious are cared for in the hospital of the compound, which has several wards,—one for cases of fever, one for convalescents, and one for surgical treatment. A qualified dispenser is in charge of the hospital and dispensary, and physicians engaged by the Company are in daily attendance.

At the shops in the compound any articles of food and clothing which the inmates commonly want are supplied. The staff of life is corn, or mealie meal in some form, sometimes baked in hoe cakes, but generally made into porridge. A considerable quantity of brown bread made from Boer meal is also eaten, with meat, vegetables, and fruit in season. Meat is commonly cooked by boiling or by roasting over wood fires. The prices are never permitted to be in excess of the common market prices in Kimberley. If a "boy" does not want the trouble of cooking for himself, he can buy ready cooked food, which is supplied by the company or at any one of a number of coffee shops in the compound. One of the favorite resorts belongs to a Zulu, popularly known as "Roast Beef," who had the misfortune to lose his leg in an accident in the mines. He does his cooking over an open wood fire with the aid of a few kettles and pans; and a bare wooden table, usually made from dynamite cases, serves for his dishes; but he is a chef in his line, in the eyes of the compound, and is making more money than he earned before he was crippled.

There are a number of native tailors on the ground, who can fit and make a suit to order, or repair one, with no little dexterity. Native mining suits are usually made of the English cloth known as moleskin, and the tailors, in accordance with South African custom, put large patches on the seat and around the foot of the trousers. Sewing machines are commonly used, which the natives buy in Kimberley through the compound manager. Some work in the mines during the week, but like to earn additional shillings by cloth cutting and sewing during their leisure hours, when their machines may be heard clicking from morning till night.
THE WORKERS IN THE MINES

ZULU WORKMEN, DUTOITSPAN MINE.
There are native barbers and hair-dressers, also, of whom the chief is "Sandy," a Cape boy, who struts about on Sunday in a khaki jacket with the airs of a tonsorial artist on the crest of fashion, and is reputed to make more on his holiday with his clippers than he can earn in a week with the drill below ground. He has not as much range for his art as a French barber, for most of his patrons want their hair cut off close to the scalp; but he is justifiably vain of the speed with which he lops off one bushy head of hair, and makes room for the next to fall.

Peddlers of all sorts, dealing in cakes, tobacco, and ginger beer, have their stalls in the moving throng, especially on Sundays and other holidays, and here and there are to be seen workers in Kafir adornments, principally in armlets or bangles, and bands for the legs. These are usually made of fine copper and brass wire rolled upon rings of horse hair. The rings are about one eighth of an inch in cross section and from four to five inches
THE WORKERS IN THE MINES

MR. ROULIOT, MANAGER OF THE "COMPAGNIE GÉNÉRALE," DUTOITS PAN MINE, AND HIS NATIVE WORKMEN.
in diameter, varying with the size of the hands over which they must be slipped. The wire is wound round the hair very skilfully. European visitors occasionally supply gold wire to these workers, which the natives wind around the hair centres into fanciful bangles, some of which are very pretty.

All the workers in the compounds are supplied with Bibles, printed in various tribal languages, which the natives are taught to read by missionaries. At any and all times De Beers Com- pounds are open to these teachers, who are specially delegated by English and German missionary societies.

When a "boy" is once moved to apply his mind to any study, he will commonly plod on persistently, and there is among the natives generally an unfeigned respect for teachers, and pride in the attainment of any advance in learning. There is only the crudest notion of religion in the minds of these negroes, and the missionary must have unwearied patience who seeks to impress them with the idea of an invisible, omnipotent, omnipresent God and Father of all. It is very difficult for the missionaries to prove by the Bible that these savages should have only one wife, and this has been a great stumbling-block in teaching them Christianity. The native argues that, if he has only one wife, she is continually wrangling with him, but if there are two or more, they occupy themselves by wrangling with one another. And again, he says, the more wives he has, the more crops he can raise. The women do all the work at the kraals, and the men idle their time away in peace and plenty.

The preachers at the compound chapel or elsewhere in the compound often call together their flocks with stirring notes of drum and trumpet, and at gatherings of natives lime-lights and lantern slides are also effectively used in vivid and telling illustrations. Sometimes an interpreter stands at the preacher's elbow, to make his meaning clear to native listeners, for the tribal dialects in the compound are like the confusion of tongues in Babel. The missionaries are somewhat vexed by the Kafir "doctors," who keep before the natives the vision of old superstitions, as they squat on the ground in the compounds, sol-
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I'mly laying out their "bones" and muttering incantations. They are so tricky with their impostures that it is difficult to bring any of them patently into contempt.

Almost all of the natives are fond of sport. They have plays of various kinds which may be seen every day in the compound, but the chief show is naturally on Sunday, the holiday for all. Then a number of the tribes put on their native dresses, and there are vivid spectacles of native dances, chants, and games. The Zulus often arm themselves with clubs or wooden assagais, or any long canes which they can brandish and strike upon their ox-hide shields, while they circle about in a ring, marking time with a stamp of the foot that makes the earth quake. It is the traditional report that no one is admitted to this war dance who has not killed a man; but the chances are that, in recent days, unquestionable evidence of this qualification is not strictly required. Nevertheless, the pretence of bloodthirstiness is very exciting, as warriors spring forward, one after another, swinging their assagais or knob kerries, and advancing their shields, while they show a pantomime of attack upon an imaginary enemy almost as vivid and thrilling as actual battle. When this dance begins, a circle of native spectators gathers about, shouting and crying with the passion of the scene, till the noise at times is deafening. Other natives, less particular than the Zulus, dance about in rings and crescents, waving any kind of stick in their hands, from a miner's candle-
THE DIAMOND MINES OF SOUTH AFRICA

NATIVE WAR DANCE, IN THE PRESENCE OF HIS EXCELLENCY THE GOVERNOR, SIR ALFRED MILNER, AND SUITE.
THE WORKERS IN THE MINES

stick to a twig or old hatchet. Among these figure the fantastic Machopis, dancing to the music of native imbilas, or Basutos blowing their little reed or bone whistles and swaying about with strange contortions, accompanied by monotonous tapping on a crude drum made by stretching a raw ox-hide over the end of a barrel. The 'Mshangaans chant while dancing, but the Basutos are not gifted with musical voices and have no evident ear for music, although they are so fond of their own harsh and discordant blowing that they will pipe away on their hollow bones and dance for hours at a time on Sunday to their own piping.

Among the other native tribes there are many boys with fine voices, sweet toned or robustly sonorous, ranging from the highest tenor or falsetto to the deepest bass; and some are readily trained to part singing. In De Beers and other of the larger compounds there are native choral societies under the charge of white instructors. The most popular songs are the familiar American negro minstrel and concert hall melodies. These are freshly ludicrous to one who pictures the black singers "climbing the golden ladder" and "wearing the golden slipper" on their big flat feet. The climax is reached when the high
voices sing, "What are you goin' to wear?" and the reply comes from the deep bass voices, "I'se goin' to wear a standin' collar." Native African chants are rarely heard in the compound, except sometimes as an accompaniment of native dances.

At all hours of the day, until the stir and buzz throughout the big compound are hushed in the sleep of its thousands of inmates, the rattling and humming and squeaking of imbilas and gubos, and various other crude instruments of native fashioning, are to be heard, more or less widespread. The "imbila" is the same as the maninba noted by Dr. Livingstone in his travels in Africa. In the native villages it is made by fixing strips of board across dry calabashes. By grading the size of these gourds, different notes are produced when the overlaid strips are struck by a drumstick with an elastic gum knob. In the compounds empty dynamite boxes with tin cans fastened underneath the strips of wood supply the lack of calabashes, and the striking knob is imitated by twisting a piece of rag tightly round the end of a stick. The native "gubo," as the Zulus call it, is an instrument also common throughout South Africa. This is a bow of bamboo with a tightly stretched string. The player holds the end of the bow against his parted lips with one hand and strikes the tight string with a slip of split bamboo. A peculiar effect is obtained in playing on this bow in the compound by attaching a calabash to the back of the bow, and holding this improvised sounding-board against the breast. These are the favorite instruments, but there are others, like the bone whistles of the Basutos, which are much cruder, and grate far more harshly on the ear of listening white men.

That the native African has an inborn fondness for music is signally shown by its persistent pursuit in the compounds, even through refuse boxes and bones. It may advance in time, with education, to high artistic appreciation and accomplishment. Even at its present barbaric stage the Kafir may be greatly moved by the art of a great singer, as was evident when Madame Albani came to the diamond mines, for she never saw an audience so passionately enraptured as the black men massed about her within the walls of De Beers Compound.
From Left to Right, front row sitting.

Mrs. Wm. Pickering, Miss Chatfield, Miss Kate Chatfield, Lady Charles Bentinck, His Excellency the Governor of the Cape Colony and High Commissioner for South Africa Sir Alfred now Lord Milner, Mrs. Hanbury Williams, Mrs. H. Hartog, Mrs. Leon Sutro, Mr. Gardner F. Williams, Major Hanbury Williams, Military Secretary, Mrs. Hartzell, Bishop Hartzell.
THE WORKERS IN THE MINES.

HIS EXCELLENCY SIR ALFRED MILNER'S VISIT TO DE BEERS COMPOUND. VIEWING A NATIVE DANCE.
There would probably be a common resort to gambling as well as to music, if the practice were not sharply restricted by the compound regulations and oversight. It was necessary to prohibit the playing of cards, because native sharers were fleecing the tyros too unmercifully. There is still, probably, some covert card playing, for many of the natives understand a few of the games familiar to white men. Faro was played with the top of an empty dynamite box as a table, upon which cards were tacked. The game was probably introduced by natives from the Portuguese possessions. The native African has only a few games of his own devising. The most popular of these in the compounds, and Africa at large, is "umtshuba" or "chuba," the Syrian "mancala," or, as the Nubians call it, "Mungala." The widespread knowledge of this game is noted by Schweinfurth as one of the links of evidence of "the essential unity that underlies all African nations"; and it has been shown by the investigations of Mr. Stewart Culin for the Smithsonian Institution of the United States,¹ and by other reports, that the same

¹ "Mancala, the National Game of Africa," by Stewart Culin, 1896.
game with essential variations is played throughout Africa and extends along southern Asia as far as the Philippine Islands. For this game a long strip of board is provided, edged with two parallel rows of holes scooped in the wood. When a board cannot be procured, the rows of holes are made in the ground. The number of holes in a row varies widely, the Nubian "Mungala" having sixteen, while the board common on the Diamond Fields has from thirteen to seventeen holes and four rows. Each player has about two dozen pebbles in hand, and the play is in shifting the pebbles from one hole to another. Stanley calls the game an African "backgammon," and speaks of the board as a "backgammon" tray. The word "mungala" is of Arabic origin, derived from "nagal," "to carry from one place to another." There is no apparent interest in the game to the ordinary white man's eye, but native players in the compounds and African negroes generally will keep on moving the little stones for hours at a time with evident satisfaction, taking up their opponents' pebbles, as certain combinations occur, until
one or the other has won all. The spectators usually offer advice to the players.

There is some running, jumping, and wrestling in halting imitation of English athletic sports; and on special holidays, like Christmas, they have obstacle races, sack races, walking the greased pole, which lies horizontally over the swimming bath, and other comical features for the general amusement of the native and white spectators. But the workers in the mines are rarely nimble enough to figure with any distinction in these sports, and the only English games that can be called popular in the compounds are the counterfeit of cricket and football. The native wickets are made of empty paraffin tins, and the fine points of the game are not in evidence; but there is plenty of hard swiping and sharp bowling, to the delight of the native players and the spectators. Christmas is the great holiday of the year for all, for everybody in the compound then receives for his Christmas box a loaf of bread, a bottle of ginger beer, and a piece of meat, and sports of various kinds are specially provided for
their amusement. Grabbing and diving for money thrown into the swimming bath by the directors and managers form a lucrative sport for the natives, and amusement for the lookers-on.

At every gathering for dances, sports, or games of any kind there are more lookers-on than participants, for the African dearly loves a spectacle of any kind, and is commonly well pleased to stand or loll on the ground where he can get a view of the contributors to his entertainment. Some of these indolent ones will be smoking cheap cigars, and more rarely pipes. A native usually puts the lighted end of a cigar in his mouth, inhaling and blowing out the smoke, and shifting the hold of his teeth as the tobacco burns. Sometimes sets of boys are seen squatting on the ground and passing from mouth to mouth a lighted pipe filled with dry dagga, a native herb similar to the Indian hemp, that burns with pungent and stupefying fumes. The natives inhale the smoke, and, after a few puffs, a fit of violent coughing comes on which brings tears to their eyes. The use of this herb is not so extended as to cause any serious ill effect, but the native becomes stupefied for a time, though he soon recovers.
There is some tribal jealousy and vanity, but the inmates of the compounds live together on good terms, as a rule. In their occasional fights they use bottles or stones or clubs, or anything they can lay their hands on quickly; but, as soon as the guards come up, they hurry off to their rooms, where they are put under strict oversight for a time. Even these short encounters often leave many with sore heads and bruised bodies. Only once has there been the threat of a serious insurrection in the compound. This was at Christmas time, when the compound manager was absent for a few days. After the usual Sunday holiday several hundred natives, chiefly from Kaffraria, refused to go to work on Monday morning, as the following day was Christmas, demanding the grant of Monday also as a holiday. I went at 5 A.M. to the compound and urged the leaders of the strike to take their followers into the mines. The Basutos were willing to support me, and offered to drive the reluctant Fingos, or Amafengu, underground. After some protracted but ineffective appeals, I sent word to Mr. Rhodes, who happened to be at Kimberley, that the Fingos refused to go to work, and suggested that he might come over and try his persuasive power on them. So he did, but after an hour of fruitless parleying we determined to try the demonstration of force, for the Fingos not only refused to work themselves, but barred the other natives from entering the mine. As they numbered from five to six hundred, they were rather a formidable barrier at the underground entrance.

We then decided to call in the assistance of the police and our own guards, Mr. Rhodes riding to the police station, while I rode to a station where a number of extra guards were posted. When we came back into the compound with a force of fifteen men armed with carbines, the Fingos instantly began to pelt us with bottles and stones, and anything else which would serve as a missile. At this outbreak I asked the officer in charge to fire a few blank shots at the crowd of rioters, and in less than a minute there was not a native to be seen in the open area of the compound, for all scurried off like frightened sheep to their
rooms. We then went around the compound, picking out the ringleaders, thirty-three in all, ranged them in line, and sent them to jail. They were soon brought up before the magistrate and each was fined £3, which they obtained by a little begging from their brothers in the compound. Meanwhile, it was difficult for us to restrain every native left in the compound from going to work that day on the first shift.

After the ringleaders came back to the compound, they wanted a meal, but they were forced to go underground and work eight hours before any food was provided. Then they were singled out and led around the compound, one by one, as an exhibition or warning to others, before they were finally discharged from the employ of the Company and sent away from the works. One of our interpreters had been taken along with the rioters by mistake. He was so vociferous that some one put him in with the other noisy boys. A few days later, when I wanted an interpreter, the unlucky one said, “All right, Baas, I don’t mind interpreting for you, but I don’t want to be run in for it.”

No corporal punishment of the natives by white employers is allowed. If a boy is unruly, he may be placed in a room by himself until he can be taken to jail, and charged with whatever offence he has committed. The most common offence is petty thieving. There can be no doubt that the covert purloining of diamonds would be a frequent practice, and cause heavy losses to the diamond mining companies, if it were not for the compound system, which makes it impossible for natives to take any diamonds out of the compounds with them.

A fine wire netting is stretched over the top of the compound to prevent the sly tossing of precious crystals over the walls, to be picked up by confederates outside the mining areas. Precautions are also taken to prevent the smuggling away of diamonds from the compounds, and all communication by the natives with persons outside the walls is carefully restricted. Until the expiration of his contract, no native can go through the compound gate, except by special permission, or when he is taken under guard before a magistrate for some
offence. If convicted, when his term of imprisonment expires, or after he has paid his fine, he must return to the compound and complete his contract. Before leaving the compound his clothes and person are thoroughly searched to prevent the disappearance of diamonds with them. Gems were sometimes found secreted in clothing, or shoe heels, or canes, or cans with false bottoms, in fact, in anything that the natives were allowed to take out with them. Even this close inspection did not bar the practice of stealing, and there was an inexplicable trickle of fine diamonds from unlooked-for quarters, until it became known that natives on the point of leaving the compound were swallowing diamonds and conveying them away.

In 1895 one native had the nerve and capacity to swallow a lot of diamonds worth £750, and did not appear to suffer by this strain upon his digestion. There has been only one authentic instance where a native has embedded diamonds in his flesh — this was done by a native in De Beers Convict Station, who made an incision under the shin bone and concealed several small diamonds wrapped in a rag. This native had symptoms of tetanus, and the visiting physician (Dr. Otto) searched the man's body, and, finding an ugly-looking wound on his leg, cut it open, and to his great surprise found a rag full of diamonds. The native soon recovered, a wiser, if poorer, man. The largest yield
of diamonds which a native had swallowed is represented by the illustration on page 85, each diamond being drawn the exact size of the original. There is no apparent fear of swallowing any stone which can be forced through the throat, and in one instance a diamond as big as a large chestnut and weighing 152 carats was hidden for over seven days by this means.
The swallowing of a rough diamond is evidently so easy, but so difficult to detect, that it was necessary to put an end to the practice by providing a longer period of detention and search. At the close of their contracts, natives whose terms of service have nearly expired are placed together in a commodious room capable of holding two hundred men or more. They enter this room entirely naked. Their clothes and baggage are deposited in sacks marked in accordance with the number on the arm band. Blankets are supplied for clothing, and as wraps when sleeping. They are fed, and generally well cared for, free of cost to themselves. While in the detention room they are under strict supervision of white guards, so that any diamonds they may have swallowed must be left behind before they leave. Natives have been known to keep diamonds in their bodies for over seven days. At the end of five days of detention, generally on Saturday morning, they are released. Meanwhile, the clothes placed in the sacks have been thoroughly searched; and departing natives are not allowed to take away with them anything but soft goods. In fact, they are even required to leave their boots behind, for cunning smugglers used to insert diamonds in their boot heels so neatly that the trick could not be detected without cutting away the greater part of the sole of the boot. Boots and shoes, and other articles which are not allowed to be taken from
the compound, are sold or given away to customers or friends before their owners leave.

It may be that De Beers Compound is a "Monastery of Labour," as was wittily said by a lady visiting the fields as a correspondent of the London Times; but the testimony of all careful observers on the ground affirms the beneficial effect of the restrictions from dissipation, and the general good cheer of the workers. Mr. Thomas H. Leggett, an entirely independent and competent American witness, wrote of his inspection of the men in the compounds, in Cassier's Magazine, September, 1898: "These chaps are well cared for, contented, and happy, as proven by the fact that many have been there for years; and the secret of it lies in their not being able to get drink."

Occasionally a visitor at the fields is less observant and candid. One such was a member of the Legislative Assembly of Cape Colony, who came to Kimberley to investigate the conditions of life and treatment of the natives in the compound. On arriving at De Beers Compound, in company with his wife, he first impressed upon the natives whom he met that he was a member of the Cape Colony Legislative Council. He had come to the fields in their behalf, and he wanted them to tell him freely everything of which they had to complain. With the aid of an interpreter he interviewed a number of natives in the compound, asking searching questions about their treatment. One native told him that he had been working for eight years in the mines and had been outside the compound only three or four times in all that period. When asked if he was well treated in the compound his answer was, "If I didn't like it, Baas, I wouldn't be here." The visitor's wife meanwhile kept tugging
at his coat continually, saying in Dutch, "They treat the Kafirs altogether too well here; they will be spoiled by such good treatment as this." Before leaving, the legislator said that he was glad to have the opportunity to inspect fully the operations of the compound. From what he had heard he had been much opposed to compounds, but he now saw with his own eyes that he was wrongly informed, and henceforth he should be a strong advocate of the system. Yet a year or two later, when questions affecting De Beers Company and the compound system arose in the Upper House, this gratified member was one of the first to denounce the system in an intemperate speech.
CHAPTER XV

THE MINING TOWNS

Kimberley

IMBERLEY, the largest of the cluster of diamond towns on the Fields, is, like the rest, the natural efflorescence of the mines near which it is situated, and from which it derives its birth and being. Its mushroom growth must have withered like so many other pretentious upstarts from the mining fields, had it not been for the fact of its rising on ground of such sustained richness and promise. While the diamond-studded blue ground continues to show a persistent extension in depth and in richness, and while man's energy and art avail to pierce and extract it, the Kimberley of the surface will surely continue to flourish.

It might indeed be said, without any stretch of imagery, that the modern Kimberley is literally as well as essentially built up on the yield of the mines. This has been brightly noted by the late Rev. James Thompson in his pleasing sketch of the modern Kimberley. "Kimberley, as we know it," he says, "with its streets and warehouses, and shops and schools and churches, is largely built upon that strange mixture known as debris, every atom of which has a story to tell if it could only speak. As in any English town you can go down foot after foot through the different strata representing the pavements or pathways upon which successive generations of ancestors pressed their feet; so in Kimberley we have beneath the present surface of our roadways the red soil on which our fathers pitched their tents, and which their labor soon covered up by spreading out all around them the heaps thrown out of that great hole which now looks
so desolate, but which was once the centre of activity and throbbing life which made Kimberley famous throughout the world."

Dr. Thompson marks the middle age of Kimberley as the period when decent buildings of iron and wood, with here and there more pretentious brick, had replaced the age of canvas; but when there were no softening or beautifying surroundings, when every tree and bush had been cut down, and when the veld once dotted with thorn trees had become a vast expanse of wind-swept dust as gray as the iron dwelling places which alone seemed to convert the desert into a town. This was the period preceding the introduction of an abundant and pure water-supply that wrought such a transformation in the appearance of the city. Now the upspringing of flowers of varied hue, and green thickets and vines and trees in the gardens that now surround nearly every house in town outside the business quarter, has made during many months of the year a beautiful country town of the old and barren Kimberley.

In spite of the visible yield of the mines and the consequent prosperity of the town there was, for many years, a prevailing

\[1\] Christmas number, *D. F. Advertiser*, 1898.
distrust of the permanency of the diamond-bearing deposits and the consequent stability and future of the city that was founded upon them. But later, as systematic development gave substantial assurance of the endurance of the mines, the advance in the architectural beauty of the residences and public buildings in Kimberley has been marked. Now many of the residences of the more wealthy townspeople are not only substantial, but distinctly ornate in character, with spreading verandas rising in the midst of green lawns and lovely gardens. Some of the public buildings already erected or in process of erection need not fear comparison with any like structures in any city of its size in the world.
Among these structures is a handsome and well-appointed theatre, built of burnt brick with stone facings, excellently situated for the accommodation of theatre goers. This building, the Theatre Royal, was designed to introduce all the latest improvements in theatrical construction, and its acoustic properties are particularly fine. The commodious stage has a face of 54 feet and a depth of 38 feet, and is so arranged that the whole stage is in full view of the audience in the box stalls, dress circle, family circle, and gallery. The theatre is lighted by electricity, and its fire exits are so complete and well placed that in case of need the whole audience could leave in a very few minutes.

The Town Hall is another building that deserves special mention. It was erected by resolution of the borough council on the Market Square after the destruction by fire of the old town hall. This building is designed in the Roman-Corinthian style and its appearance is notably pleasing. Its site is in the
centre of the Market Square, a particularly convenient position. There are three entrances to the main hall, which is finely proportioned, — 105 feet in length, 50 feet in width, and 35 feet in height. At one end there is a stage 25 feet wide, and a handsome proscenium and space for the orchestra is also provided.

There are emergency exits opening into large yards that afford abundant protection in the event of the outbreak of fire. Passages along the building lead to suitable administration offices for the borough engineer, market master,

sanitary inspector, and native officials. At the back of the main hall extends the market house, over 83 feet wide and running the full width of the building. In the east wing of the building is a council chamber, 50 feet long by 26 feet wide, and, opening
DUTOITSPAN ROAD, KIMBERLEY.
out of the chamber, rooms for the mayor and councillors. In the other wing of the building, accommodation is provided for the town clerk and his assistants. The building is substantially constructed of the best burnt brick covered with cement and enriched with cornices.

On the site of the old Kimberley Hospital, established in 1871, a new and spacious building has been erected, with sev-
eral outlying wards. The main building, about three hundred feet long, contains the operating rooms, convalescent room, and the Merriam, Victoria, and Lanyon wards for the reception of European patients only. The detached buildings comprise native medical and surgical wards, each containing fifty beds; the Southey ward for colored women and children; and isolation
wards for infectious cases; male and female contagious disease wards, and mortuaries. The offices of the resident officials, a dispensary and doctors’ quarters, nurses’ home and chapel, with a further provision of European and native kitchens, make the hospital complete and comfortable. This hospital has accommodations for 250 patients, European and colored, and from the day of its erection it has been of indispensable service. During the single year of 1897, 2683 patients were admitted, 798 of whom were Europeans, and the remainder natives and persons of color. Six hundred and sixty-three patients were admitted free, or on subscribers’ letters. Besides this service it should be noted that the number of day patients treated during the same year was 1220; one of the hospital doctors is in attendance in the day-patients’ room for an hour every morning to give advice without charge to the poor. To all who cannot afford to pay for treatment, medicines are furnished free. Every subscriber is entitled to give a letter of admission to one patient for every £2 2s. subscribed, upon the sole stipulation that the person receiving the letter must be too poor to pay for his or her own treatment. The staff of the hospital

Horns of South African Koodoo, Bushbuck, and Antelope.
consists of two resident house surgeons and a visiting body of seven local practitioners. The matron and forty-two nurses constitute the nursing staff. A recent addition has been made to the original hospital, in which will be the maternity ward, for the sake of providing the needed accommodation and the training of experienced midwives. The cost of this hospital with its enlargements has been upwards of £30,000.

The Kimberley Club has a commodious and finely furnished house on Dutoitspan Road. This building was erected in 1896 on the ashes of two predecessors which had been unfortunately destroyed by fire. It possesses a unique collection of trophies of the chase, and its list of visitors bears the name of many of the most notable men in the British Empire.

Besides these structures a government building of massive stone and brick on the north side of the Market Square deserves mention as one of the conspicuous edifices in the city. Here the High Court of Griqualand is held. The magistrates' courts are arranged on either side of the entrance, and rooms are provided for the Civil Commissioner, Judges, and Magistrates.
The Kimberley Public Library is a well-built building, containing three large rooms, of which one is free to the public, and the others reserved for subscribers. Smaller rooms are provided for the librarian and committee. It is especially notable for its remarkable store of reference works, which is esteemed to be the best in South Africa. It contains in all twenty-two thousand books, many of which would be irreplaceable if destroyed. The building up of this library is justly credited to the fostering care of Mr. Justice Lawrence, the Judge President.

Midway between Kimberley and Beaconsfield stands the Kimberley Sanatorium, a superb structure erected by the liberal contributions of De Beers Consolidated Mines Limited at a cost, with its furnishings, of £26,000. Its fine enclosing grounds, the gift of the London and South African Exploration Company, were artistically laid out under the direction of Mr. Fenner of the De Beers Forestry Department. The larger part of the building is designed for the accommodation of guests, and the smaller block contains the billiard room, smoking room, kitchen, servants' and store rooms. The buildings are of burnt brick, two
stories in height, with ample verandas and balconies; all the rooms are large, lofty, and handsomely furnished, and in the construction the best sanitary knowledge has been applied. The building is lighted throughout by electricity, and abundantly supplied with pure water.

The Masonic Temple was erected in 1889 by the combined lodges of the city. Its main hall is spacious and admirably lighted by electricity, and the interior throughout is very handsomely decorated and furnished. At the top of the staircase there is one of the finest stained glass windows in South Africa, which was presented to the lodges by Mr. Rhodes.

The post-office, police barracks, and railway station have no special pretension to architectural beauty, but they are serviceable structures for the uses to which they are applied. The offices of the De Beers Company are in the centre of the business section of the town, and are, as might be expected, excellently designed buildings, and stand out notably among the business edifices that surround them.

The South African School of Mines was established at Kimberley in 1896. The first two years' studies are taken at the
South African College, Cape Town, or at similar colleges at Grahamstown and Stellenbosch, the third year at Kimberley, and the fourth at Johannesburg. The object of the school is to train young men in South Africa as mining engineers. Suitable buildings were erected at Kimberley at a cost of £9000, De Beers contributing on the pound for pound principle with the Educational Department of the Colony. There were twenty students in attendance during the year 1901. De Beers mines and workshops are open to the students, where they are given practical instruction in mining and mechanical engineering. Their theoretical training is under the supervision of Professor J. G. Lawn, assisted by Professor Orr. The management of the school is entrusted to a local committee, consisting of the four members of Parliament representing the Kimberley district, the member of the Legislative Council for Griqualand West, the Inspector of Mines, the Mayors of Kimberley and Beaconsfield, the Chairman of the Public Schools Committee, and myself. I have the honor of being chairman of this committee.

There are six distinct church establishments in Kimberley,—the Anglican, Presbyterian, Baptist, Roman Catholic, Wes-
leyan Methodist, and Griqualand West Hebrew Congregation. The Anglican denomination has three churches in Kimberley, St. Cyprian’s, St. Augustine’s, and De Beers, besides churches at Beaconsfield and at St. Matthew’s, Barkly Road. The largest church provides accommodation for 650 attendants. The first edifice of the Church of England was built at Dutoitspan, the pioneer town on the fields, and subsequently transferred to Beaconsfield. When Kimberley became the principal city of population, St. Cyprian’s Church was erected on Church Street and removed to its present position in 1878. Kimberley became part of the diocese of Bloemfontein, and gave its name to an Archdeaconry comprising Griqualand West and Bechuanaland. The Archdeacon of Kimberley is the head of the church organization in this part of the diocese.

The Kimberley Presbyterian Church was founded in September, 1877, and has over four hundred enrolled communicants and a still larger number of adherents.
Sir Alfred Milner passing the Offices of De Beers Consolidated Mines Limited on his First Visit to Kimberley.

De Beers Offices decorated in Honor of the Governor’s Visit.
In 1889 the Rev. James Hughes, of Port Elizabeth, at the invitation of the Baptist Union of South Africa, came to the Diamond Fields and held the first denominational meetings in the Good Templars Hall in Kimberley. Through his efforts a church was formed, and in 1892 the foundation stone of the present commodious Baptist Church in Dutoitspan Road was laid.
The foundation stone of St. Mary's Roman Catholic Church was laid on the feast of All Saints, 1879, by the Vicar Apostolic of Natal and Griqualand West. For many years previously a Catholic Church had been maintained on the fields, but its building was too small for the growing congregation. The foundations of the new building had just been completed, in August, 1879, when the old building was levelled to the ground by a terrific hail-storm. This was looked upon as a significant warning to replace the iron sides of the new church with brick, and the present edifice was accordingly erected, which will accommodate about five hundred people. It is adorned with stained glass windows, paintings, and oak altar and reredos, the gifts of its parishioners.

Wesleyan Methodist missionaries were probably the first to visit the River Diggings in 1869, and representatives of this energetic denomination were among the first also that flocked to the Dry Diggings at Dutoitspan and Kimberley. The first regularly appointed minister of this church came in 1871, and
the succession since that year has been unbroken. The Methodists erected their first church at the West End, but as the town moved eastward, a new church, Trinity, was built to meet

The Post-office, Kimberley.

the call from that quarter. The original Trinity Church was blown down by one of the fierce gales sweeping over the Fields, but a second Trinity has now taken its place. There are now in Kimberley three Wesleyan churches for whites, two for natives, and one for other people of color, and a missionary is in daily attendance at the compounds. It is estimated that there are probably not less than three thousand persons under the charge of these seven ministers. At a very early date in the history of the Fields the foundation stone of the Hebrew Synagogue was laid on the Dutoitspan Road, occupying a site donated by the London and South Africa Exploration Company.

Nazareth House, Kimberley.
The Gardens of the Intermediate Pumping Station of the Kimberley Water Works Company.
The Author's House at Kimberley. Wistaria in Bloom.

Another View of the Author's House and Garden.
Experience has shown that Kimberley has special attractions as a health resort in spite of the occasional intense heat of its summer days and the blasts of its high winds laden with dust. It has the pure atmosphere of the high karroo plateau, and even in the hottest days the bright starlight evenings are usually cool and refreshing, inviting the people to live for the greater part of the year in the open air on verandas and balconies. During the winter months the nights are often extremely cold, and well protected dwelling rooms are essential for comfort and health; but during the day the atmosphere is commonly clear, and so still that the severity of the cold is not felt, and all kinds of active outdoor exercise are agreeable in the bright sunlight of the unclouded skies. It is noted by the medical officer of health in Kimberley that the number of days of unbroken
sunshine are particularly enjoyable to newcomers. They will find that the air they breathe is never heavy, damp, or oppressive, but always dry and light, and, outside of the centre of the town, pure and invigorating. The heavy thunderstorms that occasionally occur bring deluges of rain, but the water rapidly flows off the surface, and as vegetation is scanty, the soil remains exceptionally dry.

It is this marked climatic attraction which, in connection with the pleasure resorts of the city, suggested the establishment of the Kimberley Sanatorium.

**Beaconsfield**

Dutoitspan, as before noted, was the original town on the Diamond Fields. When crowds flocked to the Fields and a demand for greater accommodation arose, the London and South Africa Exploration Company laid out the town of Beaconsfield, which adjoins Dutoitspan on the north. It was laid out as a business town, and has grown to be a place of
considerable size containing several thousand inhabitants. The town limits extend to the farm Dorstfontein, but the business and residence quarters are all within the farm Bultfontein. The main street in Beaconsfield leads direct to Kimberley. Many of the houses are of brick and iron, but the larger number are of unburned adobe brick, made of clay dug directly from the soil on which the house stands. With few exceptions all are unpretentious, one-story buildings.

The town originally belonged to the London and South Africa Exploration Company, the organization which laid out the town, but together with all that company's property passed into the hands of the De Beers Company in 1898. According to the common practice houses are put up by the tenants on lots leased from the Company. Beaconsfield is laid out in wards, and has a distinctive Municipal Government of its own, consisting of a Mayor and Town Council and the usual town officers. The Mayor is a member of the Council and elected annually. Although Beaconsfield has thus a distinctive individuality, the business firms are very largely branches of corresponding firms in Kimberley. The town transacts considerable business, chiefly in stocks which are carried for the use of the mines; but there is also a large number of shops which carry supplies of all kinds for the consumption of the white residents as well as for the native population which lives in locations near the town.

Wesselton

Close adjoining to Beaconsfield lies the little village of Wesselton. This was laid out by the owner of the Wessels estate on Benauwdheidsfontein farm. Its buildings resemble those of Beaconsfield, but are commonly of a poorer order of adobe brick structures, built like the Beaconsfield houses on leased lots. Wesselton has now only a few hundred inhabitants, mostly natives and East Indians. The natives are chiefly workers for débris washers about Dutoitspan and Bultfontein mines, while the East Indians are commonly kitchen gardeners and small shop-
keepers and pedlers. The various vegetables that are raised are sold in the little greengrocer stores, or hawked about by the pedlers in handcarts. Some of the East Indians also peddle clothing and knickknacks more or less industriously.

Kenilworth

On Kenilworth farm, about two and a half miles from Kimberley, the so-called model village of Kenilworth is built. This village was planned in the latter part of 1888 by Mr. Rhodes, and laid out under his general direction by the late Mr. Sydney Stent, an architect then residing in Kimberley. It covers a space about half a mile long and a quarter of a mile wide, upon land owned by De Beers Consolidated Mines.

The land was divided up into lots of about 80 by 100 feet, and upon these lots semi-detached houses were built, of brick with corrugated iron roofs, by De Beers Company. Nearly all of the houses are built of red burnt brick made at the brick-
fields in the neighborhood of Kimberley. The cottages rent from £2 10s. to £5 a month. The houses occupied by the
unmarried men contain six rooms, and the other houses occupied by families contain from four to seven rooms. In the unmarried men's quarters each occupant has a room to himself. Nearly
all of the houses are built with verandas, and all the lots are planted with fruit trees, vines, and flowers, supplied by the Company. Most of the residents take a keen interest in their
growing gardens and have added largely to their beauty by purchasing plants on their own account. In laying out the town, the village was originally planned with four main avenues, bounded on the north by a bordering avenue, on the south by the main road to Kimberley, and intersected by a central avenue. Only two of the avenues are at present completed. They are broad, well-made roads lined with blue and red eucalyptus, beefwood and pepper trees, and provided with wide sidewalks fronting the semi-detached villa-like residences. These avenues are finely macadamized and the streets watered by distributing carts.

Supply pipes are laid out along the streets and every garden is supplied with free water for irrigation from the Premier mine or Kenilworth reservoir. Separate pipes are laid to carry water for drinking purposes, and for this water a light charge is made, averaging about 10s. for 1500 gallons.

A circle at the junction of No. 1 and Central Avenues divides the residences of the married people from the quarters of the single men, who occupy a row of houses on the south side of the circle in the heart of the village. One of the main houses on this circle is occupied by the Cape Government for a post-office, telegraph-office, and post-office savings bank. On the other side of the circle bordering on the central avenue is a club-
house, a large brick building containing a reading room, dining room, kitchen, and manager's rooms. This building, like the residences, has a veranda in front, and is surrounded by trees. It is open to any white employé of the Company, but it is, of course, principally used by those living in Kenilworth. Citizens of Kimberley may visit it, and join in the social gatherings arranged by the residents in the village. On the north side of Central Avenue, opposite the club-house, is a schoolhouse containing three rooms, in which the library of the town is placed, and this is open after school hours for the distribution of books. The library has its own store of good books, but in addition to this stock, the Kimberley library contributes books by special arrangement, and it is practically operated as a branch of the Kimberley library. The school of Kenilworth is a primary school connected with the Kimberley public schools, and the children of the village are taught the usual elementary studies ranging up to the common English grammar school. When this grade is attained, arrangement is made for the attendance of
the children at the higher schools in Kimberley. To assist them, the Company provides free monthly tickets to and from Kenilworth via the Kimberley-Kenilworth tram line.

The village is wholly given up to residences; there are no stores or shops of any kind. All supplies come from Kimberley, and by special arrangement the schoolhouse is used on Sundays for worship and mission work, and on evenings during the week by the various philanthropic and social organizations. The village is lighted by a few large arc lamps, and the houses by paraffin candles and kerosene.

Arrangements are made by which the unmarried men take their meals at the club-house at a cost averaging about 25s. a week. The men come in from their work to dinner, which they take in the dining rooms of the club; their breakfast and lunches are sent out to the depositing floors or other places of work. The breakfast at the club is like that served at the better class of miners' boarding houses at Kimberley, consisting of bacon and eggs, chops, or steaks, or other substantial dish, bread and

Kenilworth Village, with Meteorological Station on the Left.
butter, coffee or tea. Lunch consists usually of a meat dish with bread, vegetables, fruit, and tea or coffee. Dinner is the main meal, at which roast beef, roast mutton, and vegetables of all kinds are served.

The shade and fruit trees of Kenilworth and adjoining plantations are the special pride of the village and of the De Beers Company, which has been indefatigable in introducing, acclimatizing, and maintaining every variety that will thrive. Just adjoining Kenilworth on the north is the orchard of the Company, containing about 8000 trees,—oranges, lemons, apricots, peaches, plums, pears, apples, quinces, and other fruits, as well as shade trees and grapevines. Most of the grapevines are trained on trellises. The first one built by the Company was 975, and the second 1800, feet long. On these trellises all the best varieties of grapes are grown. The ripening season is from the end of December until the end of February, or during the summer months of a season stretching from October to May. Grapes and fruit from these orchards are largely distributed to employes,
and sent to hospitals and charitable institutions. Some fruit is sold in the compounds to natives at a price hardly reaching the cost of production. At times apricots have been sold at a shilling a hundred from the trees, and for sixpence when they were picked off the ground. In favorable seasons trees and vines are very prolific.

The difficulties met with in raising fruit are frost in the early part of the season, when the trees are blossoming, and hail-storms in the beginning of the year, when the fruit is young. Locusts come in millions and at times devastate the whole orchard, leaving the fruit exposed to the sun and at times badly eaten. There are two kinds of these locusts: one comes and stays for a day or so, doing what damage it can for the time being; the other one alights on the trees for permanent occupation. They first appear in the early spring as small insects. The little dark-brown, wingless creatures are commonly known as voetgangers (walkers), and come out of the ground when they are hatched, hopping along in countless myriads. The locusts plant their eggs in the
sands to hatch during the months of September and October. Sometimes all Kenilworth and the adjoining fields are swarming with these insects. In order to protect some of the gardens from young locusts, sheets of corrugated iron twenty-six inches wide are placed along, and leaning against, the fences. The locusts cannot climb up the smooth surface of the iron. In that way many residences are also protected. Sometimes servants are employed continually from morning till night in driving away the insects. They destroy all the vegetation over which they pass. The natives are very fond of eating them. They go out into the veld in large parties, and drive the voetgangers from all directions upon blankets, and then empty them into sacks which they carry to their huts. Flying locusts develop in about six weeks from the dark-brown little insects. The other variety that scourges the fields is a species of locusts with red wings, and their damage is the greater from the fact that they stay in one place until every green plant upon which they alight is destroyed. Swarms of these locusts occasionally appear, at times darkening the horizon, and following the wind. For the past seven years these swarms have been very troublesome. During one season, after consuming all the leaves, the leaf and fruit buds on the trees were entirely eaten off by these pests, destroying the fruit not only for that year, but for the following season. In spite of these drawbacks to fruit raising, the efforts of the Company have been unflagging.
CHAPTER XVI

FORMATION OF THE DIAMOND

The Diamond-bearing Deposits

VER the basin now extending as an arid karroo for hundreds of miles to the south of the Kimberley Diamond Fields the waters of a great lake once spread. It is apparent that the diamond mines are on the northerly rim of this basin, for the beds of shale that everywhere underlie the basaltic trap surface or country rock are notably thinner in the northern mine openings than they are farther south at Bultfontein and Dutoitspan, and shortly after passing Kimberley fields the shale terminates at the edge of the "bed rock" of the Vaal River diggings, an amygdaloidal trap which Dr. Stelzner determined to be olivine diabase.

By the great open excavations and the extension of the underground workings, the rock formations of the karroo basin are very clearly revealed. The red soil that covers the surface of the country to the depth of from one to five feet is evidently the result of the decomposition of the friable face of the underlying basalt, which is scattered in fragments over the country in jutting boulders and rounded stones. This rock at De Beers and Kimberley mines is from twenty to ninety feet in thickness, but very much decomposed throughout. Below the layer is a bed of black shale, ranging in thickness from two hundred to three

1 "Diamonds and Gold in South Africa," p. 19, Theodore Reunert, M.E.
2 Dr. A. W. Stelzner, Professor of Geology at the Freiberg Mining Academy.
In this bed there is a considerable amount of carbon and a large quantity of iron pyrites.

Underlying the shale is a thin bed of conglomerate, composed of small stones, some well rounded and others angular, and firmly cemented together. Its thickness, measured in the rock shaft in the Kimberley mine, did not exceed ten feet. This band has been styled by Professor A. H. Green the basement conglomerate of the Kimberley shales, and it is assumed by Mr. E. J. Dunn to be of the same origin as the Dwyka conglomerate belt on the northern base of the Zwarte Berg and Witte Berg mountains, forming the southern boundary of the old lake basin. He holds that this conglomerate is a glacial deposit marking the shore line of the ancient lake.


FORMATION OF THE DIAMOND

Below the conglomerate is a very hard amygdaloidal rock, called melaphyre by M. A. Moulle,\(^1\) which was finally determined by Dr. Stelzner\(^2\) to be olivine diabase. Its mineral composition is the same as melaphyre,—plagioclase, augite, and olivine, but one is granular and the other porphyritic. It is about four hundred feet in thickness and is very hard. Underlying the melaphyre is quartzite, about seven hundred feet thick, with quartz porphyry below it, the thickness of which is undetermined. The Kimberley rock shaft has passed through one thousand feet of it, and the bottom of the shaft is still in the same formation. All these strata lie nearly horizontal, but dip slightly to the southeast. They are graphically presented in the sectional views of the rock shafts of the several mines shown on page 120.

Through these layers of rock extend from an unknown depth the huge pipes containing the diamond-bearing deposits, or blue ground, which is a breccia filled with fragments of shale and other minerals. These immense funnels are obviously extinct craters filled with volcanic mud from below. All evidence to hand points to an aqueous formation, and the upheaval is shown by the upturning of the enclosing shales at various places in contact with the blue ground.\(^3\) Many boulders are found in the blue ground of the same composition as the surrounding rock, but others have undoubtedly come up from greater depths than have yet been reached by the sinking of shafts. It is, however, highly remarkable that there was almost no apparent overflow in the filling of these craters, for the diamond-bearing ground is either level with the surrounding surface, or rises, usually, only a few feet above it in koppies or hillocks. Outside of the mouths of the craters no diamonds have been found except at Dutoitspan, where the upheaval formed quite a hill, and some diamonds have been taken from the surrounding ground within a few yards from the margin of

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\(^2\) Dr. A. W. Stelzner, Professor of Geology at the Freiberg Mining Academy.

\(^3\) Still to be seen at De Beers Mine.
the mine. It is also evident that the mines were not all filled with the same material at one and the same time. Each mine has its distinctive characteristics, and even in the same mine all the blue ground does not seem to have been forced up at one time. This is particularly demonstrated by the striking fact that, in both De Beers and Kimberley mines, the west side blue ground is wholly unlike the other portions of the mines, and carries fewer diamonds, and these are unlike the diamonds that are found in other parts. The blue ground which filled the west ends of these mines must have come up first, filling the whole crater. Afterward there was a second upheaval which filled the eastern parts of the craters with a richer deposit. The reason why the west end was not mixed with the better blue ground was because the west end parts of the mines formed benches, and were not vertically above the second boiling mass. Mr. Rhodes suggested this solution, and I quite agree with him. This peculiarity is noticeable in the other mines.

The composition of the blue ground, which is the principal filling of the volcanic pipes, has been carefully determined by
Dr. Stelzner. This ground, he says, must be designated as a breccia. Most of the small or large angular-edged or rounded fragments of this breccia are composed of a green-black or blue-black serpentine-like mass. Fragments of rock which are found in the karroo formation, such as sandstone, shale, and diabase, are to be found in the blue ground. There are also other rocks in the shape of boulders of greater or less size, which are not known in the karroo formation, and have doubtless come from a much greater depth than the karroo beds, possibly from rocks upon which these beds lie. The mass of blue ground consists of olivine more or less changed by oxidation, with the following minerals: chromic diallage, bronzite, pyrope containing chromium, flesh-colored zircons (locally called Dutch boar), cyanite, biotite, chrome, titanium, and magnetic iron, and also small crystals of perofskite.

In the Jagersfontein blue ground corundum is said to have been found. This was for a time held to be cordierite. The existence of small crystals of tourmaline and rutile is also reported. Professor J. G. Lawn, Kimberley School of Mines, reports that he discovered rubies and sapphires of inferior quality in the Frank Smith mine near Kimberley. Iron pyrites and barytes are found in the deposit resulting from washing the blue ground. The pyrites come from the country rocks, and become mixed with the diamond-bearing ground during the process of mining. The barytes is a secondary formation of small veins in the blue ground, or at its junction with the country rock. Beautiful crystals of doubly refracting or Iceland spar are occasionally found also near the junction of the blue ground and the rock.
In Professor Lewis's discussion of the genesis of the diamond in 1886, he designated the blue ground variously as "dunite porphyry," "Saxonite porphyry," and "diamantiferous peridotite." His application of the term "Kimberlite," now generally accepted by geologists, first appears in his paper of the following year, 1887, at the British Association meeting at Manchester. Dr. Stelzner thought this name should be adopted as concisely covering "a porphyritic volcanic peridotite of basaltic structure.

In the mass of diamond-bearing blue ground in De Beers mine there is a curious dyke of igneous rock which extends from the southeast part of the mine around the east and north sides, and is lost in the unexplored poor blue ground of the west. Owing to its taking a serpentine course across the mine, it has received the local name of "snake." The upper end of this snake is at or near the surface, and the body extends down to the lowest workings. It does not adhere to the blue ground, and is very easily separated from it. It stands like a vein, nearly vertical, varying in thickness from two to seven feet. No diamonds have been found in it, yet Dr. Stelzner's investigations show that its composition is substantially the same as the surrounding breccia. It was difficult to obtain slides of the blue ground for microscopical observations and comparison, but after many trials Dr. Stelzner succeeded in getting a few sections which revealed these interesting facts:

"The main body of the blue ground is entirely analogous to the snake rock, naturally more decomposed, but in essential points the microscopic features 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."  

1 "The Matrix of the Diamond," Henry Carvill Lewis, M.A., F.G.S., Professor of Mineralogy in the Academy of Natural Sciences, Philadelphia, U.S.A., at meeting of British Association at Manchester, August and September, 1887.  
2 Letter of Dr. Stelzner addressed to Gardner F. Williams.
PIECE OF BLUE GROUND,
Showing Diamond embedded in it.
On the 1000-foot level of Kimberley mine a tunnel driven in the quartzite outside the margin of the mine shows several dykes of similar rock. Wherever these dykes exist there is a considerable quantity of water at the junction of the dykes and quartzite.

There was a large mass of country rock in De Beers mine, which in the upper levels covered several claims, or approximately an area of 3000 square feet. It continued down to a depth of about 750 feet. It was an olivine diabase, and was the same as the amygdaloidal rock, except that it was filled with numerous veins of zeolites. The "Island," as it is called, was a gigantic horse of country rock embedded in blue ground, and has disappeared in depth. Islands of the same rock appeared in the Kimberley mine near the surface and at a depth of 1200 feet, and near the surface in Dutoitspan, Bultfontein, and Premier mines, where they have been left standing as the blue ground which surrounded them has been removed, and form huge islands in a sea of blue ground, which are locally known as Mount Ararats.

Floating shale appeared at or near the surface of the mines and covered many claims. This was originally volcanic mud, and it contained no diamonds. It gradually became smaller in depth, and has disappeared in the lower levels.

In the early descriptions of the mines fossil wood and plants are reported to have been found in the blue ground. I am of the opinion that these came either from the shale surrounding the craters, which was constantly falling into the open mines, or from the pieces of shale which became embedded in the blue ground at the time the craters were filled. The only fossils which have been found in the mines since they have been under my management are the fish which are shown in the illustration on page 126. They are embedded in sandstone which was found on the 185-foot level of Premier mine.¹

The surface shales and basalt surrounding the pipes are called reef, and the masses of shale and igneous rocks, scattered through the blue ground in the upper levels of the mines, are commonly spoken of as floating reef.

¹ A fossil lizard has since been found, see illustration, p. 118. See Appendix VII.
After careful microscopical observations, Dr. Stelzner and others have reached the conclusion that the blue ground is of volcanic origin, and was forced up from below. This conclusion accords with the opinion which I formed of the origin of the diamond-bearing deposit, during my visits to the Diamond Fields in 1884 and 1885. I then thought that the filling of the pipes was due to aqueous rather than igneous agencies, possibly to something in the nature of mud volcanoes.

The Genesis of the Diamond

The chemical composition of the diamond has long been determined, at least approximately. Sir Isaac Newton conjectured it to be of vegetable origin and combustible, but it was not until 1694 that Newton's assumption of its combustibility was actually proved by the famous burning glass experiment of the academicians of Cimento, at the prompting of the Grand Duke Cosmo III.

Lavoisier, Guyton de Morveau, and others practically determined, later, that the burning of a diamond with a free supply of oxygen converted it into carbon dioxide; and, finally, the experiments of Sir Humphry Davy, in 1816, showed that the diamond was almost entirely pure carbon. Davy's conclusions

1 See Appendix VII.
A Thin Section of Diamond-bearing Rock (enlarged 3½ Times) from the 1320-Foot Level of the De Beers Mine.

*By kind permission of Sir William Crookes.*
have been confirmed by Dumas, Stas, Friedel, Roscoe, and other eminent chemists, apparently fixing with extreme precision the chemical composition of the diamond. It is, however, noteworthy that the diamond is a non-conductor of electricity, while graphite and amorphous carbon, substances so closely similar in chemical composition, are good electrical conductors. By the application of friction the diamond can be positively electrified, but Streeter says that it loses its electricity completely in the course of half an hour.¹

So much, it may be claimed, we know; but the process of the formation or crystallization of the diamond carbon is still uncertain. The proofs are most conclusive that the diamonds in the South African mines were not formed in situ, but have come up from below with blue ground. The frequent occurrence of broken crystals embedded in the blue is sufficient evidence that the diamonds are not in their original place of crystallization, for it is impossible for nature to produce a fragment of a diamond.

The late Dr. W. Guybon Atherstone, F.G.S., whose identification made known the first diamond of the South African Fields, presented his theory at a meeting of the South African Geological Society, as follows:

“The succession of the strata in the Kimberley mine is precisely the same as that of the lacustrine sedimentary beds, beginning from the quartzite base of the carboniferous rocks and shales, through the ecca and karroo formation, the coal-bearing shales of the Stormberg, to the dolerite, capping and protecting the surface, as proved by the rock shaft recently sunk out of the influence of the Kimberley mine to a depth of one thousand feet, where a thickness of four hundred feet of amygdaloidal lava with the trappean ecca conglomerate above it represents the prevailing rocks of the Vaal, Riet, and Orange rivers for a great distance below Hopetown. Incredible as it was deemed at the time, my story of the small rounded river stone which fell out of the unsealed letter placed in my hands by the post-boy, has since

¹ “Precious Stones and Gems,” p. 58.
proved to have been the key that has unlocked the vast underground wealth of South Africa.

"The story I have now to tell of its birthplace and subsequent history will, I know, appear still more incredible, as fabulous indeed as was that of Sindbad, the Arabian voyager, who, with the talisman and magic lamp of Aladdin the Seer, unlocked the caverns of Africa's fairy land, and viewed in prophetic vision the vast stores of buried treasures,—gold, diamonds, and other gems,—just as we see them now with our magic electric lamp a thousand feet down in the dark recesses of the extinct volcano, yielding millions of the purest gems upon earth.

"How came the diamond there in its hard blue matrix of ashes and lava, with its accompanying gems,—garnets, rubies, sapphires, agates, and other gems,—the products of solution and

Irregular Crystallization of Diamonds.

heat? For a substance to crystallize, its molecules must be free to move under polarizing and other metamorphic forces influencing crystallization; but the diamond we know is neither soluble nor fusible. It is the element carbon crystallized, and is consumed by heat. How, then, could it survive as a crystal in the crater of a volcano?

"The key to solve this mystery was placed in my hand over half a century ago, by one of the greatest philosophers of the
age, whose lectures I had the privilege of attending. But it was not until I had examined a diamond mine in South Africa and speculated upon the apparently irreconcilable phenomena attendant upon the origin of the diamond in its matrix, that the practical application of Faraday's discovery began to dawn upon me.

'Hold out your hand,' said he, at the close of the lecture that fairly electrified the world of science, as with a loud hiss a snowy substance, burning like a coal but in reality intensely cold, escaped into the palm of my hand from the strong iron vessel in which, with a pressure of fifty atmospheres, he had liquefied carbonic acid gas—the very gas resulting from the combustion of the diamond, consisting of one atom of carbon and two of oxygen.

'I have shown that the sedimentary beds deposited from this vast freshwater lake attained a thickness of about eight thousand feet. The lake itself, therefore, probably equalled that depth. (?) Now the experiments of Wyville Thomson and Carpenter, made during the voyage of the Lightning and the Porcupine, proved that at a depth of three to four hundred fathoms, the pressure is equal to half a ton on the square inch; at a mile to one hundred and fifty-nine atmospheres, and at seven thousand feet it amounts to two hundred atmospheres, or four times the pressure under which Faraday liquefied carbonic acid gas, the temperature at such great depths being very few degrees above freezing point. In the carbonic acid gas generated from the carbonaceous shales by heat, and interspersed as gas bubbles in the cavities of the viscid, ferruginous amygdaloid, and in the admixture of steam, lava, and ashes known as the 'Kimberley Blue'—reduced to the liquid state by the enormous pressure in the subaqueous volcano—we
have the constituents of the diamond in a form admitting of crystallization, and the subsequent absorption of its oxygen by the iron always present in its containing walls during long intermittent periods of volcanic inactivity. There are proofs in the Kimberley mine that such alternating periods of activity and repose have occurred at long intervals, as shown by the four or

five distinct and separate layers of diamonds lining its walls, of varying size and quality, known and recognizable by diamond buyers.”

In this presentation, which Dr. Atherstone seemingly regarded as conclusive, there is a lack of the clear, logical reasoning which in other discussions has distinguished his views. He dogmatically puts the carbonic acid gas evolved from the car-
bonaceous shales into cavities of the amygdaloidal rock which lies outside of the volcanic pipes. Then he reduces this gas by enormous pressure to a liquid state, and, having gotten it into a form, as he thought, admitting of crystallization, he absorbs the oxygen of the carbonic acid by the iron in the containing walls of the craters. Now, as a matter of fact, there are no cavities in the amygdaloidal rock underlying the shales, for all interstices are filled with silica in the form of agates, or with calcite. Furthermore, if carbonic acid had been left in the olivine diabase to crystallize, then the resultant diamonds would have been enclosed in this formation, which is also contrary to fact, for no diamonds have ever been found in the amygdaloidal rock. His main contention, too, is the derivation from the shales of the carbon necessary for the formation of diamonds. It will be made clear, subsequently in this discussion, that this assumption is not justified.

The late Henry Carvill Lewis, M.A., F.G.S., Professor of Mineralogy in the Academy of Natural Sciences, Philadelphia, U.S.A., advanced the proposition that the diamond is the result of the intrusion of igneous rocks into and through the bonaceous shales, and the crystallization of the carbon throughout the rocks, as it cools, from hydrocarbon, distilled from the shales that had been broken through.1

In support of such a theory, it is claimed that the diamonds in the various mines or pipes have different characteristics. It is quite true that large parcels of diamonds from the various mines have distinctive characteristics, and it can be easily told from which mine a parcel of diamonds comes; but it is very difficult to tell in which mine a single stone may have been found, though each mine has stones in a great measure peculiar to itself. Some observers claim that the broken diamonds which are extracted are broken during the process of winning them. It is admitted that diamonds may be broken in the process of mining and the subsequent operations of winning, but these cases are exceptional. Fragments of diamonds are very frequently found embedded in the blue ground, and there

1 "The Matrix of the Diamond," Professor Henry Carvill Lewis.
is no doubt in the mind of any one who has had practical experience in finding these fragments that they were not crystallized where they are found. The fact that no diamond has ever been found embedded in the shale itself strikes one as conclusive proof that Professor Lewis's theory is wrong.

Diamonds of Irregular Forms.

Again, would not the intrusion of an igneous rock through carbonaceous shales have altered these shales in the vicinity of the igneous rock? There is, however, no difference that can be detected between the shales at the junction of the pipe and at a distance of one thousand feet. Moreover, would not the fragments of shale enclosed in the blue ground have changed, and have lost the carbon which they contain, if diamonds were formed from them? One sees no difference between the shale which forms the country rock, and the fragments embedded in the blue ground. If such a theory as is attributed to Professor Lewis by Mr. Kunz had a shadow of foundation, it is dispelled by the occurrence of diamonds in the Jagersfontein mine in the Orange Free State, some eighty miles from Kimberley. The rocks surrounding this mine are gray shale from the surface to the depth of twenty feet, and then basalt as far as developed. It is apparent that no carboniferous shales ever existed here, or
were denuded before the formation of the diamond-bearing pipe. If such denudation had taken place after the filling of the pipe with a diamond-bearing matrix, the alluvial deposit of the country surrounding this mine must contain diamonds, but no such discovery of diamonds has been made.

Jagersfontein is not the only diamond-bearing pipe that has produced diamonds without having bituminous shale as a country rock. Other pipes or veins have been found both in the Free State and the Transvaal, which are, however, of little commercial value, owing to the small quantities of diamonds found in them, but they are most useful in refuting existing theories, if not in the determination of the genesis of the diamond.

An important contribution to this discussion was made by Professor Molengraaff, state geologist of the South African Republic, in a monograph on the diamonds at Rietfontein in the Transvaal. He stated that "the diamond-bearing breccia on the farm was of the same nature as the well-known blue ground of the Kimberley mines. The geological position of the volcanic chimney at Rietfontein was very different from that of the other diamond pipes in South Africa. The latter, of course, all occurred in a higher or lower horizon of the karroo formation, whereas the chimney at Rietfontein seemed to occur in the upper parts of the Pretoria beds in a system of strata overlying the Magaliesberg quartzite. If that position, which was almost certain to his mind, was proved to be correctly determined by a later and more careful geological survey of the surrounding country, this fact would be of high importance in the discussion of the genesis of diamonds. Of the different theories regarding this genesis he would only mention three principal ones.

"He would take up first the theory agitated by Messrs. Stanislas Meunier,¹ M. Chaper,² and in a somewhat modified form

FORMATION OF THE DIAMOND

lately by Professor Garnier. They denied the igneous origin of the blue ground and the diamonds in it, and considered the blue ground to be a kind of mud, or peculiar alluvial deposit, which had been forced up by a hydrostatic process. That theory, to his mind, had already been proved untenable by several eminent geologists. The two remaining theories agreed as far as the igneous origin of the blue ground. According to one of these, the diamonds belong to the primary constituents of the eruptive rock itself, and had crystallized at a great depth under very high pressure and high temperature, before an eruption of an explosive character brought the igneous rock to the earth's surface.

"According to the second theory, which was discussed by Mr. Harger at a meeting of the Geological Society of South Africa, the diamonds were formed in the blue ground, during its ascension, from carbon borrowed from the carbonaceous shales through which the eruptive rock forced its way. Now, that theory, although rather weak in his opinion, had been maintained, hitherto, mainly because the geological position of the known diamond pipes was such that it could be proved, or, at least, be accepted as very probable, that the blue ground had forced its way through carbonaceous strata. The discovery at Rietfontein deprived that theory of its strength. As already pointed out, the chimney at Rietfontein was found in the upper Pretoria beds. But in the Pretoria beds, as well as in the formations underlying these, strata containing any notable quantities of carbon were nowhere to be found in the Transvaal; so that the conclusion might safely be drawn that the igneous blue ground, in forcing its way from great depths toward the place where it was found, could not borrow any carbon from the surrounding strata in order to convert it into diamonds. The discovery at Rietfontein might afford a valuable argument in favor of the formation of diamonds as a primary constituent in breccia, or ultrabasic magma at great depth, and geologists were entitled to derive from it an argument in favor of the following more general thesis: 'The element carbon, under the conditions of heat and pressure ruling at great depth in the interior of the earth,
can only exist and crystallize in the modification called diamonds.' This thesis was, of course, in perfect harmony with the latest scientific discoveries, especially with the famous experiments of Moissan."
FORMATION OF THE DIAMOND

It was the opinion of the late Dr. Stelzner that the diamond was crystallized at great depths and came up with the magma or matrix. The following liberal translation from a lecture delivered by Dr. Stelzner before the Isis Society in Dresden on April 20, 1893, gives the views of this celebrated geologist:

"Before I give my own opinion, may I be allowed to recall three well-known geological facts: first, that various minerals which compose many of the eruptive rocks, for instance the olivine of certain basalts, contain liquid carbonic acid, and we must come to the conclusion that the molten magma under some circumstances must have been impregnated with carbonic acid; second, that the blue ground of Kimberley, as already mentioned by Lewis, has a known resemblance to many meteorites; and, third, that a modified form of carbon, besides graphite, similar to the diamond, has been met with recently in meteorites.

"If we take these three facts into consideration, and also remember that in most of the localities in which diamond-bearing alluvial deposits appear (Ural, India, Borneo, New South Wales, and in the United States), serpentine (especially peridotite) is to be found, we come to the conclusion that the carbon of the diamond itself crystallized when this molten mass, rich in magnesium silicate, became cool. In support of this opinion we find that in some instances diamonds and garnets (pyrope) are found together, showing that they have the same origin."

For the illumination of the problem of the formation of diamonds the experiments of Mr. J. B. Hannay of Glasgow, Professor Dewar, and M. Moissan, and later of Sir William Crookes, are of the greatest interest to the scientific world.

The conversion of a diamond into graphite was effected by Professor Dewar, publicly, in London, as far back as 1880. Sir William Crookes repeated the same experiment in a lecture at the Royal Institution of Great Britain, on June 11, 1897, by placing a diamond in the electric arc where the temperature was 3600° C., when it was converted into graphite.

Among the first attempts to make artificial diamonds may be mentioned that of Mr. J. B. Hannay of Glasgow, who com-

1 See Appendix VIII.
menced his experiments in 1879, and after many trials, some of which resulted in violent explosions, he is said to have succeeded. The method adopted by Mr. Hannay is described as follows:

"A tube twenty inches long by four inches in diameter was bored so as to have an internal diameter of half an inch. In the tube was placed a mixture of ninety per cent of rectified bone oil, and ten per cent of paraffin spirit, together with four grammes (about sixty-two grains) of the metal lithium. The open end of the tube was welded air-tight, and the whole mass was heated to redness for fourteen hours; on opening it a great volume of gas rushed from the tube, and within was a hard, smooth mass adhering to the sides of the tube. It was quite black, and appeared to be composed of iron and lithium, but on a closer inspection small transparent pieces were found embedded in it. The mass was dissolved, and the small transparent pieces proved to be 'crystalline carbon,' exactly like diamonds but almost microscopical.

"Out of eighty complex and extensive experiments only three succeeded. Violent explosions were frequent, steel tubes burst, scattering their fragments around, and furnaces were blown up. 'The continued strain on the nerves,' writes Mr. Hannay, 'watching the temperature of the furnace, and in a state of tension in case of an explosion, induces a nervous state which is extremely weakening, and when the explosion occurs it sometimes shakes one so severely that sickness supervenes.'"

Sir William Crookes attributes the possibility of making artificial diamonds to the facilities afforded by the enormously high temperatures which are obtainable in recent years by the introduction of electricity. While electricity has, no doubt, played an important part in the scientific researches during the last decades of the nineteenth century, Mr. Hannay's experiments would indicate that it is not absolutely essential to have enormous temperatures or pressures to produce artificial diamonds. Still, Sir William Crookes shows that by means of these high temperatures substances such as carbon obey the

1 Glasgow News.
common laws which govern other substances, and can be made volatile and fusible under certain conditions. He has demonstrated that the temperature necessary to volatilize pure carbon is about 3600° C., and that it passes into the gaseous state without liquefying, and he infers that, if sufficient pressure were applied with the high temperature, liquid carbon would be produced which upon cooling would crystallize in diamonds. For this product the absence of oxygen is absolutely necessary, as the carbon would readily unite with it in the form of carbonic acid. It is a well-known fact that iron when melted dissolves carbon, and while Moissan discovered that other metals effect this dissolution, he found that iron was the best solvent.

Sir William Crookes went through the process of producing diamonds before the eyes of his audience, but was only able to show them the result of this experiment by reproducing a lantern slide of microscopical diamonds which he had made in the same way previously, for it takes a fortnight to separate them from the iron and other substances in which they are embedded. The scientific principle upon which this experiment rests, according to Sir William Crookes, is that molten iron absorbs carbon, and as iron increases in volume as it passes from the liquid to the solid state, if the outer crust of the iron is suddenly cooled and the centre remains in a liquid state, the enormous pressure caused by its expanding while cooling affords the two factors necessary for the crystallization of the diamond — heat and pressure.

Authorities differ somewhat as to the exact moment when molten iron expands on cooling, but it is the generally accepted theory that expansion takes place at the moment of solidification. It is also a well-known fact that shrinkage or contraction takes place as the solidified metal cools. It is therefore possible to obtain enormous pressure in the molten centre of a casting by the contraction of the outer shell which has been rapidly cooled and the expansion of the inner mass just as it begins to solidify.¹

Sir William Crookes says further, that it has been "conclusively proved that the diamond's genesis must have taken place at great depths under enormous pressure. The explosion of large diamonds on coming to the surface shows extreme tension." According to my own experience, a diamond never explodes. Light brown, smoky diamonds often crack on exposure to the dry air, but they will remain intact if kept in a moist place. The cracking is, therefore, more probably the result of heat or drying than of tension or inward pressure. It is possible, however, that the greater heat to which the diamond is exposed when brought to the surface may expand contained gases sufficiently to crack the stone.

Sir William holds the same view of the formation of the diamond-bearing pipes which I suggested at the time of my visit to the Diamond Fields in 1885,¹ — that these pipes were volcanoes which were filled with the mixture which they now contain while it was in the form of mud. My reasons for this theory are fully set forth upon another page. Continuing in his lecture, Sir William says: "The ash left after burning a diamond invariably contains iron as its chief constituent, and the most common colors of diamonds when not perfectly pellucid show various shades of brown and yellow from the palest 'off color' to almost black. These variations accord with the theory that the diamond has separated from molten iron."

I have a collection of diamonds of all colors (see frontispiece, Vol. II), and recently made exhaustive tests in order to ascertain whether they contained any iron either in the metallic or oxidized state. These experiments were made upon a magnetic separating machine, the field magnets of which attracted any mineral which contained iron in a metallic or oxidized state. Although some of these diamonds had the appearance of being coated with iron in some form, and others were colored dark brown and deep yellow, they were in no way attracted by the magnet even when excited by a strong electrical current. These

¹ Transactions of the American Institute of Mining Engineers (October meeting, 1886), Vol. XV, pp. 392-417.
experiments do not, perhaps, disprove the existence of iron in the diamond, but they do establish the fact that, if iron does exist in an oxidized state, the quantity is infinitesimally small.

One more theory of the deposit of diamonds in the South African fields is deserving of special mention, more for the purpose of showing to what heights of imagination the human mind may soar, than for any scientific value it may have. This is an assumption that the diamond deposits came from a fall of meteors, "a direct gift from heaven," and was first advanced to notice, it is said, by Meydenbauer. Such a theory seems highly fantastic and is the most improbable of all. The occasional inclusion of black diamonds in meteorites is well attested, but these occurrences are very far from accounting for the formation of the South African diamond-bearing deposits. "Bizarre as such a theory may appear," says Sir William Crookes, "I am bound to say there are many circumstances which show that the notion of the heavens raining diamonds is not impossible." The "Ava" meteorite which fell in Hungary in 1846 contained graphite in cubic crystalline form which G. Rose thought was produced by the transformation of diamonds. Later Weinschenk found transparent crystals (diamonds) in the Ava meteorite.

Since it became known that diamonds (infinitesimally small, it is true, but nevertheless diamonds) occur in meteorites, a general search has been made for the minute crystals in meteorites from Australia and Russia, and from Cañon Diablo, Arizona, and diamonds and graphite have been found.¹

From the above facts and from observations which Sir William Crookes made at Kimberley, he concludes that the genesis of the diamonds found in the South African mines was by crys-

¹ Sir William Crookes's lecture.
tallization of pure carbon in molten masses of iron which form a part of the internal regions of the earth.¹

The theory that the diamonds must have crystallized in a matrix of iron is not new. That small diamonds have been produced in this way there is no doubt, and in the absence of further proof to the contrary one might assume that such was the origin of the diamond. Iron in the form of magnetite and other similar minerals forms a considerable part of the concentrates from the washing machines; but all proof that these minerals, which may have been derived from metallic iron by oxidation, were the matrix in which the diamonds originally crystallized is wanting. As a matter of fact, I am positive that neither the iron nor, as others have asserted, the olivine found with the diamonds is the original matrix of the diamond; and my assurance rests upon the fact that no diamonds, however small, have ever been found in the iron combination, or in the other minerals which accompany them, although these concentrates have passed daily under the eyes of hundreds of keen-eyed sorters for more than thirty years, and thousands upon thousands of tons have been looked over, not once, but at least four times. The pieces of the iron minerals and especially of the olivine are often very large, quite large enough to contain diamonds weighing several carats, which in many cases would have been exposed to view had these minerals been the original matrix. We must, therefore, look to other sources for the genesis of the diamond. I have been of the opinion that diamonds crystallized in very much the same way as quartz or other minerals, but under peculiar circumstances possibly of pressure and heat. Professor Crookes states that diamond crystals are almost invariably perfect on all sides. As a rule this is the case. Quartz crystals have been found which have been formed without any attachment to other substances, that is, with both ends showing pyramidal facets. The same formation may be seen in a great many other minerals, and this is usually a characteristic of the diamond, but diamonds are found which have been crystallized with some portion of the surface resting upon or adhering to some other

¹See Mr. George Friedel's experiment, Appendix VIII.
FORMATION OF THE DIAMOND

substance. The several reproductions of the various forms and sizes of diamonds will give the reader some idea of the eccentricities of these stones.

The experiments of Herr W. Luzi of Leipsic in the production of artificial figures of corrosion on rough diamonds are of exceeding interest in the light which they throw on the crystallization and the probable matrix and genesis of the diamond.

Until lately the only appearance of chemical corrosion upon the surface of rough diamonds was the regular, triangular, negative pyramids, which were produced through heating the diamonds in the open air, or under oxygen flame. Herr Luzi has succeeded in producing different and peculiar kinds of figures. He discovered that the breccia from the South African diamond mines (that is, the matrix or blue ground), when in a molten condition, possesses the property of absorbing the diamond or of changing its shape.

He describes his experiment as follows: A small quantity of blue ground was melted in a crucible placed in a Fourquinon-Leclerq furnace at a temperature of 1770° R., which was the highest temperature attainable. A diamond with perfectly smooth natural faces was submerged in this molten mass. A further quantity of blue ground was then added to the contents of the crucible until it was completely filled. A tightly fitting cover was placed on the crucible, which was placed in the furnace and again exposed for thirty minutes to the greatest heat attainable. When the crucible was cooled the diamond was removed and found to be

1 "Artificial Figures of Corrosion on Rough Diamonds," Berichte der Deutschen Chemischen Gesellschaft, 1892.
covered with irregular oval and half-round grooves of various depths. In one experiment, the diamond was found to be deeply eaten away on one side, so that the depression nearly penetrated through the stone.

Diamonds thus magmatically corroded have a similarity, as regards the appearance of the corrosion, to hornblende and kindred materials. A small spot or scar was, at times, found at the bottom of a large indent. The diamonds were usually found, after the experiments, to be blackened, or covered with a red coating, which proved to be oxide of iron.

Diamonds of Irregular Forms.

Some of the diamonds showed little black or greenish black balls located exactly in the centre of the holes. The formation of the balls is doubtless connected with the creation of the grooves. These little balls are magnetic, and when treated with hydrochloric acid, in which they are only partly soluble, they evolve a gas.

The quantity of these balls was too limited to permit of any very exact investigation of their nature. Herr Luzi presumes that they are transformed diamond-carbon, i.e. a different modification of carbon, which contains either oxide of iron or metallic iron reduced out of the oxide. He was, however (owing to the
cost of the material to be experimented upon), unable to determine positively what chemical action took place during the time the diamonds were heated in the complicated silica flux. Some of these partly absorbed diamonds, upon which Herr Luzi experimented, are deposited in the mineralogical museum of the Leipsic University.

Herr Luzi further remarks that perhaps other molten silica combinations, or those of a similar nature to the blue ground, may have the same power of attacking the diamond.

The knowledge that diamonds can be absorbed by a silicate magma makes one inclined to investigate further the genesis of the diamond, which many claim was formed under great heat and pressure. If such was the genesis of the diamond, Herr Luzi's experiments would indicate that the original matrix was not a silica combination.
such as the present blue ground. They tend to prove, rather, the theory, which I advanced more than sixteen years ago, that the blue ground which contains the diamond owes its formation, as it at present exists, more to aqueous than igneous agencies. If the diamond is unable to withstand the corroding influence of the silica magma at the comparatively low temperature given above, — how could it possibly have retained its forms of crystallization and perfect faces at the far higher temperature and pressure which must have existed under the volcanic or igneous theory?

It seems a pity that Herr Luzi did not state the exact weight of the diamonds upon which he experimented both before and after his experiments. The burning or absorption of the diamond in its matrix would be a strong argument against the diamond having been crystallized in situ, or that it came up in its present matrix when such matrix was in a molten state. If a diamond, subjected in its own matrix or magma in an ordinary graphite crucible to a temperature of 1770° R., changes its shape and appearance as described by Herr Luzi, — could it be expected that many diamonds in our mines should be found perfect in shape, without a flaw or spot, and with clear, transparent sides, so smooth that they have the appearance of having been polished? Nevertheless, such is the appearance of nearly all South African diamonds. It would seem from the evidence brought forward that only one conclusion is possible, namely, that the blue ground in its present state is not the magma of the diamond. What the original magma or matrix was is unfortunately far less certain. Some years ago a diamond, weighing 28½ carats, was found at Kimberley. The external surface of the diamond was smooth and crystallized, showing no other mineral except the diamond itself. The interior of the diamond was white, but not transparent, and, owing to its peculiar appearance, the valuator broke the stone in order to satisfy his curiosity. The result of the breaking is shown in the full-size illustration on page 147. A small perfect octahedral diamond was enclosed in the centre of the larger diamond. Nor was this all. There were flakes of a white mineral, not diamond, attached to
the fragments of the broken diamond. A few grains of these were collected and analyzed by Professor Lawn, of the Kimberley School of Mines. In appearance the flakes were white, translucent, and crystalline, and about as hard as the steel blade of a knife. When heated in a closed tube, moisture was given off. The mineral was very slightly effervescent, probably due to a trace of carbonate of lime. It fused readily on platinum wire to a white bead.

The mineral was determined to be apophyllite, a silicate of lime and potash with 16 per cent of water. If a mineral, which is fusible at the ordinary temperature obtained with a blowpipe, and which contains 16 per cent of water, was formed at the same time the diamond crystallized, it is certain that this did not take place under the condition mentioned above, i.e. under enormously high temperature. How, then, one may ask, did the apophyllite become a part of this stone?

Von Tschudi describes a beautiful crystallized Brazilian dia-
mond, in the centre of which is a little gold leaf. He had the information from Dr. Mills Franco, who maintained that there was no deception in its being gold. Occurrences of this nature tend to veil the genesis of the diamond in still further mystery.

Professor T. G. Bonney lately obtained specimens from the Newlands mines, some forty miles northwest of Kimberley, of a coarsely crystalline rock studded with garnets, technically "holocrystalline allied to eclogites," which were embedded, as he says, in typical blue ground. In this eclogitic rock he found a number of small but perfectly formed diamonds. At a meeting of the Royal Society in July, 1899, he presented his conclusions: "The blue ground is not the birthplace, either of the diamond or of the garnets, pyroxenes, olivine, and other minerals, more or less fragmental, which it incorporates. The diamond is a constituent of the eclogite, just as much as a zircon may be a constituent of a granite or a syenite.

"Though the occurrence of diamonds in rocks with a high percentage of silica (itacolumite, granite, etc.) has been asserted, the statement needs corroboration. This form of crystallized carbon hitherto has been found only in meteoric iron (Cañon Diablo), and has been produced artificially by Moissan and others with the same metal as matrix. But in eclogite the silica percentage is at least as high as in dolerite; hence it is difficult to understand how so small an amount of carbon escaped oxidation.

"I had always expected that a peridotite (as supposed by Professor Lewis), if not a material yet more basic, would prove to be the birthplace of the diamond. Can it possibly be a derivative mineral, even in the eclogite? Had it already crystallized out of a more basic magma, which, however, was still molten when one more acid was injected and the mixture became such as to form eclogite? But I content myself with indicating a difficulty and suggesting a possibility; the fact itself is indisputable: that the diamond occurs, though rather sporadically, as a constituent of an eclogite, which rock, according to the ordinary rules of inference, would be regarded as its birthplace.

1 "'Travels in South America,'" by J. J. von Tschudi.
FORMATION OF THE DIAMOND

"This discovery closes another controversy, viz., that concerning the nature of the 'hard blue' of the mines (kimberlite of Professor Lewis) in which the diamond is usually found. The boulders described in this paper are truly water-worn. The idea that they have been rounded by a sort of 'cup and ball' game played by a volcano may be dismissed as practically impossible. Any such process would take a long time, but the absence of true scoria implies that the explosive phase was a brief one. They resemble stones which have travelled for several miles down a mountain torrent, and must have been derived from a coarse conglomerate, manufactured by either a strong stream or the waves of the sea from fragments obtained from more ancient crystalline rocks.

"The presence of water-worn fragments, large and small, in considerable abundance, shows the blue ground to be a true breccia, produced by the destruction of various rocks (some of them crystalline, others sedimentary, but occasionally including water-worn boulders of the former), i.e. a result of shattering explosions followed by solfataric action. Hence the name Kimberlite must disappear from the list of peridotites, and even from petrological literature, unless it be retained for this remarkable type of breccia.

"Boulders, such as we have described, might be expected to occur at the base of the sedimentary series, in proximity to a crystalline floor. The karroo beds in South Africa . . . are underlain in many places by a coarse conglomerate of considerable thickness and great extent, called the Dwyka conglomerate, which is supposed to be Permian or Permo-carboniferous in age. It crops out from beneath the karroo beds at no great distance from the diamond-bearing district and very probably extends beneath it. If this deposit has supplied the boulders, the date of the genesis of the diamond is carried back, at the very least, to Palæozoic ages, and possibly to a still earlier era in the earth's history."

I cannot accept the contention that the boulders came from any strata through which the pipes have been formed, unless these strata lie very deep and below the quartz porphyry.

The conglomerate which lies between the shale and melaphyre is only a few feet thick, ten to fifteen at most, and does not contain large boulders such as are found in the blue ground; besides, the quantity of boulders or conglomerate which could have been contained in the area of the mine would not have supplied the amount of stones already found in the blue ground. These must, therefore, have come up from below with the diamond-bearing ground. If the boulders came from the Dwyka conglomerate, it must lie very deep beneath the surface, for nothing of the kind has been found at a depth of over twenty-one hundred feet.

Professor Bonney says above that the statement of the occurrence of diamonds in itacolumite\(^1\) needs corroboration. There is no doubt in my own mind that diamonds in Brazil have been found in itacolumite, and the consensus of opinion is that it is not the original matrix, but that the diamonds were washed from their volcanic origin and became bedded in this sandstone when it was being formed.

I have been frequently asked, “What is your theory of the original crystallization of the diamond?” and the answer has always been, “I have none; for after seventeen years of thoughtful study coupled with practical research I find that it is easier to ‘drive a coach and four’ through most theories which have been propounded than to suggest one which would be based upon any more unassailable data.” All that can be said is that in some unknown manner carbon, which existed down deep in the internal regions of the earth, was changed from its black and uninviting appearance to the most beautiful gem which ever saw the light of day.

\(^{1}\) Brittle quartz sandstone of slaty (schistose) character. — Heusser.
CHAPTER XVII

THE DIAMOND MARKET

In preceding chapters the extraction of the blue ground and the winning of the precious stones have been fully described. It remains to trace the handling of the diamonds from this point until they reach the hands of the jewellers and are spread broadcast in glittering array over the face of the world, or applied to uses less showy than adornment.

After the diamonds are separated and collected at the Pul-sator, they are cleaned and sent under guard to the diamond office, which is in the general offices of the Company. Here the crystals are boiled in a mixture of nitric and sulphuric acid to remove any particles of earth which may adhere to them. They are then thoroughly rinsed with clear water to get rid of the acids, and finally washed in alcohol and spread out on tables to dry. The alcohol seems to clean the diamonds and leaves them brighter than when water alone is used.

The daily productions of diamonds are put away in parcels until there is an accumulation of about 50,000 carats of De Beers and Kimberley diamonds. The diamonds from these two mines are mixed and are known locally as “pool goods.” When the requisite quantity is at hand, the mixed stones are screened to grade the sizes, after first taking out the larger diamonds by hand. They are then ready to pass to the hands of the sorters, who separate and classify them for accurate valuation. The chief classifications in use are—

"Close goods" are pure, well-shaped stones; "spotted stones" are crystals slightly spotted; and "rejection" stones seriously depreciated by spots. Broken stones are grouped under the head of "cleavage." Flat crystals formed by the distortion of octahedra are classed as flats, and flat triangular crystals, which are in reality twin stones, are marked as maacles. "Rubbish" is the refuse, ranking a little better than the lowest grade of all, ordinary "boart" the material used for polishing purposes. Round or shot boart is found in the mines at Kimberley and is very valuable for use in diamond drills since the Brazilian carbonado has become so scarce. Well-formed shot boart, averaging about the size of peas, sells readily for £6 a carat.

After this separation has been made, the first eight classes are each further subdivided according to their shades of color. The scale is given below in descending order of purity —

Blue White, First Cape, Second Cape, First Bye, Second Bye, Off Color, Light Yellow, Yellow.

Only the first grade, or close goods, are carefully distinguished by separation of all eight shades. For other classes a
smaller number of shade divisions is noted. It may be perceived that the minute distinctions of this separation can only be made by the trained eyes of experts. No magnifying glasses are used by the sorters, all being able to make the distinctions with the naked eye. Ten sorters are employed, all Europeans, two women and eight men. To replace any who leave, apprentices are trained to the work at Kimberley. The sorters determine the quality of diamonds with notable accuracy and speed.

De Beers mine is noted for yielding an exceptionally large percentage of ordinary "yellows," a very small percentage of very "dark yellows," a limited number of brilliant "silver Capes," and considerable "light-brown cleavage" of a delicate shade. The very "dark yellows" are ranked as "fancies" and highly valued, and the "silver Capes" are also rated highly, as they have great lustre when cut as brilliants, but absolutely white or colorless stones are rarely found in this mine.

Kimberley mine yields a fair proportion of "white crystals," a good percentage of "white cleavage," and quite a remarkable percentage of large "maacles." It also produces a fairly large proportion of "yellows," generally somewhat lighter in color than those from De Beers.

Dutoitspan mine yields some very fine blue-white stones, "silver Capes" and ordinary "white" stones and "cleavage" of comparatively fine quality, together with large "yellows," showing an exceptional proportion of large stones, and a comparatively small percentage of very minute crystals.

Bultfontein's product is very largely composed of white stones, but many of these are spotted more or less; its diamonds are also comparatively small, usually ranging from two to three carats downwards.

The diamonds from Premier mine are mostly octahedron crystals, or fragments of these, with a large percentage of rubbish and boart. Beautiful, deep-orange colored diamonds are frequently found, and blue-white stones are not uncommon.

When the sorting has been completed, the diamonds are
placed in little heaps on a long table covered with white paper. In all cases, except in small sizes and boart, where the weight and value only are recorded, the number of diamonds in each heap and their average weights and values are carefully recorded in a book kept for that purpose. This exhibit was previously made also for the benefit of buyers calling at the diamond office, who could thus readily value the stones; but of late years the entire product has been sold to a syndicate composed of the leading diamond merchants of Holborn Viaduct and Hatton Garden, London. The careful sorting and arrangement are nevertheless continued in order to determine precisely what the relative quality and value of the diamonds are in passing from level to level as the mine grows deeper. The buyers know the exact value of every shipment they make, and the De Beers Company must also be informed of any changes for better or for worse in the value of its production, so as to take advantage of them in the former case, or make allowances to the syndicate upon the renewal of the contract, in case the quality should become poorer. These are perhaps remote conditions, for, up to the present time, the average monthly or annual production of diamonds has been remarkably regular in quality.

For the safe-keeping of the gems in the Company’s office there is a strong room or vault, built of very thick concrete walls, which are fire and burglar proof. The door of the vault is secured by several bank locks of the latest and best design. The keys fitting these locks are kept by several officers in the secretary’s department of the Company, who must all be present at the opening and closing of the strong room. Inside the strong room are burglar-proof safes, with doors also secured by several locks, which can only be opened by two or more persons having separate keys. In addition to these safeguards, the strong room is protected by the application of an electric alarm system. Two armed guards are on duty at the offices at night, and connections are made by which they can signal for help should an attempt be made to break into the building. Even
In both men should be overpowered before they could be allowed to pass, and no signal could be made before they were overpowered. The signal was to be given by the officer in command at a signal tower. If the force were not in the position to prevent the robbery, the force would act to the utmost extent.

Burned force would soon arrive on the ground and frustrate any temptation. Under existing conditions for the sale of diamonds, only a small quantity of precious stones are kept at the diamond office; but, in former years, the quantity, at times, been very large and the need for exact precautions were

To start a fixed signal that almost measures were taken apart as quickly for the entire room occupied by the diamonds. During the last few years, the improved method of working, where a fixed signal has been used, has been the basis to have an average quantity of diamond sent out, which is fixed percentage of small stones included in the parcel. If there is any surplus, it is in the ordinary way sold to the buyers at a valuation agreed upon between the seller and buyers. After the
Standing, From Left to Right:

Wm. Pickering, Secretary.
I. R. Grimmer, Assistant Secretary.
A. F. Williams, Assistant General Manager.
H. P. Rudd, Director.

Sitting, From Left to Right:

F. Hirschhorn, Director.
Captain Penfold, Director.
C. E. Nind, Director.
Gardner F. Williams, Director (General Manager).
Lieut. Col. D. Harris, Director.
if both men should be overpowered before they could give a signal, no robbery could be effected; for, as soon as they should cease to send test signal reports at regular intervals, an armed force would soon arrive on the ground and frustrate any attempted burglary. Under existing conditions for the sale of diamonds only a small quantity of precious stones are kept at the diamond office; but, in former years, the quantity, at times, has been very large and the most stringent precautions were necessary. It may be noted further that adequate measures have been taken also to protect the office from assault in the daytime.

Of late years, with improved methods of working, a larger percentage of small diamonds has been recovered from the blue ground. In order to have an average quantity of these in each parcel made up for the buyers, a fixed percentage of small stones is included in the parcel. If there is any surplus, it is valued in the ordinary way and sold to the buyers at a valuation agreed upon between the seller and buyer. After the
diamonds are sorted, they are put into square tin boxes, fitting into tin cases like despatch boxes, which have tightly fitting, locked covers. A despatch box will contain about forty tin boxes.

All De Beers diamonds are delivered to the buyers at the diamond office of the Company and paid for at once in cash or in bills on London, as the Company may prefer. After delivery to the buyers the diamonds are sorted over again for the London market, which desires a classification of the stones for different purposes than valuation simply.

They are reassorted according to quality into from 350 to 400 different parcels. Each parcel is put into specially made papers bearing on their face a description of their contents. Then these parcels are packed in tin boxes which are securely wrapped in cloth-lined packing paper, carefully sealed and delivered to the post-office, which forwards them to Europe as registered mail. All diamonds so forwarded are insured with insurance companies in Europe.

Classification is made into—

- Pure goods
- Brown goods
- Spotted goods
- Flat-shapped goods

<table>
<thead>
<tr>
<th>Pure cleavage</th>
<th>Completely formed or crystallized stones.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spotted cleavage</td>
<td>Broken crystals or split stones.</td>
</tr>
<tr>
<td>Brown cleavage</td>
<td>Flat, triangular crystals, in reality twin stones.</td>
</tr>
</tbody>
</table>

- Naats or Maacles
- Rejections or Boart

<table>
<thead>
<tr>
<th>Naats or Maacles</th>
<th>Uncutable diamonds used mostly for splitting and polishing more perfect crystals.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rejections or Boart</td>
<td>Most of the above classifications, except rejections and boart, are subdivided into six or seven colors, and each color is again subdivided into eight, ten, or twelve sizes.</td>
</tr>
</tbody>
</table>
### The Percentages of Diamonds in the Various Classes

<table>
<thead>
<tr>
<th></th>
<th>De Beers and Kimberley Mines Pool Goods</th>
<th>Premier Mine</th>
<th>Jagersfontein Mine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pure Stones</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Close goods, stones over one carat</td>
<td>4.1%</td>
<td>8.7%</td>
<td>11.7%</td>
</tr>
<tr>
<td>Irregular shapes of all sizes</td>
<td>1.6%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Melee of all sizes under one carat</td>
<td>3.1%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Brown stones of all sizes</td>
<td>1.6%</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Spotted Stones of all sizes</strong></td>
<td>8.1%</td>
<td>6.6%</td>
<td></td>
</tr>
<tr>
<td>Cleavages, pure and spotted, over one carat</td>
<td>38.8%</td>
<td>28.2%</td>
<td></td>
</tr>
<tr>
<td>Chips, pure pieces of all sizes under one carat</td>
<td>1%</td>
<td>1.2%</td>
<td></td>
</tr>
<tr>
<td>Chips, spotted pieces of all sizes under one carat</td>
<td>12.6%</td>
<td>5.5%</td>
<td></td>
</tr>
<tr>
<td>Maelces (Naats) and Flat Stones, pure and spotted, all sizes</td>
<td>4.3%</td>
<td>4.3%</td>
<td></td>
</tr>
<tr>
<td>Rejections, lowest quality of above descriptions</td>
<td>17.5%</td>
<td>16.2%</td>
<td></td>
</tr>
<tr>
<td>Boart, diamonds not suitable for cutting</td>
<td>7.3%</td>
<td>25.4%</td>
<td>10.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100. %</td>
<td>100. %</td>
<td>100. %</td>
</tr>
</tbody>
</table>

When the diamonds arrive in London, they are again reassorted for sale, *i.e.* in the manner that will best suit the customs and requirements of the trade. The London importers sell *(a)* to merchants of rough diamonds, who again resell the goods in their rough state, *(b)* to merchants of brilliants who get their purchases cut and polished for sale, *(c)* to actual manufacturers who, buying for their own account, cut and polish the goods and then resell with profit as compared to the manufacturer who works for a fixed cutting charge.

It is of interest to compare the present elaborate method of assorting and valuing with that obtaining in the eighteenth century and previously in the European market. It was the custom then to forward diamonds from India in "bulces" or parcels neatly wrapped in muslin and sealed by the sellers. The largest stones were never offered for sale, but reserved by the native owners, as David Jeffries observes, to aggrandize their families. He states further that "the head of the family has a small shal-
low hole drilled in the surface of the stone, and when he dies the next chief does the same, and so from one to another, and the more of these holes a stone has the higher it is in esteem, although such holes may prejudice it if it were to be manufactured; but as that is never intended, they do not regard such prejudice; and these stones are never parted with, let what will happen, and if they foresee any ruin to the family . . . in such cases they bury these stones, so that they never appear again." The other stones, comprising the small and middle size and some of the large ones, were put in the parcels for sale un assorted and "valued by the lump, as they weigh one with another, by the rule." In the European markets such parcels were generally bought, he states, "by the invoice, that is before they are opened, it being always supposed they contain the value which they were sold for in India; and the buyer here gives the merchant such a profit as contents him. The diamonds being thus bought, the buyer opens the parcel, separates them, and then values them separately as his judgment directs; making to himself likewise such a profit upon the whole parcel as he thinks proper." 1

This expert jeweller notes with regret that at the time of his

Standing,
From Left to Right.

Captain T. G. Tyson.
Wm. Pickering
I. Dreyfus.
H. Hirsche
A. M. Robeson.
H. Robinow.
I. R. Grimmer.
J. J. Michau.
Sir Charles Metcalfe,
L. Sutro

Sitting,

Francis Oats.
C. E. Nind.
Capta'n Penfold.
C. J. Rhodes.
John Morrogh.
Richard Solomon.
D. J. Haarhoff.
A GROUP OF DIRECTORS AND OFFICIALS OF DE BEERS CONSOLIDATED MINES LIMITED AND PROMINENT SOUTH AFRICANS WHO ATTENDED THE ANNUAL MEETING, DECEMBER 19, 1898.
writing, in the middle of the eighteenth century, there was no uniform standard of valuation and that the purchase of large stones in particular was essentially a gambling speculation. In the East Indian market there was a persistent effort to maintain fixed prices, and there was comparatively little fluctuation in the market rates of the East Indian stones, but the diamonds of Brazil were thrown irregularly on the market, so that the supply ranged from a dearth to a glut, and the prices were so greatly fluctuating that any investment in these stones was extra hazardous. Mr. Jeffries marked clearly the disastrous consequences of greatly varying products and prices in the marketing of precious stones. He reached the conclusion "that to maintain as invariable a price of these jewels [diamonds] as is possible must be of the greatest utility to the public," and gave high praise to the owners of East Indian diamond fields and diamond merchants because they did not flood the market regardless of the diamond, like the Brazilian producers. He notes a shift of fully 33 per cent in the market rate of diamonds in a single year. In 1733 the value of Brazil diamonds fell to a point below 20 shillings per carat for rough diamonds, and within 20 years ran up to more than treble this price.

One of the simplest and oldest divisions in grading and in the measure of values of diamonds and other precious stones is in accordance with their weight. The transmitted measure of weight is the carat, derived from the Greek κεράτιον, the fruit of a variety of acacia, whose remarkably uniform seeds served as convenient measures of value of diamonds and other precious stones, and is equivalent to 4 grains avoirdupois or 3.174 grains troy weight. In market quotations from year to year and in contracts for sorted diamonds the valuation is expressed in a stated price per carat. Von Tschudi states that the word carat is derived from kaura, an African creeping plant, whose red seeds specked with black were used for weighing gold in Africa and diamonds in India. On the supposition that £2 may be reckoned the general or average price of a rough diamond of one carat weight, Mr. Jeffries gives two methods or formulas
for computing the values of "wrought," or as we would say "cut," diamonds. First, the weight of the cut stone should be doubled, to offset the loss of one-half in working; then this figure or figures should be squared, and the product multiplied by the price per carat. Thus a cut stone weighing one carat would be valued by multiplying 2 by 2 by 2, or at £8, and a stone weighing 5 carats by multiplying 10 by 10 by 2, or at £200. By the second method, the calculation is made on the basis of the valuation of a cut stone weighing one carat, at £8, as before determined. Then to find the value of a stone of any given number of carats, multiply the number by 8, and the multiplicand will be the estimated value of every carat in the stone. The total value may then be reached by multiplying the number of carats by this multiplicand. For example, if a given stone weighs $5\frac{1}{8}$ carats, the value of every carat in the stone will be found by multiplying by 8 to be £41. Then multiply £41 by $5\frac{1}{8}$ and the result will be £210 2s. 6d.; the estimated value of a cut stone weighing $5\frac{1}{8}$ carats. It was the expectation of Mr. Jeffries that the general adoption of his method of valuation would go far to fix the price of diamonds, and it did prevail for more than a century before falling into disuse.

Production of Diamonds

De Beers Consolidated Mines. During the sixteen years ending June 30, 1904, the yield of De Beers Consolidated Mines has been 36,000,000 carats of diamonds in round figures, which would measure about 106 cubic feet, showing an average of something more than 2,250,000 carats annually. Compared with this product, the production of the other diamond fields of the world, with the exception of Jagersfontein, is comparatively unimportant, not exceeding 5 per cent of the total.

The Orange River Colony. The principal diamond-producing mine in this colony is Jagersfontein, which has averaged about 250,000 carats annually for several years past. The Jagersfontein mine is controlled by the syndicate which has for many years purchased the total production of De Beers Company.

1 See Appendix IX.
There are a few other diamond mines in the Orange River Colony, but the yield of diamonds from all of them combined is small in comparison with Jagersfontein. The total output of diamonds from Jagersfontein up to March, 1901, was 2,168,399\(\frac{1}{4}\) carats, valued at £3,923,940. See Appendix VI.

Transvaal.\(^1\) There are alluvial diggings along the banks of the Vaal River a few miles above the river diggings in Griqua-land West, Cape Colony. The town of Christiana is situated near these diggings, lying just outside the jurisdiction of the Cape Colony and the late Orange Free State (now Orange River Colony), in which Colonies the Diamond Trade Act, which forbids dealing in rough diamonds except by licensed dealers, is in

\(^1\) See Appendix IX.
force. A large illicit trade has been carried on at Christiana for many years in diamonds stolen in Kimberley and the river diggings in the Cape Colony. A few years ago the Government of the late South African Republic passed certain laws in reference to the registration of diamonds, but these laws were not stringent enough to stop the illicit traffic. Diamonds have also been found at Rietfontein, near Pretoria, but up to the present time the total yield has been very small. A few years ago there was a remarkable occurrence of diamonds in the conglomerate gold ores from the mines at Klerksdorp, when several green diamonds were found in the battery box. As the conglomerate is a sedimentary formation, the diamonds may have been washed into it from some crater in a similar manner to the depositing of diamonds in the itacolumite of Brazil.

Outside of South Africa the diamond fields of any determined value are in Brazil, India, New South Wales, and Borneo.

Brazil. There was a revival of the diamond-mining industry to some extent in the Brazilian fields, owing to the diminution of the South African product by the Transvaal War. The State places a duty of 16 per cent on the valuation of all diamonds produced, and there is in addition a tax of 1 per cent demanded by the municipalities. Owing to the tax evasion, it is difficult to determine the total annual product. The value of exports from Minas Geraes during the first half of 1900 was reported at 250,000 milreis, $140,000.

Mr. A. de Jaeger has estimated the total production of Brazilian stones from the time of the discovery of the diamond fields at 12,000,000 carats, valued roundly at $100,000,000. It is stated, however, in "The Mineral Industry," presenting probably the best extant record, that the best available statistics show that the total output of Brazil, up to and including 1898, was 13,105,000 carats.\footnote{"The Mineral Industry," 1899, p. 222.}

Dr. Le Neve Foster, one of his Majesty's inspectors of mines, in his Annual Report on Mines for 1899, says: "Compared with the output of Kimberley, the total production of
diamonds in Brazil for the year, estimated at 40,000 carats, is at present insignificant. . . . The most important diamond districts in Brazil are Diamantina, Grao Mogul, Chapada Diamantina, Bagagem, Goyaz, and Matto Grosso."

India. In the same report the quantity of diamonds produced in India for 1898 is given at 170 carats, valued at 10,873 rupees, and for 1899, 124 carats, valued at 8,011 rupees.

New South Wales. The existence of diamonds in New South Wales was made known as early as 1859, by Rev. B. W. Clarke, who received in that year several specimens from the Macquarie River, Burrendong, and Pyramul and Calabash Creeks. It was not, however, until the rush for the gold diggings, seven or eight years later, that any considerable number of diamonds was found, when the gold digging along the Cudgegong River, about nineteen miles northwest of Mudgee, brought to light diamonds in an old river drift, generally covered with a layer of basalt.

The diamonds were sparsely distributed through the gravel, and were usually small, the largest of the stones, a colorless octahedron, weighing only $\frac{5}{8}$ carats. Later, other diamond fields were opened near Bingera, on the river Hocon, and in the tin-mining districts near Inverell. The diamonds occur in alluvial gravel wash in the beds of ancient rivers. This gravel carries tin ore or gold in places, and usually one or both of these are won with the diamonds. These ancient river channels resemble those in California, in which diamonds were occasionally found with the gold. Many of these rivers lie buried beneath lava hundreds of feet thick, and the diamonds are won by driving long tunnels and drifting out the gravel lying on the bed rock.

Dr. C. Le Neve Foster gives the production in New South Wales for 1898 as 16,493 carats, valued at £6060, and for 1899, 25,874 carats, valued at £10,350. These figures give an average value per carat of seven shillings and four pence and eight shillings respectively, as compared with forty shillings per carat for De Beers and Kimberley mines.

Borneo. The estimated production of diamonds in Western Borneo was 1190 carats for 1897, and 1950 carats for 1898.
British Guiana. Some attention has been drawn of late to the reported diamantiferous deposits in British Guiana. It is stated that there was a shipment of 282 specimens from this field to London early in 1900, and, later in the year, 400 small stones were brought to Georgetown. The location of the deposits is reported to be on the Mazaruni River, about 250 miles from its mouth. The diamonds have been found in an alluvial formation, consisting of sandy clay mixed with pebbles and fragments of ironstone, quartz, and felsite.\(^1\)

Importation of Diamonds

In the importation of diamonds the United States leads, and England, Germany, France, and Italy follow in the order named. The increase in the demand of the United States has been extraordinary, showing an advance of fully 2000 per cent in the last fifty years. In 1899 the valuation of the total import of precious stones was $17,208,531. In 1900 there was a falling off of about $3,850,000 owing to the interruption in the supply, but the records of the year 1901 indicate a probable importation exceeding $20,000,000, the total for the first two months of the year reaching $3,870,359.31, an increase of $2,674,787.88 over the import of the corresponding months in 1900. The importation is a close measure of the total sale, as the production of precious stones in the United States only reached a valuation of $185,770 in 1899, and this was larger than in any previous year. Nearly five-sixths of this native product is made up of sapphires and turquoises.

Rubies, emeralds, sapphires, and pearls are the gems most commonly used in settings in combination with diamonds. It is estimated by Mr. George F. Kunz, of New York, an expert of international reputation, that the value of the diamonds imported into the United States is approximately 75 per cent of the valuation of all precious stones and pearls imported, and it is judged that this consumption fairly represented the percentage in other countries. The changes in settings from year to year and even from decade to decade are not very pronounced. The resetting of

\(^1\) "The Mineral Industry," 1900.
stones is an appreciable fraction of the jeweller's business, but in-
considerable in comparison with the setting of newly cut stones.

The World's Stock

Diamonds are so highly prized and so imperishable that the
amount of these gems in existence to-day may almost be reck-
oned as the total of the world's production, ranging in value
through hundreds of millions of dollars. Mr. Kunz does not
estimate a loss of 5 per cent in a hundred years, and the South
African Diamond Fields alone have contributed over $400,000,-
000, or £80,000,000, in value to the world's stock. Yet the
demand advances apace with the world's growth in wealth, and
no diversion of the world's fancy is apparent. The plunder of
Delhi by Nadir Shah in 1739 has been estimated at $300,000,-
000, and a great share of this was precious stones. There may
never again be such a collection in the hands of any monarch or
nabob as the store amassed by the Great Moguls, but the crown
jewels and private treasures of the leading courts of Europe
to-day are of immense value and are growing greater.

The crown jewels of France were estimated at $6,000,000
(£1,200,000) more than a hundred years ago, and even this great
amount is far exceeded by the value of the Russian crown
jewels. The crown of Ivan Alexiowitch contained 881 brilliants,
the Empress Catherine had 2536 brilliants in her crown, and
the purchases of succeeding Czars have been enormous. At the
London Industrial Exposition in 1851 a firm of Russian jewellers
exhibited a superb diadem on which were mounted 11 beautiful
opal, 67 rubies, 1811 brilliants, and 1712 rose-cut diamonds.

The British crown jewels do not equal the Russian in num-
ber or value, though there are other magnificent gems among
them besides the Koh-i-nûr, whose romantic story is told in a
former chapter. The crown specially made for the coronation
of the late Queen Victoria, in 1838, was regarded as a superb
showing of the art of the leading jewellers of London as well as

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1 "Great Diamonds of the World," Streeter.
of the gems displayed. It is fashioned of hoops of silver encircling a cap of deep blue velvet. Precious stones completely encase the hoops, which are surmounted by a ball covered with diamonds and bearing a Maltese cross of brilliants, with a splendid sapphire as the central jewel. The rim of the crown is clustered with brilliants and Maltese crosses. On the cross at the front of the crown is set the magnificent heart-shaped ruby, which was worn by Edward, the Black Prince, and beneath this ruby in a circular rim is an oblong sapphire of extraordinary size and beauty. Clusters of drop pearls add to the resplendent effect of the massing of the diamonds, emeralds, rubies, and sapphires.

The exquisite beauty of the jewels of Queen Isabella of Spain has been particularly noted. At the London Exhibition in 1851 two sets of her jewels were shown. One consisted of a diamond necklace, in the form of a ribbon, interlaced with foliage of emeralds. Brillants were arranged also to form a bouquet of lilies with emerald leaves, encircled with ribbons of brilliants and pendants of pearls. A ribbon of brilliants, interlaced with emeralds, formed a bracelet, and the crown of this set was of the like combination of gems, with aiguillettes of flowers whose stamens were pearls. The second set of jewels was made up entirely of diamonds and sapphires of the finest quality and most artfully matched.

It is scarcely to be expected that any private collections of gems should rival in extent the treasures of sovereigns, whose crown jewels may be the display of centuries of accumulation, but some of the noble families of Europe and other wealthy owners have gems that any monarch in the world might covet, and there are a considerable number of collections ranging in value over a million dollars. In the United States it is estimated that there are at least half a dozen such collections, one of which contains a necklace valued at $320,000.1 At every leading court reception, or grand ball or opera, the display of jewels may be measured in millions of dollars, and the diffusion of gems is constantly spreading with the extension of wealth.

1 George F. Kunz.
CHAPTER XVIII

CUTTING AND POLISHING

It has been shown in the opening chapter of this work that fancy has still, and probably must forever have, a free range for its surmise when and how the first diamond crystal was picked from the river-shore wash of the Indo-Gangetic plain. Equally vague and conjectural must be any effort to fix the period when a rough or natural diamond was first artificially ground or polished. It is only certain that some rude polishing, at least, was essential to the revelation of any notable beauty in the diamonds of India; for the surface of these crystals is covered with a grayish white film or incrustation, veiling their refulgence so completely that the rough stones are scarcely more ornamental than common quartz pebbles.

It was in view of this obscuring that the apostle of deportment, the Earl of Chesterfield, wrote to his son: "Manners must adorn knowledge and smooth its way through the world. Like a great rough diamond, it may do very well in a closet by way of curiosity and also for its intrinsic value."¹ A contemporary of this high authority, Dr. Samuel Johnson, was able to controvert this dictum by demonstrating that knowledge can rise from obscurity without any adornment of manners, but polish is indispensable to the revelation of the latent beauties of the rough diamond.

Indian tradition runs back romantically five thousand years to the first gleam of the Koh-i-nūr or "Mountain of Light" in the serpents of a chief who fell in the great battle described

¹ Letters of the Earl of Chesterfield, July 1, 1748.

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in the epic poem "Mahabharata"; but nothing more solid than tradition sustains this tale. If it were true, it would demonstrate incontestably a very ancient proficiency in the art of grinding and polishing a rough Indian diamond, as the figure of the Koh-i-nūr on page 1 shows, illustrating the appearance of this famous gem before it was recut by modern lapidary art to hold the foremost place in the jewels of the British crown. The Italian, Augusto Costellani, is the mouthpiece of another tradition, little firmer than a floating pipe-bubble, that a certain King Carna of India, who lived some three thousand years before the Christian era, possessed a diamond whose natural planes or

1 "Indian Epic Poetry," Sir Monier-Monier Williams, 1863.
2 "A Popular Treatise on Gems," Dr. Lewis Feuchtwanger, 1867, Plate VIII, No. 15 and No. 15a.
facets were polished; but what the good king did with his sparkling treasure, or where it has wandered, is unfortunately left to the drift of fancy.

It has been shown that the earliest known catalogues of gems do not include the diamond, and that the references to it in the Hebrew Scriptures and other writings before the Christian era are far from decisive, in view of the likelihood that the white sapphire was the ancient adamas. The failure to bring to light any diamond in the exhumation of ancient gems is further significant. If it be true that a genuine diamond, bearing the engraved head of the philosopher Posidonius, exists in the collection of the Duke of Bedford, as reported by Streeter, this is a solitary instance, so far as is known, of the application of engraving to this adamantine surface at a date probably prior to the birth of Christ, for Posidonius was a Tyrian Greek, living in the second and first centuries B.C.

It is, however, highly probable that the genuine diamond crystals were discovered in India hundreds, if not thousands, of years before the Christian era, and partially polished, at least, in the primitive method of rubbing or striking the planes of one crystal against the other, or even by laborious friction with grit-stone by hand or a grinding wheel.

It is certain that revolving stones or metallic wheels for grinding gems were in use in remote antiquity, perhaps two thousand years or more before the Christian era. From the softer stones, carnelian, onyx, and jasper, the ancient workmen advanced to harder gems, preparing their face first chiefly by a smooth polish for the sculptors of cameos and intaglios. Their mode of

1 “Precious Stones noted in the Sacred Scriptures,” R. Hindmarsh, 1851.
3 The Story of the Nations, “Phœnicia,” George Rawlinson, M.A., 1894.
4 “Ancient Mineralogy,” N. F. Moore, 1834.
working was very simple, as Feuchtwanger notes.\(^1\) The polishers prepared the stones on a plate by means of the powder of harder stones, either round, oval, flat, or in shield form, according to the designed subjects, and the sculptors cut the engraving with iron tools or diamond splinters mounted in iron.

The Egyptians taught the art of carving to the Phoenicians, Etrurians, and Greeks. The Indians and Persians learned to carve and polish gems perhaps as early as the Egyptians. Representations of the adored beetles or scarabs were the earliest known Egyptian engravings, while the Persians engraved chiefly mythological animals or figures of their priests. Cabalistic devices and -Arabic letters on gems formed the doubly precious “talismans,” and even without talismanic lettering, marvellous or supernatural origin and powers were attributed by current superstition to all the notable gems.\(^2\) Alexander’s seal typified the sovereignty transferred to his vicegerent, Perdiccas. Augustus Caesar cherished his seal engraved with a sphinx as a token of his divine authority.\(^3\)

In the carving of cameos, precious stones with layers and veins were employed with great skill, bringing out contrasted effects, as where a face is shown in one color and the hair and dress of a figure in different colors. Sometimes certain colors were made typical. Thus Bacchus was carved in amethyst, the color of wine, while Neptune or nymphs of the sea were cut in aquamarine.\(^4\)

Such surface polishing and engraving antedated, however, very far any grinding or faceting of the harder gems, and the intractable diamond especially, for uses of ornament. Pliny writes, “The polished hexahedral Indian diamond thins to a point.”\(^5\) As the crystallization of the diamond is much more

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\(^1\) "A Popular Treatise on Gems," Feuchtwanger, 1867.
\(^3\) "A Popular Treatise on Gems," Feuchtwanger, 1867.
\(^4\) "Naturalis Historia," Caius Plinius Secundus, 23 A.D.—79 A.D.
commonly octahedral and dodecahedral than cubical, the adamas of Pliny may have been the white sapphire crystal, a hexagonal prism.¹

Long before the days of Sindbad the sailor,² when the true diamond was unquestionably known and prized, and when the lucky adventurer filled his pockets with the choicest crystals, copper had been substituted for lead in revolving wheels used by the most skilful lapidaries for grinding the harder stones; and powdered stone, moistened with oil or water, was sprinkled on the grinding wheel or pressed into furrows on its face. Cutting in the scientific method of the modern art was of comparatively recent development. The grinding or cutting of the Indian stones by native lapidaries was, at first, only a surface polish of natural planes, and later proficiency did not extend beyond an irregular and unsymmetrical fashion, which rarely ventured the risk of cleavage. There are perhaps no known samples indicating with certainty a higher proficiency in the art at the beginning of the Middle Ages than the four large diamonds now to be seen on the buckle of the mantle of the Emperor Charles the Great,³ which were planed and polished on their natural faces.⁴

There is a particular Oriental cut of diamonds, still followed, which had its origin about the year 1000 A.D. This bears the distinctive name of "Indian" or "Lustre of India." It had four rectangular plates and one upper facet in the form of a parallelogram. The stone was polished highly on all surfaces except the under side, which was left in its natural state. It is thought that the wandering merchants of the East, who travelled

³ "Charles the Great, King of the Franks and Emperor of the Romans," 742-814 A.D.
by caravan, brought these stones, or a knowledge of their style, from the far Orient to Constantinople, whence they were made known to France, Italy, and Holland.¹

That such forms of gems were made in Paris and in Venice as early as the thirteenth century is certain. In 1290 A.D. a society of lapidaries was formed at Paris, and at the close of the fourteenth century there were professional diamond cutters of somewhat higher skill in Nuremberg. In 1365 A.D. an inventory of the jewels of Luigi d’Angio was made, which mentions a diamond having eight facets and another shaped like a shield. The facets here spoken of may be only flat sides such as any true octahedral crystal presents.²

One of the first, if not the first, of European workmen to attain any distinction as a diamond cutter was named Hermann, living in Paris about 1407 A.D., and it seems to be certain that from his time or the beginning of the fifteenth century the business of polishing and developing the diamond became an established industry in western Europe. Gems in the rough were somehow finding their way from India and Borneo, and were coming into the market not only among kings and the members of the royal households but among noblemen and burghers of great wealth. In 1465 A.D. there were three registered diamond cutters living in the city of Bruges. Perhaps these cutters were associated with Louis de Berquem, a native of that city, who announced in that year a new method of cutting diamonds and established a guild of diamond cutters.

The method which he pursued and the forms which he evolved were deserving the name of a new discovery of which he was truly the inventor. With whatever assurance others may claim to have invented the art of faceting or of cutting diamonds,

it is very evident that none before him had done so on any scientific basis of geometrical relations. Berquem was not merely a craftsman; he was an accomplished mathematician, highly versed in optical science, and he had determined the true angles at which the planes of each facet should lie in reference to its crystallization and to its size, in order to make its reflections of light most perfect and its color most complete.

He discovered that in the development of the octahedral form there are certain measurements of relation which must be preserved in the trimming of the diamond for the perfect reflection of all the light which enters the crystal. By this scientific formation he completely changed the basis for estimate of the value of diamonds. Under his treatment the diamond of largest size and weight was not most valuable, but the gem which was transcendent as a light producer or reflector and as a crystal of symmetrical parts. The connoisseur, the artist, and the thrifty merchant alike have vastly profited by the principles evolved by Berquem. He raised the craftsmen of his day from the common plane of gem polishers to the higher position of artists and skilled lapidaries. The successful lapidary of to-day — to whose cutting is intrusted the gems of India, Brazil, and Africa — must be a close student of optics as well as a dexterous stone cutter.

Figs. 1 and 2 above represent the simple octahedral form of diamond crystallization. By the second figure it will appear that if two pyramids of four triangular sides were joined together at their bases, we should have a diamond form with eight triangular surfaces, or an octahedron. Fig. 3 is the same octahedron with its corners either rounded or ground flat as additional facets. The diamond's natural edges are not often so straight and sharp as here represented, but are usually convex, that is.
bowing outward; but when mechanically trimmed to perfect their shape, each line and angle must be unerringly true.

Fig. 4 is a cube of six faces having its corners rounded or flattened, and Fig. 5 is a double cube or dodecahedron, having twelve equal rhombic faces. Some diamonds can readily be made to receive these shapes with little loss of substance. Fig. 8 represents a gem shaped as a parallelogram with a facet on one upper corner, the lower side showing its natural state. It is called "Indian" or "Lustre of India."

Figs. 6 and 7 represent the oldest and simplest form of gem cutting, called the "table cut." It suits the other precious gems much better than the pure diamond. A celebrated "table" diamond was given by Prince George (afterwards George IV.) to Mrs. Fitzherbert. She had it split along the line from a to b, and used each half to fit in the face of a locket; one holding her own portrait, and the other that of her princely lover. The diamond with the portrait of Mrs. Fitzherbert was buried with the old king in the locket which hung on his neck.¹

The first and simplest modification of the "table cut" of a diamond is called the "Old English single" or the "star single cut." By this arrangement the table cut diamond had its top part planed down about the edges to represent an eight-pointed star whose centre figure was an octagon, or elongated octagon, if the stone was longer than its width. This style of cutting appears in sets of old diamonds for crown jewels or ordinary wear. These sloping triangular faces were ground upon the edge of the upper surface of the stone only, reaching from the flat part, which is then technically called the "table," to the central line which is called the "girdle," and these cut surfaces are called "facets" or small

¹ "Macaulay's Essays," Thomas Babington Macaulay.
THE DIAMOND MINES OF SOUTH AFRICA

faces. Their size and shape are most accurately measured and most exactly ground.

Figs. 9 a, 9 b, 9 c represent, successively, side or girdle, top or table, and back or culet of the next most simple cut of modern date, which is of a scientific cast. It is called the "single cut brilliant," a modification of the simple table cut. Fig. 10 below represents a single cut having sixteen triangular facets on its upper section and twelve facets on the under section, plus eight long facets. Figs. 11 and 12 show one of half that number, but both belong to the style here described — the single cut brilliant. Indeed, with very small stones, the single cut has but four faces above and four below. In commercial circles they are called "single sets."

The two figures above present another modification of the simple table cut of India. It is called the "step cut." In this style the plane above the girdle is only half as thick as that below the girdle. From Fig. 13 it appears that the part above the girdle has been bevelled off at two different angles, making two "steps" besides the table. The other figure
represents the part beneath the girdle, which being twice as thick as the upper section is cut with six steps instead of three. In closely studying this step cut and the table cut it was discovered that the diamond crystallized in thin laminae or plates, and that it might be split into very thin sections resembling plates of mica. By taking advantage of these "lines of cleavage," as they are called, many large diamonds were split into thin leaves and used as faces of small pictures enclosed in lockets. At Queen Victoria's coronation this thin sheet diamond was so common that many distinguished guests were favored with a gift of their own likenesses encased in golden frames and covered with a diamond instead of a glass face.

In the plates below, Fig. 15 and Fig. 16, facets of the "rose cut" pattern are represented. It will be seen that the bottom of the diamond is flat, though not unpolished, while all the facets lie above the girdle. This design, which is called the "Holland," groups twenty-four facets, but a simpler style known as the "Antwerp rose" shows facets ranging from six to sixteen. This rose cut is a very convenient style to adopt for fragments which have been cleft from large stones, or for diamonds which are imperfect in their crystallization on one side. If well proportioned, the depth of the rose must be one-half its breadth at the base.

In the rose cut diamond every facet is a triangle and all meet at the central apex, forming a cupola. When the facets on large stones number thirty-two, the dealers call it "fiam minghi" or "half brilliant." A common practice of the trade is to obtain a second "fiam minghi" of the same size, but cut in quartz crystal or even in glass, and glue their bases together with gum mastic, thus forming the "briolet" or "brilliolet," which is palmed off for a pure diamond. Briolets are pear-shaped or oval stones, having neither table, culet, nor edge, but covered with triangular-shaped facets, sometimes pierced at their points of greatest diameter, to be suspended on an axis.
It has been told how the diamond by Berquem's talent was first cut in harmonious and systematic proportion and regular facets at such an angle to its axis and to each other that the fullest play of reflected light is secured from every surface on which it strikes. His art produced the single cut brilliant, the highest achievement of the lapidary of his day. Near the close of the seventeenth century a Venetian engraver, named Vincenzo Peruzzi, while experimenting to get rid of obnoxious color in small diamonds, invented the double faceting which is now known as the "brilliant." It is regarded as the perfection of the lapidary's art, and is adopted in cutting the most costly gems now put upon the market. There are thirty-two facets in its upper section, and twenty-four below the girdle. A diamond cut in this style is shown in Figs. 17 and 18.

The usual double cut brilliant has only fifty-six facets, but, of late years a supposed improvement has been made by adding eight star facets around the culet, which makes a total of sixty-four facets. The proportions of measurements for the perfect brilliant diamond do not hold for other colored gems whose depth increases or diminishes their color. The triangular facets on the bezel, which touch the table, are named "star facets," while those which touch the girdle are "skill facets."

In order to show the names of lines and the geometrical relations of diamonds as a lapidary sees them, the above figures may prove helpful. Fig. 19 shows the side view of an ordinary octahedral or eight-sided diamond. Fig. 20 shows first the
line at \( a \) cutting off the upper point of the diamond. When this is accomplished, the flat top surface is called the “table.” The line at \( c \), which is the largest girth of the diamond, is called its “girdle.” The space \( b \), between the girdle and its “table,” is called the “bezel.” The line at \( e \) cuts off the sharp lower point, and its flat surface is the “cullet.” The space between the culet and the girdle is called the “pavilion.”

**Cleaving Diamonds**

There are three distinct processes in the treatment of diamonds by the lapidary—cleaving, cutting, and polishing. To split the diamond successfully demands a thorough knowledge of its individual character as well as of its generic crystallization and lines of cleavage. The skilled lapidary takes in hand a large rough diamond. If it is an Indian or Brazilian stone, it is coated or partly coated with a hard dull crust. Its corners are perhaps abraded. It may have defects or cracks in its surface, unequal coloring, or black deposits in its interior. He must needs remove the crust, correct the distortion of the crystal, remove or conceal its defects, and decide what is the largest perfect gem which can be cut from the rough stone. He must be able to see the priceless jewel through its shrouding veil, and determine on which surfaces of the stone its prominent corners must rest. Having decided what shape will best befit the stone, he must know whether the rejected portions can be split off safely or whether they must be ground off. Grinding away the rejected portions is probably the safest procedure, but it is the slowest and most expensive. The quickest method is to split off the surplus material. The process will be easy if the proposed fracture is in the direct line of cleavage in that particular stone. If not, his attempt at splitting may ruin a gem of countless price. Shall he make the attempt? He must be both an expert and a man of nerve. If he be so, a single feat of successful polishing may bring him fortune and the reputation of a master, while a single disastrous venture may quite undo him.
The early lapidaries dared not attempt the splitting of a stone to correct its faults or alter its natural form. Every stone was estimated according to the impression it made upon the scales. Hence its facets were only smooth flat surfaces ground upon the rounded exterior,—an unmitigated rose cut of trivial triangles, or a terraced surface of rings and bands. The master of his craft to-day must make his diamonds perfect reflectors of light at all hazards. If any excrescence exists, he must cut it away, or the light which enters a flattened surface may be so entangled that it will never emerge. When he takes up a cross-grained, defective stone, he will reject it. Like a true surgeon he will quickly discern how he may remove most safely a defective part, and will proceed boldly with his task. His first step in the work is to scratch the surface round the part to be split off with another diamond. Having made the diamond fast in a cement bed com-
posed of brickdust and resin, he applies the edge of a steel knife to the scratched surface, and strikes a quick, hard blow with a slender rod. If he has struck the lines of cleavage, the external scale is at once removed, for the diamond, despite its hardness, is quite easily fractured. Then the split surface must be polished. If no other scale or marked inequality needs removing by splitting, the next operation is that of grinding.

**Cutting**

As the diamond is the hardest of all known substances, it is evident that much patience and strength are required in reducing its size or altering its rough figure by grinding. The ordinary file would serve to reduce some other gems, but it will not touch the diamond. Diamond cut diamond is not merely a current phrase, for diamond dust is now invariably used in polishing or grinding this precious stone.

For cutting and polishing purposes the lapidary has a table above which a flat steel wheel revolves horizontally. On the upper surface of this wheel are fine grooves or striae, cut angling
from its centre to its perimeter. By means of belts beneath the table, the grinding wheel is made to turn at a rate from three to four thousand revolutions a minute. Diamond dust mixed with olive oil is applied to the upper face of the wheel, and against this erosive surface is held the diamond to be ground or cut.

For this object the diamond is set in a fusible solder on the end of a copper cupel which is held firmly against the surface of the wheel by a small projecting arm and clamp. By adjusting this holder, the lapidary presses the exposed face of the stone on the revolving wheel until the desired amount of material has been ground away and the proper angles turned. Such work in its finishing stages cannot be intrusted to a tyro or experimenter. Unusual patience and steadiness of nerve are required for such a task. When the facet is finished, the workman wipes the dust off and tests its smoothness and finish, after which he resets the diamond, leaving the uncut facet exposed which he intends to cut next.

Most of the "skill" facets and "underskill" facets are made by grinding, while the lozenge and larger faces are first shaped, when possible, by cleaving. If the stone is thick enough to form a brilliant, the lapidary first forms the table, and then successively the adjacent facets and lozenges. The table must be absolutely flawless and smooth, while all the surrounding facets in an ideal brilliant must hold the same precise angles and have their shape correspond to the thousandth of an inch. After completing the bezel, the pavilion is next developed. The underskill facets of the pavilion must match exactly at the girdle with those of the bezel, and the girdle when finished should be as sharp as a knife. Some lapidaries leave the girdle blunt, but with a great sacrifice of brilliancy in the gem. The triangles and lozenges of the pavilion must, of course, be much larger than those of the bezel.

There is a still simpler method of cutting diamonds by a device attributed to Berquem. Two uncut stones are cemented into the ends of two sticks resembling penholders in shape. Then the operator grasps these handles and presses the stones
CUTTING AND POLISHING
against each other with a rubbing motion over a trough. Considerable leverage is obtained for the rubbing by resting the holders against projectors at the sides of the trough. The exposed face of the stones is coated with diamond dust to advance the process. In this laborious way facets may be ground, and the cutting may be completed by repeatedly refixing the stones in the cement. Expert handling is necessary to keep the diamonds from becoming overheated by the constant friction.

Polishing

The third process is that of polishing. The method employed does not differ materially from that adopted in cutting, described above; but as this is the finishing process, all irregularities in faceting must be corrected and the practiced eye of the artist must detect and remedy every defect. Each line and angle must be made geometrically correct; each facet and lozenge must be shaped to perfection. The colorless stone must glisten pure as a dewdrop sparkling in the sun, producing the colors of the prismatic spectrum; the gem of red or blue or green color must flash forth its hue with intense brilliancy.

Such exact and delicate alignments are not the work of a day, though the time required has been greatly shortened by modern methods. The patience of weeks and even of months must be expended in perfecting these tiny crystals. It is said that it was the work of two years to cut the celebrated Pitt diamond, now among the French jewels, and the lapidary received for his skill and labor the sum of £3,500 or $17,500. The last cutting of the Koh-i-nur by Coster of Amsterdam in thirty-eight days was unusually rapid. The ablest workmen in Holland were engaged continuously on it and the wheel was driven by steam power; yet it cost $40,000 to do the work and the diamond lost eighty-four carats in weight.¹

¹ "Great Diamonds of the World," Streeter, 1882.
CUTTING AND POLISHING.
Loss in Cutting

No general rule can be stated covering loss which occurs in cutting gems. The waste depends on the character of the stone, — its perfect natural form and crystallization, its purity, and the style of the cut adopted. Perfect octahedrons lose two-fifths of their weight, if cut as brilliants. Rhombohedrons will lose over half of their weight in taking the same form, and stones of other shape will lose as much or more. The following figures will show at what cost of substance some of the natural gems have been perfected in the process of their cutting: The Mogul in its rough outer coat weighed originally \(780\frac{1}{2}\) carats; when cut it weighed only \(279\frac{9}{16}\) carats, a loss of nearly two-thirds. The Regent weighed 410 carats and was reduced to \(136\frac{14}{16}\) carats. The weight of the Koh-i-nûr was originally 793 carats. It was first cut unskilfully by Hortensio Borgio to \(186\frac{1}{2}\) carats, and a second cutting reduced it to \(102\frac{1}{2}\) carats, — a loss by both processes of the astonishing amount of \(690\frac{1}{4}\) carats, or more than six and a half times its present weight. The L’Etoile du Sud shrunk from \(254\frac{1}{2}\) carats to \(124\frac{9}{16}\) carats in the process of cutting.\(^1\) The average loss of South African diamonds by cutting is from one-half to three-fifths of their gross weight. The \(428\frac{1}{2}\) carat diamond found in De Beers mine lost 200 carats in cutting.

It has been demonstrated in cutting that diamonds are of different degrees of hardness and that the same stone may exhibit different degrees on different faces. The Koh-i-nûr is a signal example of this fact. In cutting the facet near a yellow flaw, the section grew noticeably hard, until six hours’ grinding at a speed of 2400 revolutions a minute produced only the faintest change. A speed of 3000 revolutions was necessary to cause any perceptible loss of material on that facet. A speed of 4000 revolutions a minute is about the average now in vogue at Amsterdam.\(^2\)

\(^1\) "Famous Diamonds of the World," Streeter, 1882.

\(^2\) Description by Messrs. Veder and Rozelaar, dated 6th March, 1902.
There is another material loss occurring in cutting or in the handling of rough diamonds from a curious infirmity of some of these crystals. The explosion of diamonds sometimes occurs, and the loss is the greater because large stones are more liable to explode or fly into pieces than small ones. This phenomenon is attributed to the heat of the hot solder, or frictional heat of the revolving disk.

The Lapidaries

Early handlers of the diamond were hardly more than polishers, striving to produce an even, glistening surface, and satisfied to retain the natural face of the stone, or to grind away some upper portion of the crust. This clearly appears from the many old, half-polished stones that have been found in treasuries of gems. A signal instance is shown on the royal mantle of Charlemagne, still preserved in the French National Collection. In the clasp of this robe are diamonds whose natural octahedral faces have been simply polished. In ancient church furnishings diamonds have been found with an upper table and four polished borders, and the lower sides cut as four-sided prisms or pyramids. Streeter quotes this inventory of the Duke of Anjou's jewels exhibited in 1360 a.d.: (1) a diamond of a shield shape, from a reliquary; (2) two small diamonds from the same reliquary, with three flat-cut, four-cornered facets on both sides; (3) a small diamond in the form of a round mirror; (4) a thick diamond with four facets; (5) a diamond in the form of a lozenge; (6) an eight-sided, and (7) a six-sided plain diamond. We must allow, of course, for the mistakes and the ignorance of those who may have catalogued rock crystals for diamonds, but granting that some were diamonds, their existence shows what forms were then prevalent and the real development of diamond cutting.

Previous to the success of de Berquem as a lapidary, there were polishers and cutters in Paris and at Nuremburg, as has been noted. A guild was organized in Paris in 1290 a.d., and the table cutters joined in a guild with the stone engravers in

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1 "Precious Stones and Gems," Streeter, 1880.
Nuremburg, which became a primitive Lapidaries' Union. They received and taught the apprentices on the strict condition of their contract to serve for five or six years before undertaking business for themselves. The artist Hermann won for himself an honorable name in France as early as 1407 A.D., and Gutenberg, the originator of the art of printing from block type, learned the lapidary's art at Strasburg in 1434. At a dinner given by the extravagant Charles the Bold, the Duke of Burgundy, to the king of France, he bestowed upon his guests eleven diamonds partially cut and mounted in gold. Undoubtedly these jewels were declared in the height of the fashion by European artists. But it is from de Berquem's day that the profession reckons its firm establishment, and his contemporaries have acknowledged him as the father of his art.

Though many Europeans have become skilful workers at this trade, the most successful lapidaries have been of Hebrew stock. The Jews had, at one time, the monopoly of the trade in diamonds in Portugal, and their especial centre of business was Lisbon. The old "Lisbon cut" of diamonds has never been surpassed for perfection and beauty of workmanship. But unfortunately for Portugal and for the Jews, religious bigotry kindled the fires of persecution against this ancient people, and they were expelled from the kingdom. Hospitable little Holland opened her doors to receive the exiled merchants and lapidaries, and Amsterdam has since become the central mart for the diamond merchant and his comrade, the diamond cutter. Out of thirty-five thousand Jews who reside there, at least a third are engaged in one department or another of the diamond industry.

The settlement of some of de Berquem's pupils at Amsterdam was probably the reason why the exiled Jews selected that city as their home; but others went to Antwerp and some made their homes in Paris. The descendants of these expatriated Jews received especial encouragement and protection from Cardinal Mazarin two hundred years later. Twelve of the largest crown jewels were intrusted to them to be recut on Berquem's
principle. Their success was so marked that these stones were afterwards known as the "Twelve Mazarins." Unfortunately these rare gems were poorly guarded and all but the tenth had disappeared by 1791. The French cutter Jarlet gained an international reputation in the seventeenth century by cutting one of the notable jewels of the Russian crown weighing 90 carats, but the industry withered in France in spite of its special encouragement by Mazarin and other powerful ministers.

England and Holland had secured almost exclusive trade relations with the East, from whence the diamond supply was obtained. Hence the Hebrews of these countries secured control of the diamond industry, and French lapidaries sought employment in vain. Then the revocation of the Edict of Nantes flooded Holland with French refugees. Of the seventy-five diamond cutters whom Mazarin had so carefully guarded, only five remained in 1775. Inquiry showed that the total rough diamond stock in Paris, just before the outbreak of the Revolution of 1789, was only 3832 carats, and there was little employment obtainable in recutting old stones. During the Revolution and the troubled Napoleonic reign, the industry was fatally paralyzed, and diamonds were sent out of France to Antwerp for cutting.

In the eighteenth century there was a determined push in England to foster the diamond-cutting industry, and some expert workmen, headed by Ralph Potter, made a stout struggle to hold the home trade. The so-called "Old English style" was developed on strict mathematical lines, and gems cut by these artists are still eagerly sought as models of the lapidary's art; but the centralizing drift to Holland was too strong for competition until the discovery of the South African Diamond Fields. In the last twenty years the languishing art has raised its head in England, and become, without doubt, a well-established industry. A hundred and fifty years ago London was accounted the chief centre of business for lapidaries, and it is not beyond expectation that its former preëminence may be reëstablished. Even now it is thought that diamond crystals
are cut in London town as well as the work can be done in Amsterdam.

In the United States the late Henry G. Morse of Boston was the pioneer in establishing the lapidary business on a successful footing early in the last (nineteenth) century. He opened his workshop in Boston in 1866, and made several important improvements upon the cumbersome machinery in use in Europe. His business was confined, at first, to recutting and polishing damaged gems; but the influx of South African diamonds brought about speedily an enlargement of his works and the employment of thirty expert hands. At the start only foreign workmen were engaged, but Mr. Morse succeeded in training American women to a height of proficiency as lapidaries which rivalled the best foreign work. Among the fine gems cut and polished in his shop were four weighing fifty carats each, and he later scored a notable success with the cutting of a superb South African diamond weighing 125 carats. The brilliant fashioned from this stone weighed 77 carats, and has been greatly admired by connoisseurs as a specimen of exquisite beauty and purity developed by perfect workmanship. The cutting and finishing of this gem was a work occupying three and a half months.

In spite of this well-designed and ably pushed venture of Mr. Morse, American lapidaries have struggled continuously under serious handicaps. The United States is not a producer of diamonds, and Europe is the established mart for rough stones from India, Africa, and Brazil. Moreover, the business of diamond cutting has been so firmly rooted in Europe that the work naturally gravitates to these older establishments. Foreign lapidaries and dealers enjoy a further advantage in the fact that the banks of England and Holland make loans on uncut stones, knowing that the finished diamond is much enhanced in value, while American bankers do not grant such assistance to American cutters and dealers. Nevertheless, the work of diamond cutting has been so persistently developed that over half of the diamonds imported now enter as rough stones.¹

¹ George F. Kunz.
CHAPTER XIX

AN UPLIFTING POWER

What a change came over the dismal face of South Africa with the discovery and development of the diamond mines! In a former chapter it has been shown how dragging had been the advance from the few scattered settlements on the coast up to the year when the revelation of diamonds drew the first rush of prospectors to the banks of the Vaal. The yield of this marvellous field was, from the first, of material consequence in the sum of South African products, but it was of far greater importance in the stimulus which it gave to the flagging and stinted enterprises and the sinking hearts of the colonists.

The bits of iron hoop that scraped the diamond-bearing ground were as transforming as magicians' wands. The river
Standing, From Left to Right.
W. H. Craven, Secretary.
Gardner F. Williams, General Manager.
G. W. Compton, Director.

Sitting.
C. E. Nind, Director.
C. J. Rhodes, Life Governor.
H. Robinow.
Lieut. Col. D. Harris, Director.
A Group of Uiree>^'VrvCi of Dc aaboria.[a;9 isnbisO wonido?i notqmoO W 0. ziiifiH a *0^ I' p 1^ XIX AN UPLIFTING POWER

change came over the dismal face of South Africa with the discovery and development of the diamond mines! In a form chapter it has been shown how dragging...

incnrs on the coast up to the year when...

reveal; and, as the diamond attracted, so it attracted...

The brs of iron hoop that scraped the diamond-burrown in the diamond mining communities.

The 192...
wash of the Vaal glittered like the diamond-strewn valley of Sindbad. No Man’s Land had the sparkle of diamond founts. No part of the world was too remote to be dazzled by the vision of the novel Golconda, and the black face of the despised karoo changed in a twinkling to one of transcendent promise.

Then came the rush from every quarter of the globe of ardent visionaries and fortune-hunters, streaming over the desert

![Natives riding Bullocks.](image)

sands of South Africa from every coast port to the Diamond Fields, while from far inland the tribesmen flocked to the same glittering beacon. Bitter experience rubbed the glamour from the eyes of thousands of visionaries, who trooped back disheartened, but the plucky and the lucky held their ground and thousands came streaming in to take the places of the faint-hearted. It followed naturally, too, that thousands who would never have come to South Africa except at the beckoning of the
diamond lure, remained in the country even after the blasting of their hopes of diamond winning. Many were ashamed to run away with the confession of failure; many were too poor to get away, and many were keen to see the profitable openings in other occupations for their work and savings. So every industry in the colonies gained new headway with the influx of capital and labor. Supplies of all kinds were needed for the bustling diamond camps and the flow of travel between the mines and the coast.
This demand was quite enough to stir the pulse of production in every part of South Africa, and the heartening impulse thus given was sustained and advanced far beyond the stretch of this novel requirement by the rising faith in the possibilities and future of South Africa as a field for investment, which now began to lift the drooping spirits of the colonists and to attract the coöperation of the home country and the leading nations of the world. Hopeful prospectors rambled off farther and farther over the deserts and ranges, or followed the watercourses, testing the sands for diamonds or gold, and picking at every promising ledge in their search for ore. Pioneer
grazers trekked to new pasture grounds with their flocks and herds. Abandoned farms were reoccupied and virgin soil upturned for crops. Manufactures of various kinds began to spring up and multiply. Not only Cape Town but little coast ports were thick set with steamers busily discharging cargoes on piers or in lighters and bidding for exports at rates highly stimulating to the products of the Colonies.

The march of development was signally marked in the construction of railways to meet the pressing demands for inland communication and transportation, and especially the imperative call of the Diamond Fields. The progress of mining was greatly handicapped from the start by the heavy cost of dragging supplies in lumbering ox-wagons for hundreds of miles from the coast ports, and the patent impossibility of moving any large plant in this way for mine opening or diamond winning. The pioneer railway from Cape Town to Wellington barely covered a twelfth of the stretch from the coast to the
mines, and the little lines from Salt River to Wynberg, and from Port Elizabeth to Uitenhage were of no service in the advance of transportation.

However, capital was wary and loath to invest in any of the projects for railway building into the heart of South Africa, until the continued working of the Diamond Fields for three years convinced investors that rich diamond deposits were indeed open, whose continuance in depth might reasonably be anticipated. When the export of diamonds in 1872 amounted to over £1,000,000, the Cape Government authorized the purchase of the sixty miles of railway then in place in the colony and sanctioned the extension of the existing line and the construction of railways from Port Elizabeth and East London. It was a heavy strain to raise capital for the extension of all simultaneously; so the advances were groping and slow. At
some points, too, there was even an obstinate fight against any railway extension in their direction. Little towns that had been centres of distribution for surrounding districts feared that the
railroad would divert some trade to the coast. It was further contended that the main scheme was unprosperous and that the uncertain yield of the small inner trade and the wide-ranging pasture lands would not pay interest on the cost of construction and maintenance. One of the most persistent objectors, the town of Worcester, actually sent in five petitions against the extension of the railway line to that point.

There was further protracted disputing over the proper gauge for adoption after an extension had been commenced. The short line already constructed from Ootara to Wellington was of the standard English gauge, 4 ft. 8½ in., but the continuance of this gauge was generally opposed. It was urged that the light traffic of the country would not warrant the heavy outlay required for the construction of lines of this standard adapted to the requirements of a thinly settled country like Great Britain, and that only narrow-gauge lines were practicable. Some would have pressed this reduction of gauge to 2 ft. 6 in. or even less, in view of the fact that some of the lines might be required to the necessity of resorting to tram car and horse service, but the final conclusion...
Standing.
A. Caldecott.
Max Michaelis.
Dr. R. Harris.
Sir Charles Metcalfe.
Henry Robinow.

From Left to Right.

Sitting.
Advocate Richard Solomon.
Advocate Searle.
Dr. L. S. Jameson.
James Taylor.
Mr. Justice Solomon.
George Kilgour.
railroad would divert some trade and shake their preëminence. It was further contended that the whole scheme was chimerical and that the uncertain yield of the South African farms and the wide-ranging pasture lands could not pay interest on the cost of construction and maintenance. One of the most persistent objectors, the town of Worcester, actually sent in five petitions against the extension of the railway line to that point.

There was further protracted disputing over the proper gauge for adoption after an extension had been determined. The short line already constructed from Cape Town to Wellington was of the standard English gauge, 4 feet 8 1/2 inches, but the continuance of this gauge was generally opposed. It was urged that the light traffic of the country would not warrant the heavy outlay requisite for the construction of lines of the standard adapted to the requirements of a thickly settled country like Great Britain, and that only narrow-gauge lines were practicable. Some would have pushed this reduction of gauge to 2 feet 6 inches, or even less, in view of the fact that some of the lines might be reduced to the necessity of resorting to tram car and mule service, but the final conclusion
was the adoption of a standard gauge of 3 feet 6 inches. It was properly recognized that uniformity of gauge, at any rate, was essential for intercommunication, and whimsical notions of construction were not suffered to break this uniformity. Time has shown the fallacy of these pessimistic predictions as well as the adoption of the 3 feet 6 inches gauge.

There was, however, one essential error in the whole scheme of construction. The pressure of the demand of widely separated points for railway construction was so hard to resist that the Par-

liamentary authorization for railway extensions was far in excess of what was feasible at the time in view of the limited capital that could be secured for the prosecution of the scheme. The rivalry of the principal ports was too keen to permit of the drafting of any cooperative plan of extension, for the superior accommodation, even temporarily, accorded to any one port would be challenged by others as injurious favoritism. So, instead of carrying forward a single main line by the most direct or feasible route to the Diamond Fields to meet the most pressing demands for communication, there was for many years only a crawling advance from the
competing coast ports, Cape Town and Port Elizabeth. Neither of these competing lines were able to pay any adequate return upon the capital invested, and the common aim of reaching the Diamond Fields was blocked and greatly delayed. Kimberley is only 485 miles by rail from the nearest outlet on the coast; but 1600 miles of converging railway lines were actually built before one was extended from De Aar to Kimberley, in November, 1885, then first putting the richly productive diamond mines in railway communication with the coast.

All the lines in operation at this time were single lines, with the exception of the Cape Town-Wynberg line, and the first six miles of the Port Elizabeth-Uitenhage line. The most difficult engineering in the course of this railway extension was in the crossing of the barrier range of mountains forming the ridge of the karoo plateau. After repeated surveys an entrance for the
CAPE TOWN.
line from Cape Town was effected through the Hex River Valley with a gradual ascent to Hex River East, where the line begins to climb the mountains by sweeping curves and zigzags, piercing some of the spurs in tunnels, and spanning gulleys with viaducts, until it attains its highest elevation of 3588 feet at Pieter Meintjes Fontein, 77 miles from Worcester. This is a trifle higher than the summit of Table Mountain, which rises in air 3582 feet above Cape Town. For a stretch of more than 20 miles in the ascent of this ridge, the gradients are one in 40 and one in 45, with curves of five chains radius.

In the year following the extension to Kimberley there was a fortunate impulse to the extension and operation of all the lines by the discovery of the Witwatersrand Gold Fields. Then first appeared some substantial prospect of profit for all the competing lines by the addition of another great centre of attraction and production. The junction of the Cape Town and Port Elizabeth line at De Aar, in March, 1884, had largely diverted the flow of freight and passenger traffic between the Diamond Fields and the coast, which, for some years, had been passing principally along the line through Graaff Reinet; but the rise of Johannesburg offset this loss to the Port Elizabeth,
Graaff Reinet, and East London lines. The linking of the Diamond and Gold Fields by direct railway communication from Kimberley to Johannesburg was apparently of high importance; but this extension has been blocked for years by the action of the Orange Free State in refusing to build the line themselves or to allow either the Cape Government or private corporations to construct it. Several years were passed in dilly-dallying before sanction was given to the Cape Government for an extension of a connecting link of the Cape Town and Port Elizabeth lines from Naauw Port across the Orange River at Norvals Pont, thence to Bloemfontein and the Vaal River at Vereeniging, where it connected with the Netherland Company's system of the Transvaal. It was not until September, 1892, that the first through train from the Cape reached Pretoria, but after the essential link was constructed, the Cape Town and Port Elizabeth lines contrived to secure the greater share of the Transvaal traffic for the next three or four years.

While these two lines were delayed in reaching out for the business of the Gold Fields, a more favored competitor, the Netherlands Railway Company, was actively building an eastern
line from Portuguese territory through Middleburg to Pretoria, and shortly afterward running radial lines southeast to Natal and southwest to Klerksdorp. By the extension of these well-designed lines the first through train from Delagoa Bay arrived in Johannesburg in November, 1894, and the first train from Natal in December, 1895. More than two years later, in March, 1898, the dragging extension of the Graaff Reinet line was opened to Rosmead Junction, on the main line to Port Elizabeth, and was then in a position to assist in carrying merchandise from the coast to the Diamond and Gold Fields.

While these railway extensions essential to the development of the existing States and Colonies in South Africa were more or less efficiently accomplished, the grand project of Mr. Rhodes for a railway running far north into the heart of Africa was most energetically prosecuted. By the advance of his exploration and colonization plan, to be hereafter described, the range of British territory was extended from Table Bay to the shores of Lakes Tanganyika and Moero.

The line from Kimberley was opened to Vryburg, 774 miles from Cape Town, December 1, 1890. Thus far the conservative government was prevailed upon to proceed, but the profit

1 Report of the General Manager of Railways, Cape of Good Hope, 1898.
from any further extension seemed so essentially speculative that it is very doubtful if any further advance would have been made, had it not been for the daring enterprise of the Bechuana-
land Railway Company, an organization promoted and financed by Mr. Rhodes and his far-sighted associates. Following hard
upon the heels of the pioneers in Mashonaland and the conquest of Matabeleland the line from Vryburg was opened to Bulawayo in No-
vember, 1897.

When the grand importance of this railway advance became clear, even to the doubters, the Brit-
ish Government subsequently guaranteed a loan of £2,000,000 to carry the line 800 miles farther on to Lake Tanganyika.

With the rate of progress attained it was expected that Aber-
corn at the foot of Lake Tanganyika would be reached in four years, but the outbreak of the war with the South African States was an unlooked-for clog to this advance. As soon as the line has reached Lake Tanganyika a further extension of 600 miles to Uganda through the Congo Free State has been guaranteed by an appropriation of the needed funds by vote of the share-
holders of the African Transcontinental Railway Company. Besides this main line of advance, the Beira Railway, which was constructed with a gauge of two feet, had been completed and engines were running as far as Salisbury over a stretch of line 375 miles in length before the close of 1900. The narrow
gauge of two feet was soon found to be unworkable, and the line has already been relaid from Beira to Umtali with heavier rails
and with the standard South African gauge of 3 feet 6 inches, the remaining stretch from Umtali to Salisbury having been originally laid with the broader gauge.

In spite of the lack of coöperation and capital, and all other impediments and delays in view of the character of the country, the advance of railway systems in South Africa has been phenomenal in the last few years. Including the six or seven short private lines constructed for the advance of mining operations and suburban and other local traffic, there were 2264 miles of railway in Cape Colony at the close of the year 1898. The Transvaal came next with 777 miles, followed by Rhodesia with 604 miles, Natal with 465 miles, and the Free State with 361 miles. Besides this aggregate, 256 miles had been constructed in Portuguese territory, making a total of 4727 miles of railway actually opened and working in South Africa, and more than half as much more in process of construction, or guaranteed by appropriations.

In the struggle to reach the goal of the Diamond Fields, with the handicap of the lack of capital, it is not surprising that much of the roadways and the rolling stock fell below any high modern standard. The light rails and rickety cars answered the purpose
of the day, however, fairly well, and have since been largely replaced by a plant that will bear wear and tear, but is still not up to the requirements. Makeshift bridges were soon supplanted by durable structures, and other engineering works on the lines of the various systems have also been greatly improved. The engineers who advanced the pioneer lines deserve, on the whole, high credit for their energy and talent in piercing or traversing the barriers in their way. At the time when the first train reached the Witwatersrand Gold Fields, at the close of 1892, there were somewhat more than 8500 bridges, culverts, and cuts to be counted on the various lines. Some of this bridge construction, especially the bridges across the Orange and Vaal rivers, was of a high order of excellence. The Orange River bridge on the Kimberley line has a length of 1230 feet, with open spans of 130 feet each between the piers. The Bethulie bridge is 1486 feet long, and the Norvals Pont bridge,\(^1\) the longest of all, has 13 spans of 130 feet, and a total stretch closely approaching 1700 feet. The total cost of this fine bridge was £76,593. At Fourteen Streams,\(^2\) on the Vaal River, there is a bridge of ten spans of 133 feet that is fittingly classed with the chief Orange River bridges.

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\(^1\) See photograph, p. 209, of this bridge after destruction by the Boers.

\(^2\) See p. 258.
For rapidity of building railways the palm has heretofore been claimed by America, but the best American records have been challenged repeatedly in the advance of the African Transcontinental Railway, and it is now claimed that the world’s record for rapid construction and bridge building has been captured by The Patent Shaft and Axletree Company, of Wednesbury, England. The Boers had effected the isolation of General White and his men in Ladysmith by blowing up the two railway bridges on the Tugela River at Colenso and Frere, and, promptly on learning of the destruction of these bridges, the Natal Government took steps for their rebuilding. The crossing over the Tugela at Colenso was designed in five spans of 105 feet each, and the crossing at Frere of two spans of the same length. The call for the utmost haste in construction was imperative, and tenders were invited, both in England and America. The contract was awarded to The Patent Shaft and Axletree Company upon its undertaking to deliver the first span in six weeks from the day of the contract. The order was given on the 21st of December, 1899, and the first span was finished on the 13th of January, 1900, or in nineteen working days. When the order was received, nothing was in stock at the company’s works from which the structural steel was rolled, yet at five o’clock on the afternoon of the day of the order 100 tons had been rolled at the company’s works, and tested and approved by the engineer of the Natal Government. Each of the spans weighs 105 tons, or a ton to the lineal foot of the bridge. There was about 7500 feet of planing work, and 69,000 rivet holes were drilled in each span; yet on January 19, two of the spans had been built
and work begun on three more, while the material for the whole seven for both bridges had been rolled, cut to size, tested, and approved.

Besides government railway building, important private lines have been constructed for the operation of large mining works, and local or suburban traffic. The oldest of these lines was the undertaking of the Cape Copper Company, covering a stretch of 100 miles from Port Nolloth to Ookiep. Some of the grades on this line are very notably steep, exceeding any others where ordinary steam-engine traction is employed. For this service special engines were constructed by Litson & Co. of Leeds, which have been working very successfully since October, 1890. On Klipfontein mountain there is a rise of 1330 feet in 7½ miles, and in several sections the gradient reaches the extreme of 1 foot in 19. This line was built for the development of the Namaqualand copper mines, one of the most profitable undertakings in the Colony. The Cape Copper Company owns most of the paying mines, and has been extracting annually about 30,000 tons of ore, averaging nearly 20 per cent in copper.

The Indwe Railway Company's line is only second to this, with a length of 66½ miles. This line was opened in 1896 to reach the Indwe coal mines, and is operated by the Cape Government as a branch of the Eastern System which it joins at Sterkstroom. It was built by the Indwe Company with the material assistance of De Beers, which subscribed £75,000 to its working capital. The Company owned all its rolling stock, but it was operated under the supervision of the Cape Government Railway Department. This railway has been lately sold to the Cape Government, and is to be extended to Natal.

It is computed that the lines owned and operated by the Cape Government have cost, with their rolling stock, about £20,000,000, representing the investment of about £7200 per mile. The capital invested in the Natal lines was £6,750,000; showing an outlay of £15,000 per mile. The 777 miles of

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Netherlands Company cost nearly £9,000,000, or £13,500 per mile. This gives a total of £38,000,000 for the construction of 3500 miles of railway, not including lines owned and operated on private account. With all lines included, it is estimated that there is a total outlay of £56 per head of the white population of the country, which does not average more than 163 to the mile of railway opened.

In 1896 the earnings of the Cape Government railways came to something over £4,000,000, of the Natal railways £1,000,000, and of the Netherlands Company nearly £3,000,000. The net profit after paying interest on capital in the Cape was £1,221,675; in Natal £464,762; and in the Transvaal £1,328,424, making a total of over £3,000,000, not including the Free State share of profit, which for 1896 was £289,553.

Five extensions were authorized by the Volksraad resolution of the Free State in October, 1896. One line through Fauresmith was to serve the diamond mines of Jagersfontein and Koffyfontein and place them in direct communication with the coast ports. In 1898 the Free State decided to build a railway by concession from Bloemfontein to Kimberley, and to extend the Springfontein-Fauresmith line to join the Bloemfontein-Kimberley line at a point near Petrusburg. The Springfontein-Fauresmith line forms a direct route between East London and Kimberley, shortening the present route by 100 miles, making East London 40 miles nearer to Kimberley than Port Elizabeth. The Bloemfontein-Kimberley line will reduce the present
distance by rail between Kimberley and Johannesburg and Cape Town. The war has, for the time being, stopped this work.

The Natal Government is also proceeding with the construction of north and south coast lines: one through Verulam to Zululand, and the other to the Cape border, where it will connect with the extension of the Sterkstroom-Indwe line.

Twenty-five years ago only 781 miles of telegraph were open in all of South Africa. A message of twenty words from Cape Town to East London cost 17s. 6d. At the outbreak of the late war 19,000 miles of wire were working in Cape Colony, and probably 10,000 miles in other states and colonies. The march of the telegraph through South Africa will be later detailed.

In addition to the railway and telegraph, several thousand miles of excellent roads have been made, and every river of magnitude has been spanned by substantial bridges. The great Zwarte Berg Pass, which rises 3400 feet in eleven miles from base to summit, is one of the finest monuments of road construction to be seen in any country.

At every port the shipping accommodations have been extended and improved, and approaches to the coast have been made safer by construction of numerous lighthouses.

The impulse given by the Diamond Fields development for prospecting for mineral deposits of all kinds led to the discovery of the mines of Lydenburg, De Kaap, and the Rand. In the year preceding the discovery of diamonds Thomas Baines had led a party from Durban to prospect for gold in Matabeleland, and secured a concession from Lobengula in April, 1870, to dig for gold in the district between the Gwelo and Ganyona rivers. But Baines's party found no largely promising deposits, and without the excitement of the rush to Kimberley there would hardly have been any considerable and determined effort to push prospecting far beyond the Vaal. Luckily, shortly after the rush to the Diamond Fields in 1871, reef gold was found by prospectors at Eersteling and Marabastad, and, two years later, gold placers were discovered about thirty-three miles east of Lydenburg, at Pilgrim's Rest.
These discoveries were greatly magnified in the fever of speculation excited by the opening of the diamond beds, and companies were formed in Natal and England to develop these gold-fields, while daring adventurers pushed still farther on, to the region north of the Limpopo, seeking the traces of the ancient mining works that were known to exist. Upon the report of the discovery at Lydenburg some fifteen hundred prospectors flocked to this field, and a year or two later gold was found in the Kaap Valley, fifty miles south of Lydenburg. The returns from the placers were hardly tempting enough to hold the gold seekers, and conflicts with the natives, followed by the outbreak of the war with the South African Republic in 1880, were further discouraging to any development in this region. After the war the exactions imposed by the South African Republic upon the prosecution of mining in the Lydenburg district were a check to outside prospecting.

In 1882 an Australian digger, Charles Durnin, found some very rich patches of gold-bearing ground on the Kantoor plateau in the Kaap Valley, and the rush to the Duivels Kantoor and Moodies brought to pass the first considerable undertaking of gold quartz mining in South Africa. Some gold mines showing great richness of ore were soon developed in this district, and the bustling mining town of Barberton marked the centre of a field which was thought to be of marvellous promise. Unfortunately the booming of the district ran to a pitch of insane and fraudulent speculation that was greatly damaging to the reputation of this field of investment, and gold mining undertakings in South Africa would commonly have been reckoned as "bubbles," had it not been for the uncovering, at this juncture, of the astonishing riches of the Rand.

Nearly twenty years before, the famous elephant hunter, H. Hartley, after marking the gold-bearing ground in Matabeleland and the region of the Zambesi, made his home on a farm in the Witwatersrand, unconsciously settling on the face of deposits of gold far more marvellous than any tradition of King Solomon’s mines. Hartley died without any vision of the treas-
ures over which he and others were tramping day after day. It was soon noticed by roving prospectors, and by settlers in the district, that there was gold-bearing sand in the beds of the little river and creeks rising in the Witwatersrand, but no noteworthy search for gold was attempted until an Australian mining man, Armfield, a reputed expert, was sent to prospect in this region during the British occupation from 1876 to 1880. He made some tests of quartz ledges on a farm adjoining Paardekraal, but found nothing of value.

The credit of the first important revelation of gold in the district undoubtedly belongs to Mr. Fred Struben, who had given his earnest attention to the gold developments in the Transvaal, and who prospected the Witwatersberg district in 1883, and found traces of gold in creeks and reefs, as well as ancient workings for copper. In the following year his elder brother, Mr. H. W. Struben, purchased two small farms on the northwestern end of Witwatersrand, and both the Strubens continued their prospecting energetically during the year. In the summer of 1884 a gold-bearing vein or reef was discovered and traced for several miles by Fred Struben. Ore shoots and pockets were found which assayed over one thousand ounces of gold and silver to the ton. The rich ledge, named the Confidence Reef, was supposed to be of prime importance; and the Strubens erected a five-stamp battery on the ground to crush the ore of this and neighboring ledges. Several samples of the ore were tested in the stamp mill, but the best ore yielded only eight pennyweight to the ton. Work on the Confidence Reef was greatly disappointing, for the gold-bearing rock was soon proven to be a small deposit.

In August, 1885, I visited a small mine called Kromdraai, situated about twenty miles, in a northwesterly direction, from the present site of Johannesburg, but at a much lower elevation, near the old Pretoria and Kimberley wagon road. A small reef of gold-bearing rock was being mined, and the ore crushed in a little mill in the immediate vicinity. I also spent a few days looking over the Confidence Reef, with the Strubens, who were
MR. RHODES'S HOUSE,
Groote Schuur, near Cape Town.
at that time the most enthusiastic and energetic prospectors, as well as the most enlightened and progressive men, in the Transvaal. Mr. Henry Struben owned large estates near Pretoria.

The Strubens had spent over £11,000 in their mining operations in the Witwatersrand, and their venture seemed a losing
one, when, in the spring of 1886, one of their employees, Walker, found the rich reef, now known as the Main Reef Leader, on the farm Langlaagte, about two miles west of the present Johannesburg. In July the first sample of the conglomerate from the reefs on the Langlaagte farm was panned in Kimberley. The showing was so remarkable that Mr. J. B. Robinson, backed by Mr. Alfred Beit, who saw the panning, started on the following day for the Rand. The Kimberley-Pretoria coach road ran through Potchefstroom, and thence northeast, leaving the little pioneer town called "Ferreira's Camp" (now Johannesburg) some fifteen or twenty miles to the east; but Robinson drove in a cart from Potchefstroom to the little sprawling camp that was the first sprout of Johannesburg. Within a day or two after his arrival he bought the Langlaagte farm for £7000. Scoffers, who posed as experts, told him bluntly that "a fool and his money were soon parted"; but he did not take heed of their gibes, and, before the end of the year, bought the whole of the ground comprised in the holdings of the "Robinson" Company for £13,100.

Messrs. Rhodes, Porges, Beit, and other enterprising men of Kimberley shortly followed Robinson in the pioneer work of the Rand. In January, 1887, the development work on the Robinson mine consisted of a hole in the ground, fifty feet deep, which was full of water. Robinson, who had been somewhat unfortunate on the Diamond Fields, went "nap" on the Gold Fields, and the rivalry between him and Rhodes was very keen. One story, with some foundation of fact at least, will show this. While Rhodes was trying to buy a farm from the Dutch owner, and they were parleying in the orchard, Rhodes conversing in English and bad Dutch, and the Boer in Dutch and bad English, Robinson arrived on the ground. He went direct to the farm-house, and at once opened negotiations for the purchase of the farm with the Boer's vrou. His familiarity with the "Taal," South African Dutch, was a telling advantage in his competition with Rhodes, and he reckoned shrewdly that the wife would jump at a bargain more quickly than the husband. So he slapped
a handful of golden sovereigns on the table, saying smartly, "Those are for you." The old vrouw clutched greedily at the gold and called shrilly to her husband to come to the house. He obeyed the call dutifully, and when he entered the door he found that his wife had already sold the farm to Robinson. Even a hen-pecked man might have grumbled at such a sale, but when the simple Boer saw the heap of glittering sovereigns on the table, he could not hold out stubbornly against a man who had so kindly presented his vrouw with so great "a mark of respect." While Rhodes stood in the orchard, Robinson got the farm.

In the early rush to the Rand, farms and mines were bought, not so much for any phenomenal richness, as for the fact that they showed more gold distributed over a greater stretch of country than had ever been disclosed in South Africa. The first two or three years were very disappointing, for the total output did not cover the taxes levied upon the mines by the Government. A large percentage of the gold was lost in working the
ores, for the precious metal was so extremely minute that it floated away with the water, and, at no considerable depth, a portion of the gold was held in the pyrites, and could not be recovered by means of the ordinary process of amalgamation. Some other process was needed that would save the minutely fine gold which became suspended in the water owing to the attachment of globules of air. When the Rand was discovered, no such process had been developed beyond the experimental stage. MacArthur and Forrest, of Glasgow, were experimenting with a solution of cyanide of potassium, which was known to be a solvent of gold. They found that the ores from the Rand readily yielded their gold when treated by this process, which soon came into general use. This was the saving of the Rand, for without such treatment only a few of the richer mines would to-day be paying properties.

A little more than a year after Robinson bought properties on Witwatersrand, the despised "cabbage field" of the Langlaagte farm was floated with a capital of £450,000, and yielded £950,000 in gold in the next five years, with a profit of nearly seventy-five per cent in dividends on the par value of the capital stock. The holdings of the Robinson Company, in the same time, produced over £1,400,000 in gold and paid £570,937 10s. in dividends to shareholders.

By the discovery of the diamond mines in Griqualand West, a product ranging over £80,000,000 in value in less than thirty years had been added to the meagre output of South Africa, and the gold mines of the Witwatersrand began, about seventeen years ago, to swell this great exhibit of the mineral riches of the land by the addition of gold already aggregating over £100,000,000.

The annual flow from the diamond mines has averaged, for years, over £4,500,000 in value and the Rand has greatly outstripped even this rich showing. Prior to the discovery of diamonds, the total tally of South African exports and imports combined was not £6,000,000 in value. In 1898 it was nearly £50,000,000, and, of the total exports, eighty per cent were mineral products.
With this general survey it is now practicable to trace with more clearness the essential and special services rendered in this grand development by Rhodes and his associates in De Beers Consolidated Mines and other organizations. Viewing, as he did, the control of the Diamond Fields very largely as the intermediary step toward the attainment of an aim far grander, the consolidation of the chief diamond mining properties had hardly been effected when Rhodes took action swiftly to extend and intrench the range of British influence north of the Transvaal by obtaining the concession of the mineral rights in Lobengula’s kingdom of Matabeleland, through the adroit agency of Messrs. Charles D. Rudd, Rochefort Maguire, and Frank Thompson, in return for an annuity of £1200 and a coveted stock of rifles and ammunition. Lobengula made the grant which gave to Rhodes the needed nucleus for the creation of the grand exploring and developing agency which he pressed for incorporation as the British South Africa Company.

There was a natural hesitancy on the part of the public in
supporting this scheme at the outset, for the Matabele concession seemed to investors at large—little more solid than a moonlit cloud bank, and even venturesome speculators shrank from buying shares in a prospecting license in a country held by savage blacks, trained in the school of Chaka to pillage and murder. But this incredulity was anticipated by Rhodes, and a solid backing was given to the enterprise by the subscription of De Beers Consolidated Mines for more than £200,000 of the working capital. This was a demonstration of good faith and practical intent so convincing that the British Government granted a charter formally to the new company in October, 1889, and it has since been popularly known as the Chartered Company. The government was reluctant to extend the working scope of the charter north of the Zambesi, but Rhodes's aim was not pent up in Matabeleland, or Mashonaland, and by his forceful representations the British South Africa Company was left unrestricted in its range to the north, as far as it could advance without infringing on other concessions, or entering territory acquired by Germany or other nations of Europe. There seemed, at first, some likelihood of competition and possible conflict of interests in the race of extension with another adventurous association, that applied for a charter as the African Lakes Company. But the risk was forestalled by Rhodes's foresight and promptness of action. The promoters of the African Lakes Company had spent all the capital they could raise, and were so dangerously near the verge of collapse that they welcomed the helping hands of Rhodes and his friends without much quibbling over the terms exacted. At once
£20,000 were subscribed by the organizers of the British South Africa Company to float the African Lakes Company, and a further subscription of £9000 a year was pledged in return for the right under certain conditions of merging the subsidized company in the British South Africa Company.

Then, with his unhampered charter and its range cleared to the source of the Nile, Rhodes was ready, like Davy Crockett, to go ahead. After consulting with Frank Selous, the famous African hunter, and others familiar with the field, he pitched upon Mashonaland as the first base of operations. Dr. L. S. Jameson was deputed to go to Bulawayo and get Lobengula’s express license for this undertaking. The envoy made all possible haste in his mission, and won the king’s favor so quickly by his tactful bearing that the entry to Mashonaland was conceded. Rhodes lost no time in taking advantage of this opportunity. A force of five hundred armed men were enlisted under the chartered right to an adequate “police,” and two hundred pioneers were hired to make a passable wagon road to Mashonaland. Colonel Pennyfather was placed in command.

Meanwhile, the fickle Lobengula changed his mind when Dr. Jameson was no longer by his side to persuade him, and sent
a message to the expedition, forbidding the road-making. The messenger of the king met the British at Tuli, but the men picked by Rhodes were not of a temper to be checked or frightened away, and the road was pushed ahead as fast as possible through the thick brush and woods of the lowland, where the peril from attack was most to be dreaded. Dr. Jameson rode in the van with forty of the best mounted men as an advance guard. Selous led the pioneers and marked the roadway. Finally, on the 13th of August, 1890, the road-makers came to the great plateau of Mashonaland, through an easy mountain pass, and a heavy weight was lifted from the minds of the leaders, for on this open plateau hostile attacks were no longer to be dreaded, and a few hundred well armed and mounted men might well defy a horde of marching Matabeles. It is probable that this daring advance would not have been made unmolested, if Lobengula's attention had not been artfully distracted by a feint of entry in another quarter made by a body of Bechuanaland police on the
southwest border of Matabeleland. Thus was the first grip of civilization secured on the rich territory which now bears fitly the name of "Rhodesia," in lasting commemoration of the grand foresight and enterprise of its redeemer from barbarism, Cecil John Rhodes.

No sooner was this entry effected than Rhodes's untiring energy sought further extensions of British control. By treaty with the native chief, Umtasa, the neighboring Manica was brought under the same protecting power as Mashonaland, and a footing was gained with the like expedition in the native province of Gazaland. It was obvious that no extended development of the resources of this territory or stable colonization could be effected without railway connection with the Cape, and Rhodes at once undertook the provision of capital for the essential extension of the Transcontinental Railway through Mafeking to Mashonaland. He raised the money required, besides drawing heavily upon his private fortune, at the same time, for the Beira Railway extension. He contributed also four-fifths of the capital of the Transcontinental Telegraph, and, all this
while, bearing in great part the extraordinary expenses, amounting to \£250,000 annually for the first two years, of the development of the undertaking of the British South Africa Company in Mashonaland.

Fortunately, by the extraordinary executive ability of Dr. Jameson, who was appointed Administrator for the Chartered Company in 1891, the immense outlay required of the company was reduced to only \£30,000 annually. The thriving town of Victoria was founded and the settlement of the country was most energetically pressed in spite of every obstacle. But when the way for the profitable advance of the company's operations seemed to be clearing, its Colony was menaced in 1893 with utter destruction by the attack of the fierce Matabeles.

Lobengula had viewed the entry of the Rhodes expedition into the territory north of his kingdom with rising disgust, accentuated by his failure to stop it, but it was two years before he came to the point of open attack. He had been accustomed, all his life long, to regard the district occupied by his neighbors,
Standing.

Sir Charles Metcalfe.
Sir Thomas Uppington.
Gardner F. Williams.
Colonel Griffiths.
C. J. Rhodes.
Miss Willson.

Sitting.

From Left to Right.

The Bishop of Derry, and his daughter, Miss Alexander.
Mathew Blake.
Fortunately, by the extraordinary business ability of Dr. Jameson, who was appointed Administrator for the Chartered Company to carry out the immense sums required by the company on the reserved in only 2,000,000 annuities. The thriving finance was assured and the settlement of the country was most successfiull preceded by spite of every obstacle. But when the prospects for the advance of the company's operations were at their height, the Colony was occupied by the-led by the advance of the Matabele.

Jameson had gained the trust of the whole expedition and was allowed much of his own power and freedom, supporting him in his efforts to stop it, but it was not until nearly two years before he came to the point of open armed. He had been accustomed all his life to the same sort of open armed, but in the end...
the weak and unwarlike Mashonas, as convenient harrying ground for his brutal forays. Marauding troops of freebooters were constantly harassing the poor Mashonas, and oftentimes the king would send his robbing and murdering expeditions to scourge the land, just as he sent his impis to take Ugami,—to despoil and enslave and massacre the Batuwani,—and, across the Zambesi, to raid the Mashukulumbwe or the Barotse.

To the sorely persecuted Mashonas the coming of the English was an assurance of protection which was greatly welcomed,

but even the presence of the bold white men and the unfolding of the British flag did not stop the marauding. Dr. Jameson protested over and over again to Lobengula, but the king was deaf. Finally, in July, 1893, parties of the Matabeles pushed their ferocious raids contemptuously up to the very bounds of the township of Victoria, and the English could not look on unmoved. Then Dr. Jameson sent a squad of police to warn off the marauders. The Matabele insolently fired on the guard, and the police charged and drove them flying.
This wholly rightful rebuff upset the temper of Lobengula, who was stuffed with barbaric conceit. His impis began pouring over the border, and the infant Colony was threatened with extinction. The menace was met by a heroic response. There were only a handful of police at the time in Mashonaland, but the settlers were men who could defend themselves.

It was judged best to meet the roving assaults by a direct counter attack on Lobengula's stronghold, his capital of Bulawayo. The Chartered Company's funds were drained out; but Rhodes, as ever, rose to the occasion, and raised the money imperatively needed to arm and conduct the little force that was to make the daring venture into the heart of the most savage and warlike province in South Africa. With this backing Dr. Jameson raised a force of about nine hundred men, and, placing himself at their head, as Commander-in-chief, marched on Bulawayo. Just after crossing the Shangani River, his little army was attacked by the Matabele in force, but beat off their assailants. With the encouragement of this success the English pushed on to the Imbesi.

Here they were attacked again in the old Zulu fashion by desperate charges of seven thousand frantic blacks in rank after rank of impis upon the well-prepared English camp. It was a fierce fight, but the issue did not hang long in doubt. The Matabele were as dashing and reckless as the impis that had fallen like breakers of surf on the laagers of the Boers during their "Great Trek." But they were overmatched by the ceaseless belching of machine guns and repeating rifles, mowing them down swath by swath when they charged within close range. At last they broke and fled, and Dr. Jameson's little army marched on to Bulawayo, which was entered without further fighting, for the disheartened Lobengula abandoned his capital.

The British pursued him hotly, for it was highly important to put a decisive end to the war by his capture before the advance of the rainy season. Unfortunately this pursuit was too daringly pressed. Major Wilson, with a little force of less than forty mounted men, nearly plucked Lobengula out of the
AN UPLIFTING POWER
midst of his retreating impis. His impetuous rush reached the cart that carried the king; but the desperate Matabele flung themselves upon this little troop in such masses that its advance was checked. Messages for help were sent to the main troop in pursuit, under Major Forbes, but succor was cut off by the rising of the Shangani River. Flight would have saved most of them, but Wilson and his men who were able to ride off scorned to abandon their wounded comrades. So, hard pressed by the Matabele on all sides, they made a barrier of their horses, living and dead, and held their ground until their last cartridge was fired. Then they stood up defiantly and fought hand to hand until the last man was cut down and trampled under foot in the crush of the savage blacks. The troop under Major Forbes was forced to retreat, and suffered much privation before it was met by a relief party headed by Rhodes, who rode out from Bulawayo.

The loss of Major Wilson and his gallant men was deeply mourned; but the campaign as a whole was a most brilliant success. Lobengula's power was completely broken, his impis scattered, and he soon afterward died a fugitive. The royal city of Bulawayo was made the capital of Rhodesia, the province of the Chartered Company, and Dr. Jameson took his seat there as Administrator. The rich mineral ground near Bulawayo soon attracted a considerable influx and made a rising town, which in less than three years boasted of its banks, clubs, newspapers,
AN UPLIFTING POWER

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electric lighting, and water-works. The brave colonists who made up the force of "Jameson's Volunteers" were disbanded, and began to prospect for gold and pick out farms in the new province.

With the fall of Lobengula, a standing menace to the march of settlement was removed, and the attractions of Rhodesia began to come out in a brighter light. It was the settled purpose of the Chartered Company, from the outset, to do everything that was feasible to encourage investigation and the taking up of farms by honest and thrifty colonists. This was regarded, by Rhodes at least, as transcending in importance even the development of the mineral riches of the country, though the latter was naturally the chief object with most investors. Particular pains has been taken, in directing the colonization, to harmonize relations between the men of different races and nations, and to draw as closely as possible all together in a common bond of union as Africanders.

Considerate and elevating treatment of the natives has also been a notable feature of the determination and policy of the Chartered Company. The relief of Mashonaland from the ferocious forays of the Matabele was a memorable service which will be credited at the outset to this company. It has further given to all within its jurisdiction the fullest protection of English law, and safeguarded all working in service from abusive treatment by their employés, prohibiting the use of the lash, and enforcing other humane regulations. The sale of liquor to the natives is forbidden by stringent laws, and the most discreditable and demoralizing influence in South Africa is barred out of Rhodesia, at least.

To determine the extent of arable and pasture lands, deputations of experienced farmers were appointed to inspect and report by public meetings in the Cape Colony and Orange Free State. Their examination of less than half the area of Mashonaland and Matabeleland reached the conclusion that at least 40,000 square miles were well adapted for colonizing purposes. It may further be noted that highly favorable reports of the agricultural and
mineral resources in the vast territories of the British South Africa Company, north of the Zambesi, have been furnished by Joseph Thomson, Alfred Sharpe, and other well-known explorers. Actual experience and the medical officers' reports have shown that the climate is not unhealthy for any white man who will avoid undue exposure and observe a few simple precautions.

The advance of immigration and development has been remarkable in view of existing conditions. There were inevitable hardships and discouragement to check the first rush of gold seekers. The gold-fields were only slightly explored and lay far from any base of supply. There was lack of resources and means of communication to develop even the most promising

openings. Yet, in spite of all obstacles, prospecting has been pushed far enough to show the range of gold-bearing ground and ledges for hundreds of miles. Convincing evidence of the mineral richness of the country is given to the extent of the ancient workings that have been traced through Mashonaland far beyond the southern end of Lake Tanganyika. There can be no doubt that an enormous amount of gold has been taken from this region both by placer washing and quartz mining. There are no other ancient workings, on the face of the Old World at least, of like extent, and this undeniable evidence weighs heavily for the contention that the flow of gold from this source was the main supply, for centuries, of Arabia and Asia Minor. In view of the superiority of modern appliances for mining and the extraction of gold, it would seem, at least, probable that the yield of this territory may, in time, be large.

There are apparently well-verified reports also of the dis-
covery of extensive copper and iron deposits in North Rhodesia and in the region lying along the western shores of Lake Tanganyika. The missionaries of the Roman Catholic society known as the White Fathers have long been at work on the shores of Lake Tanganyika, and a report of their explorations has been published lately in Petermanns Mitteilungen. It is
VICTORIA FALLS,
East Corner.
noted that great quantities of iron ore have been found along the banks of the rivers flowing into Tanganyika, particularly along the Lufuko and Miobosi.

The wide-ranging Marungu district is said also to be exceedingly rich in copper ores; and the copper areas, better withstanding denudation than the surrounding country, are reported to stand comparatively high above the general level and to be easily recognizable. Agents of the Chartered South Africa Company have also reported the discovery of a rich copper field, estimated to cover 40 square miles, in north Rhodesia. This field lies about 150 miles north of Victoria Falls, near the Congo Free State, and runs over the border. De Beers Company has already taken an active part in the development of the copper mines of Namaqualand, and the new field may prove to be of even greater importance.

The rapid extension of the railway lines of the Bechuanaland Railway Company from Vryburg to Bulawayo was mainly due to the aid given by Mr. Rhodes and his associates in the Chartered Company. This line reached Bulawayo, a total distance of 1360.4 miles from Cape Town, in 1897, and has since been extended northward about 30 miles. The war has interrupted this work during the past two and a half years. The main line north, it is expected, will reach the enormous coal beds at Wankie, 200 miles north of Bulawayo, in about eighteen months, and will be pushed on
MR. RHODES'S HUTS IN THE MATOPPO HILLS, RHODESIA.
to the Victoria Falls on the Zambesi and thence north as rapidly as possible to tap the rich copper districts.

The telegraph line running ahead of the railway was carried across Rhodesia and reached Lake Tanganyika, from which it is fast extending to Uganda, so that Cape Town and Cairo will soon be in direct overland telegraphic communication. The inspiration of this work of the Transcontinental Telegraph Company was due to Rhodes, and the greater part of the capital needed to extend it was contributed by him personally. The postal service already effected is as remarkable as the telegraph. Even from points hundreds of miles beyond Bulawayo, which, eight years ago, was the heart of savage Matabeleland, the pioneer can send a letter home to England for twopence halfpenny, and the settler on the remote shores of Lake Moero can get by mail a pound package of tea from Liverpool at the cost of a shilling.

Already the Chartered Company has carried the work of exploration and expanding control to Lakes Tanganyika, Moero, and Nyassa, and made treaties with the native chiefs north of Rhodesia, as well as with Lewanika, king of the Barotse, to the west. The range of British influence and civilizing advance now reaches to the heart of Africa from the south, embracing all the country not within German control in the west, and the Portuguese domain in the east. The grand aim of Rhodes has been swiftly advanced in realization even beyond sanguine expectation.

Another undertaking, less far-reaching and impressive in scope, but of evident material importance to the development of the industrial resources of South Africa, was liberally and energetically supported and advanced by De Beers Mines. The cost of importing coal was from the outset, and still continues to be, a crippling handicap upon the advance of the mining and manufacturing industries of the South African Colonies. Persistent searches for coal deposits throughout the country were made, but no coal seams of high quality were uncovered. The best apparent prospect for opening deposits that might compete in the market with imported coals was shown in the Stormberg and neighboring hilly districts lying between Queenstown and the Orange River.
Progressive colonists developed the outcrops in the Stormberg district, and in the face of grave discouragements opened seams of importance in the Molteno and Cyphergat mines, but it was impracticable to work these mines with any prospect of profit until railway communication was opened from Stormberg Junction via Steynsburg to Middelburg, connecting the East London and the Midland or Port Elizabeth lines. The possibility of supply from this district was immediately grasped by De Beers Company, both for the sake of an eventual saving in the cost of its fuel, and the public-spirited object of co-operating, so far as was feasible, in the development of a resource of such importance to the colonies.

The Stormberg coal was so mixed with shale that even the shipping coal after sorting held about one-third waste, which clogged the furnaces. But special grates were designed to burn this coal, and by this resort it was practicable to use a supply from this field at the diamond mines. De Beers Company was soon taking by contract practically the entire product of the Stormberg seams at a price of about 20s. per ton at the shipping point.

Not long after the opening of the Stormberg mines, coal seams of much greater width and promise were discovered at Indwe, a point about seventy miles east from Molteno and Cyphergat. Here the prospective returns from energetic devel-
opment were really very bright, but, to market the coal, the construction of an expensive railway line from Indwe to the East London or Eastern systems was indispensable. In spite of the unwearied and cogent representations of Colonel Schermbrucker and his associates in control of the Indwe field, the Cape Government was reluctant to defray the cost of building this line. The scheme was a dragging one for years, until De Beers Company came forward with a subscription of £75,000 to the shares of the Indwe Railway Collieries and Land Company, organized to extend the necessary railway lines and operate the mines.

In view of this essential backing of capital, coupled with the cogent appeals of Rhodes and his associates, the Cape Government was moved to contribute a grant of £50,000 toward the expense of construction, with an additional allowance of 50,000 acres of land, worth about one pound an acre. Then a line of sixty-six miles was laid at half the rate per mile that was paid for building the lines under Government Administration, and the mines were opened very successfully. It was supposed by the projectors of the scheme at the outset that the main business of the company would be the supply of coal for steamship use at East London; but it was soon demonstrated, upon the com-
pletion of the railway, that De Beers Company was the principal customer, consuming about 5500 tons of the average monthly production of 12,000 tons. This coal supply was delivered to De Beers by agreement for 15s. per ton at Sterkstroom, the point of junction of the Indwe and Eastern system lines. In spite of the inferior quality of the coal, compared with Welsh coal, the South African coal at this price was a good bargain for De Beers, and the very profitable record of the Indwe Company proves that the interests of its shareholders were not sacrificed in making the bargain. The mines of the Stormberg district are still continuous producers, and supply about 1000 tons monthly to the mines at Kimberley not under control of De Beers Company.

Coal mining in the Orange Free State has not been carried on very energetically on account of the distance of the coal measures from the existing railways. But the developments in this field are already promising, and the Kroonstad Coal Company, in particular, has opened up a bed of very good coal. A railway is in course of construction from the main Free State line to the Kroonstad coal fields. When this line is completed these mines will be in a position to compete with any others, and if the long-promised line is constructed from Branford or Bloemfontein to Kimberley, Kroonstad coal can be delivered at the diamond mines cheaper than any other coal yet discovered. Beyond these undertakings is the opening of the promising coal mines in Natal to which De Beers Company has liberally contributed. (See Appendix IV.)

Other enterprises, too, of public service are worthy of mention. De Beers Company is steadily furthering fruit and stock farming, and has constructed storage buildings in various locations in order to prevent a monopoly of the meat supply which was threatening South Africa. It is constructing, also, one of the largest dynamite factories in the world, near Cape Town, under the able superintendence of Mr. W. R. Quinan.

Of course Rhodes could not foresee the marching steps of this progress in varied lines, but it is none the less certain that
THE TERRACE GARDEN,
Back of Groote Schuur.
the expansion of the undertakings of De Beers Consolidated Mines was the carrying out of his long-cherished aims. It was for this chiefly that De Beers Charter was drawn with so free a hand. Assured control of the great South African diamond mines was the assurance of great wealth,—from Rhodes's point of view, great power that should be greatly used. His aims ranged far beyond any personal exalting. His heart was set on the making of Greater Britain by expansion and loyal federal union. In the Dark Continent, beyond the confines of civilization, he saw the open field for British occupation and development, and was unresting till it was grasped. How great this attainment was in actual stretch of territory may best be comprehended, as the London Times notes, "by any one who will take the trouble to contrast the map of Africa as it appeared in 1881, when Mr. Rhodes first entered public life, with that which is open to his study to-day. At the earlier date, the line of the 28th degree of south latitude bounded our possessions in South Africa; the later map he will find coloured red right up to the shores of Lake Tanganyika—within a few degrees of the Equator."
That this annexation has been, and will be, greatly to the advantage of the territory and its occupants will not be seriously questioned. Its material advance and the security to life and property stand already in bright contrast to its barbaric state—a land which knew only the rudest tillage and was ravaged at the whim of savage chiefs. It is too early yet to think of measuring its resources and probable advances, but enough is known to warrant high confidence in its future, with the assurance of alert grasp of its openings for immigration and capital.

To any eye the gaining of Rhodesia was a long step forward toward the attainment of Rhodes's hope of carrying British dominion from the Cape to Cairo. But the ordinary observer would not mark, as intently as Rhodes did, the force of this acquisition in determining the control of South Africa. Seventeen years ago, in addressing his constituents, at Barkly West, he declared publicly, as a settled conviction: "I came to the conclusion that the key to the (South African) puzzle lay in the possession of the Interior, at that time an unknown quantity. In a humble way I have been mixed up with the politics of the
Interior during the last four years, and such politics, I contend, will be in future most intimately connected with the settlement of the South African Question, for I believe that whatever State possesses Bechuanaland and Matabeleland will ultimately possess South Africa." It was his view, asserted in repeated conversations with Mr. Edward Dicey, that the taking of Rhodesia necessitated the creation of a predominant South African Confederacy, which would be brought to pass by the force of circumstance. In the interest of South Africa and Great Britain Rhodes sought the inclusion of this Confederacy in the British Empire.
CHAPTER XX

THE MINES BESIEGED

The siege of Kimberley was one of the striking episodes of the late war. As an interruption to the peaceful progress of diamond mining in the South African Fields, it has a place apart from the industrial story. Yet no history of the Diamond Fields would be complete without some account of its course, and my personal view may be of interest in the possible emphasis of the part taken by De Beers in the maintenance of the defence. I would mark, too, exactly how the war affected the working of the mines, and tell from my own observation how the call to arms made soldiers of men accustomed to the use of drill, pick, and shovel, and caused our mechanics to turn their hands to the making of ordnance.

For some time previous to the actual outbreak of the war (October 11, 1899), it was apparent to us who were living upon the border of the Orange Free State that both the South African Republic and the Orange Free State were making preparations for war with England, and that the invasion of the Cape Colony was but a matter of a short time. These preparations had been going on for many years until the magazines and arsenals of the Transvaal were filled with the finest munitions of war that the works of Schneider at Creusot or of Krupp at Essen could produce. The Mauser with which the Boers were armed was as good as the small arms of any Continental power, and better than the Lee-Metford which the British brought against them.

In July, 1899, Major Scott-Turner came to Kimberley, and Lieutenant McInnes, Royal Engineers, followed him shortly after. Colonel Trotter, R. A., Chief Staff Officer, also came to
stay a short time. He had made a report on the defences of Kimberley as early as 1896, and an accurate military map had been prepared of the town and surroundings. Major O'Meara came later as Intelligence Officer. The Imperial Government sent these officers to prepare for the defence of Kimberley, and on the 13th of September, shortly before the war was declared, there arrived a half regiment of the Loyal North Lancashires (infantry), and a battery of Royal Artillery, consisting of six

muzzle-loading seven-pounders of obsolete pattern, and some Maxims.

On the 30th of September the Governor of the Cape Colony gave his consent to the formation of a Town Guard, "solely for local defence in case of attack from without." The radius of the circle in which the Town Guard must confine their operations was eight miles, with the market square as the centre. Lieutenant-Colonel Robert George Kekewich was appointed commandant. Lieutenant-Colonel Harris, V. D., a director of De Beers,
was second in command and was placed in charge of the Town Guard. Major Peakman, an officer of the local volunteer force, who had had a considerable amount of experience in the Kafir wars, was appointed Staff Officer. On the 4th of October the local volunteers, five hundred strong, were called out by the Governor, and went into camp.

On the 5th of October the first serious disturbance of the work at the mines occurred. An alarm was sounded at one o’clock in the morning of that day, and all the forces in town, including the men working in the mines, were called out to do military duty, as it was rumored that an attack was contemplated by the Boers, who were massing commandoes in the Orange Free State, only a few miles distant. It had been arranged that the whistles (sirens), commonly called “hooters,” at the various engine houses of De Beers Company, should be blown in case an alarm had to be given. The first alarm caused great consternation throughout the whole town. Men were running, helter-skelter, in the dark, seeking their various redoubts, the moving guns and ammunition wagons rattled through the streets, and
the gardens of the houses were filled with men, women, and children, anxiously awaiting some news as to the cause of the alarm. The screeching of the hooters was appalling. These sirens, which in times of peace could “blow the boilers dry” and not disturb the quiet morning slumbers of the dwellers of the Diamond City, had, all in a moment, become a nerve-shattering mechanism. In later days the roar of the Boer artillery and the bursting of shell all over the town did not so frighten the mass of people. The horrifying effect was so lasting, that when work

at the mines was resumed after the siege, many people in the town asked me to discontinue the use of the hooters, and, in compliance with their wishes, the old whistles were for a time put into service.

Kimberley, as may be imagined, was quite unprepared for an attack on the 5th of October, as war had not been declared. The Intelligence Department had received some false reports, and those in charge thought it best to have every man at his post; hence the alarm. The proven falsity of the reports did not, however, dispel the menace of the situation, and it was con-

Fort on Tailings Heap, Kimberley Mine Floors.
sidered necessary to make better preparations for the defence of the town. Our miners were called out to drill during a part of each day. Our tailing heaps, which formed natural defensive positions, were taken possession of by the military. Strong forts and redoubts were constructed on the tops of these heaps, and mines of dynamite were laid at their bases.

Sir Edwin Arnold, writing in the *Daily Telegraph*, said: “There is something singularly picturesque and suggestive in the thought of the Diamond City of South Africa being defended by her own waste heaps. Since Syracuse was fortified against Nicias with the columns of her own white marble temples, and the breaches of Badajoz were filled up with the empty wine casks, there has been no such curious use made of local material. Strange, indeed, is the destiny of matter. It may turn out that the blue clay will prove more valuable to Mr. Rhodes, to the isolated garrison, and to the little city, than all the diamonds she ever dug up.”

Other defensive fortifications were made upon the ground lying between the tailing heaps. The labor necessary to do this work was drawn from the mines and works. Nearly all the men working in and about the mines joined the various military organizations, and slept in the forts and redoubts. Owing to this distraction, work at the mines proceeded very slowly.

Rhodes, accompanied by Dr. Smartt, member of the Legislative Assembly, arrived in Kimberley a few days before the investment. He took up his residence at the Sanatorium. Mr.
THE MINES BESIEGED

Fort Rhodes, Kenilworth, and its Defence Force.

View from the Conning Tower, looking Northeast.
and Hon. Mrs. Maguire arrived a day or two later and were his guests during the siege. Upon his arrival at Kimberley, Rhodes realized at once the gravity of the situation, both as regards the
defence of the town and the food supply. Orders for large quantities of provisions were wired to Cape Town, Port Elizabeth and East London, with the hope that we might be able to
add to the seemingly large stock already on hand—but these supplies never arrived.

The siege of Kimberley commenced on the night of the 14th
of October, a little before ten o'clock, when the wires to the south were cut, the wires to the north having been cut about an hour before. The last train from the south arrived at Kimberley about 11 P.M., bringing several truck-loads of supplies which were at Modder River Station, destined for the Free State Boers.

Colonel Kekewich at once issued a proclamation, declaring the district in a state of siege. The war had actually begun.

The various fortifications were made stronger, military organizations were increased in numbers, a mounted force of four companies, known as the Kimberley Light Horse, was formed, and on all sides there was the greatest activity in making Kimberley
The Sanatorium in Time of Peace.

Mr. Rhodes, The Hon. Mrs. Maguire, Dr. Smart, Mr. Rochefort Maguire.

The Sanatorium during the Siege.
a strongly garrisoned town. When all the military organizations were completed, the forces at the disposal of Colonel Kekewich were as follows:

The Imperial Garrison consisted of the 23rd Company of Royal Artillery, one section of the 7th Field Company Royal Engineers, and four companies of the 1st Royal North Lancashire Regiment. There was also a small detachment of the Army Service Corps. The total strength of the regulars was about 600 officers and men. Volunteer companies had been enrolled from the early days of the Fields, and at one time comprised a very considerable force of men, but of late years the community had lost nearly all interest in the volunteer service. Still the organizations had been kept up, and when the muster roll was taken, shortly before the siege, it showed the following numbers: One battery, Diamond Fields Artillery, consisting of six seven-pounder muzzle-loading guns, with 3 officers and 90 men, in charge of Captain May; the Kimberley Regiment (infantry), under Lieutenant Colonel Finlayson, with 14 officers and
285 men; the Diamond Fields Horse, Major Rodger, 6 officers and 142 men. The total force of regulars and volunteers was about 1100.

The Town Guard was organized, and the men were drilled in the use of the Lee-Metford rifle. At the beginning of the siege this force numbered about 1200 men, but both the volunteer corps and the Town Guard were soon increased until the total strength of the garrison reached 4500 men. This included the Cape Mounted Police, numbering about 360 officers and

men, and unmounted police to the number of 175. The limit of the defence force was gauged by the number of rifles in Kimberley — which had been considerably increased during the previous year by the importation by local merchants of 1000 rifles and six Maxims, together with a considerable amount of ammunition for the use of the rifle clubs.

Our forts and redoubts were in many ways unique and picturesque. The waterworks reservoir was surrounded by a huge fortification, made of grain and coal sacks filled with soil. The forts on the tailing heaps were made with rows of the trays of trucks which in times of peace convey the diamond-bearing
ground to the floors. The trays were filled with tailings, banked up on the outside with the same material, and coped with sand bags. Large shelters were made within the forts for the protection of the garrisons. As tents were not to be obtained, spacious houses with roofs of corrugated iron and sides of canvas were constructed as sleeping and eating rooms, and for protection against the tropical sun and violent thunderstorms. When the supply of corrugated iron gave out in town, for even the enormous stock of De Beers did not prove equal to the demand, the
iron fence which surrounded the race-course was taken down and carted to the various fortifications.

Barriers were constructed around Kimberley to check any sudden attack upon the town. The roads leading from the town were strongly guarded and barricaded with barbed-wire entanglements, with mining trucks filled with earth, and with camelthorn trees. Of late years the outskirts of Kimberley had begun to assume quite a parklike appearance, by the growth of young trees from the roots and stumps of those that had been
cut down during the early days of the Fields. It seemed a pity that the little natural beauty which these afforded should be destroyed; but the preservation of the town was of first importance, and all the trees were cut down and dragged into long lines of fences, where they were interlaced with barbed wire, making most formidable barriers. When the siege was over, these fences disappeared, almost in a day, to supply the inhabit-

ants with firewood, which had been cut down to the scantiest allowance,—a week’s supply being barely sufficient to do a day’s cooking. The defences were in places supplemented with dynamite mines planned by the Royal Engineers, and carried out by the electrical department of De Beers. On one occasion the officer in charge gave instructions to put down ten pounds of dynamite every thirty feet, and returning later in the day he asked if his instructions had been carried out, and received the reply, “Yes, sir, we have put down thirty pounds of dynamite every ten feet.”
Premier Mine

Premier mine occupied a unique position during the siege. It was isolated from Kimberley and Beaconsfield, the former town being about four miles, and the latter two miles, distant. There is a large, disused tailing heap near the mine, on the top of which is a small reservoir, into which water from the mine is pumped for distribution to the washing plant and floors. Around this reservoir a fort was built and made almost impregnable. Large shell-proofs were made for storing supplies and ammunition for a local siege, should communication with the Kimberley and Beaconsfield defences be cut off. One of the three searchlights which De Beers Company uses on their "floor" for preventing theft of diamonds by night was placed at this fort. The Boers called these searchlights "Rhodes' eyes." About 150 of De Beers employees and one hundred regulars, with two seven-pound guns and a Maxim, were constantly on duty at this fort.

The pumping plant which supplied Kimberley was down in the open mine. This plant, as well as all the machinery of the mine, was protected with sand bags. In heaps about the mine, and in all the buildings on the side of the mine adjoining the Free State, mines were laid, with wires leading from them to the
fort. One of the powerful electric searchlights was placed in the fort, and so arranged that it could be lowered out of harm's way during the daytime. Connections were made between the two sets of boilers and the pumping and electric light plants, so that, in case a shell damaged one set, the other could be used. A large number of hand grenades filled with dynamite, with fuses and detonators fixed, were made and kept in the magazine. An underground hospital for the wounded was constructed. In fact, everything necessary was done to make this fort independent and secure. There was apparent need for these precautions, for the Boers constructed the most formidable fort of any about Kimberley on a low range of hills about three miles distant, where they kept two guns and a pom-pom, which they fired nearly every day during the siege, except Sundays.

Great credit is due to the manager of the mine, Mr. J. M. Jones, and to Captain O'Brien, who was in charge of the garrison, for the manner in which the defences were constructed, and to all who occupied the fort during the long, weary four months, for their courage and patience. On several occasions lightning struck the wires connecting the mines and exploded them. One explosion carried
away part of the mine compound, and another wrecked the end of the large stables. Fortunately no harm came to any of the garrison or to any of the machinery of the mine. Although it was isolated from Kimberley, the Boers never made an attack upon it nor came within rifle range.

A few days after the commencement of hostilities the Boers
took possession of the Kimberley Waterworks Company's plant on the Vaal River, some sixteen miles distant, and cut off the water-supply. Connections were made between Premier mine pumping system and the Kimberley Waterworks Company's reservoir, and a supply of eight to ten million gallons of water per month was delivered by De Beers, free of cost to that Company, on the understanding that only half rates should be charged to the inhabitants of the town. The water was perfectly clear, pure, and wholesome.

As the supplies of food in hand seemed ample for any emergency that was thought possible, there were practically no restrictions upon the consumption of supplies during the early part of the siege, except that the amount of meat was fixed at one pound per diem for each adult, and one-quarter of a pound for children under fifteen years of age. As there were no restrictions as to prices, the speculating part of the community soon took advantage of the situation. Few had laid in stocks of food, and, as the greater number of people had not the means of making large purchases, they saw starvation staring them in the face. It was impossible for many even to purchase their daily requirements at the fabulous prices to which the necessaries of life suddenly rose. Paraffin, which usually sold for 15 shillings a case, jumped to 100 shillings. Naturally the community rebelled against this extortion, and the daily
newspaper was full of complaints. As some of them put it, they had taken up arms to defend the very people who were starving their families by putting the prices for the necessaries of life beyond their means. Colonel Kekewich was equal to the occasion, and wisely issued a proclamation fixing the price of all supplies at the same figures as formerly existed.

For the support of people too poor to pay even for the barest necessaries of life, thoughtful provision was made by Rhodes in the institution of a soup kitchen in De Beers convict station. The details of the work were ably carried out under Captain Tyson, Dr. Smartt, and the Hon. Mrs. Maguire, the latter attending to the distribution at Beaconsfield. The soup was excellent, being composed of beef or horse-meat (with now and again a donkey or a few Angora goats thrown in), and a variety of vegetables from Kenilworth, and thickened with Boer meal or mealie meal. Captain Tyson carried pockets full of
small bottles, the contents of which would be emptied in the brew, "just to make it a little more appetizing, don't you know." The allowance of meat was a half pound for two days, which could be exchanged for soup. Long rows of people stood for hours awaiting their turn to be served.

When the siege commenced, De Beers had 8000 tons of coal in stock and also about 2000 tons of wood. There were about 1500 cases of dynamite belonging to merchants, and De Beers had several hundred cases in stock. Owing to the dangerous proximity of the magazine to the town, it became necessary to remove nearly all the dynamite to a magazine at Dronfield, about six miles north of Kimberley, from which, for a time, supplies were drawn; but these magazines were subsequently blown up by the Boers.

In order to do as much work as possible while the supply of coal and dynamite lasted, permission was obtained from the officer commanding for the miners to resume work in the mines, on condition that substitutes were found to take their places in the forts. A company of men was organized at De Beers and Kimberley mines by the assistant general manager, which was
known during the siege as the Permanent Guard, and was composed mostly of refugees. Work was continued at Kimberley mine until the 3d of November, and at De Beers mine until the 4th of December, when it was thought advisable to discontinue work and save the supply of coal for pumping water for the use of the town and preventing the mines from being flooded. The amount of ground hoisted at Kimberley mine from October 14 to November 3 was 60,396 loads, and at De Beers mine to December 4 was 173,447. The pumps in both mines were kept going until a few days before the siege was raised, and started again before the water had filled the tunnels in the rock outside the mines proper. While the pumps were stopped a gang of natives were kept busy at each mine picking out pieces of coal from the old ash-heaps to supply the boilers with fuel. Fortunately all damage by flooding to the underground works was prevented.

Communication was kept up between Kimberley and the nearest military post, which was at the Orange River bridge on the Kimberley-De Aar railway, by despatch riders who evaded
the Boers and found shelter and remounts at several farms of friendly colonists. The distance was eighty miles. Trooper Brown of the Cape Mounted Police carried the first despatch, and covered the distance in thirteen hours. Great credit is due to these men, who went to and fro at great peril to themselves. Foremost among them were Brown, Cummings, Hambly, and Harding, but there were many others who did good work. The remuneration paid by the military was very small—£5 for the round trip, but in many cases, where private letters were carried, this sum was largely increased by private donations. Later, when the investment of the town was closer, it became very difficult to get through the Boer lines, and despatch riders, carrying private despatches, were paid as high as £100 for a round trip. Many of these men were captured and taken to Bloemfontein as prisoners of war.
How zealously and efficiently Rhodes took part in the preparations for the defence of Kimberley has been particularly noted by Mr. George A. L. Green, editor of the Diamond Fields Advertiser in his able and accurate description of the siege. "The need for mounted troops to watch the enemy’s movements was early felt. The formation of a new corps, to be called the Kimberley Light Horse, was one of the last things authorized by the High Commissioner before Kimberley was cut off, but the trouble was to find the horses. Mr. Rhodes came to the rescue, and in a few days presented the corps with five hundred admirable mounts; he also did some good work as recruiting sergeant.

Largely through his efforts the mounted arm of the defence forces was thus increased to nearly nine hundred men. Major Scott-Turner was appointed with the local rank of lieutenant colonel to command the mounted corps, which now comprised Cape Mounted Police, Diamond Fields Horse, and Kimberley Light Horse.

"It was Mr. Rhodes's pleasant custom to go round asking the question, 'Do you want anything?' Needless to say he rarely met any one who did not want something.

"One evening, while Major Chamier was dining with Mr. Rhodes, they were discussing the artillery branch of the defence forces, when Mr. Rhodes asked him if he needed anything for
his artillery. The Major replied quickly, 'Yes, I want to make my guns mobile. [Note.—It is mentioned elsewhere that these guns were small mountain guns without limbers.] I require, to do that, 43 horses, 62 mules, 7 buck wagons, and 4 Scotch carts.' It was a tall order, but Mr. Rhodes made a mental note, without any comment, and three days later Major Chamier found that the whole requisition had been delivered at the artillery camp. All he could say, when he saw what had been done in

Effect of a Nine-pound Shell.

so short a time, was, 'What a wonderful man Mr. Rhodes is!'" It was an object lesson to the military officers to see how quickly provisions of this kind could be made by a civilian who was in no way handicapped by official red tape.

From the first threat of the outbreak of hostilities, the resources of De Beers were at the command of the garrison for any needed service. At De Beers workshops several engines and trucks were armored in the manner shown in the accompanying illustrations.

These trains were useful in many ways, and of very great
service in keeping the lines of communication open. Those running between Kimberley and De Aar were manned in part by De Beers men. The military organization known as Scott's Railway Guards was also mostly made up of De Beers men, with Lieutenant Colonel R. G. Scott, one of the officers of De Beers Company, in charge.

The first encounter with the attacking Boers was on the 24th of October, ten days after the investment of Kimberley. Shortly after the water-supply had been cut off, Lieutenant Colonel Scott-Turner made a reconnaissance in the direction of the pumping station, but took the precaution to follow the line of the railway as far as Macfarlane's farm, which lies eleven miles to the north of Kimberley. His force consisted of detachments of the Kimberley Light Horse, Captain R. G. Scott, V. C.; Cape Mounted Police, Major Elliott; and the Diamond Fields Horse, Major Rodger. The armored train, in charge of Lieutenant Webster, Loyal North Lancashires, supported the troops. On arriving at the farmhouses at Macfarlane's, which stand on a knoll from which the country recedes in all directions, the troops halted and had breakfast. Immediately afterward Lieutenant Colonel Scott-Turner with 180 men proceeded on his mission, but soon after his departure Boers were seen in several directions.

Upon the appearance of the enemy Lieutenant Colonel Scott-Turner took up a strong position with his men. In a short time the Boers sent a few of their number under a flag of truce. Major Elliott of the Cape Mounted Police met them, and was
told that if he and his command were on police duty the Boers would not molest them, but if he was there for a fight, they would put a bullet through his head. Major Elliott returned, however, without hindrance. In the meantime the armored train had proceeded beyond Macfarlane's, but was soon recalled, as the Boers were evidently trying to cut it off. Later in the morning Boers continued to arrive from the north and east, and came within rifle range of Macfarlane's farm, not knowing that it was occupied by the British. The patrol opened fire on them, and several of them were seen to fall and their riderless horses ran across the veld. The Boers retreated helter-skelter. Shortly afterward five Boers from another commando came forward, bearing white flags, and were met by Major Elliott, who received the same message as before. The Boers evidently had little knowledge of the proper use of the white flag.
In pursuing his advance Lieutenant Colonel Scott-Turner fell into an ambuscade, for, owing to the very long grass, which was nearly waist high, he was unable to detect the position of the Boers, who were strongly posted behind the wall of a dry reservoir in numbers greatly exceeding the British force. Not a shot was fired until the British came within easy rifle range, when they were met with such a fusillade from the magazine Mauser rifles that they sought the nearest cover. In this repulse the losses on the British side were three killed and nine wounded, and fourteen horses were killed or disabled. The wounded men were taken up and carried back with the retreating force, but the dead were left behind, to be brought in two days afterward, as the searching party failed to find the bodies, on the first day, in the tall grass.

Lieutenant Colonel Scott-Turner had heliographed to the conning tower to have two mountain guns and two Maxims sent out. These were despatched at once, and the armored train took out 150 of the Loyal North Lancshires under command of Major Murray. The Boers were seen to be moving toward Dronfield, a ridge halfway between Kimberley and Macfarlane's. The armored train proceeded beyond Dronfield, but was ordered back to that place, and the troops left the train near the siding. In the meantime Captain May, with two guns, had reached a position just south of the siding, when the Boers opened fire on him at short range, having allowed his scouts to come close to the place where they were in ambush. Captain May quickly unlimbered his guns under a hot fire, and began to shell the Boers in return. Fortunately for him most of the Boer bullets went over the heads of his men, while he fired his guns.
with great precision, riddling the gamekeepers' houses, behind which the Boers had taken shelter, and soon driving them to the rocky ridge beyond.

Hearing that the guns and regulars had gone out, I drove to

a position north of Kenilworth, where this part of the engagement was in full view. Captain May fired eighty rounds at the Boers, and his men behaved splendidly under a rain of bullets from the enemy, only a thousand yards distant. Out of a total of twenty-six men and eighteen horses, he had seven men wounded, three horses killed and nine wounded. Gunner
Payne, who was wounded in the foot early in the fight, continued to lay his gun until the end of the firing; and bugler Dickinson, who was wounded in the right hand, changed the bugle to his left hand and finished his notes.

While this fight was going on Major Murray had taken his men from the train near Dronfield, and had begun to ascend the hill. At his first advance the Boers opened fire. Forming his men in skirmishing order with all possible speed, he led the way up the rocky ridge where the Boers were lying closely under cover. Fortunately for the Major and his troops, the ascent of the Dronfield ridge on the north was comparatively easy, being over a gently rising country covered with small brush, with here and there a shallow ravine which gave a little shelter to his men. While they were moving forward, three men, not in uniform, rode up to him. At first he took them for Boers, but the Northumberland accent of the first who hailed him was convincing. They were men in charge of De Beers farms, and when the firing began they were looking after the large herd of De Beers cattle.

One of these keepers, Dott, guided the troops up the hill, taking them out of sight of the enemy as much as possible, and shouting, "This way, Mr. Officer!" "This way, Mr. Officer!"

Their scramble up the hill was very plucky. In front lay the Boers hidden in the rocks, and on their left was a magazine
THE MINES BESIEGED

The Funeral of Colonel Scott-Turner and the Men Who Fell with Him.
containing 1,500 cases—37\(\frac{1}{2}\) tons—of dynamite, which might explode at any moment should a Boer bullet strike it, as it was protected only by a thin sheet of galvanized iron. Two firing parties of twenty-five each went ahead gallantly, with the main force, a hundred strong, following close behind. The men volleyed and ran forward alternately, until they reached the crest of the hill, Botha and two or the large Griqualand stood upon the summit their escape by east boun-
mander, the

In this engagement only one of the Boers beside Botha was killed, but seven were wounded. Major Murray had two officers and two men wounded. Colonel Scott-Turner and his men returned to Kimberley without meeting with any further opposition.

It was fortunate that this reconnoissance was made, for the following despatch was taken from the body of Commandant Botha:

"Hoof Lager, October 23, 1899.

"Veldcornet Botha, Bakinkop, Weledele Heer.

"In reply to your inquiry about the taking of cattle in the neighborhood of Kenilworth, I am ordered by the Head Com-
mandant Wessels to assure you that he considers it highly desirable that the same should be captured as soon as possible.

"I am, &c.

"J. B. M. Hertzog."

The success of this engagement was encouraging, but the fast-increasing numbers of the Boer besiegers and the extension of their lines soon put a check on such excursions. Early in November Commandant Wessels offered to receive all Africander women and children into his own camp, and at the same time offered safe-conduct to all other women and children to the Orange River. The first part of his despatch was made public, but not the last. Wessels's despatch contained the following passage, "And whereas it is necessary for me to take possession of the town of Kimberley, therefore I demand of your Honor that upon receipt of this you, as Commanding Officer, shall forthwith hand over the town of Kimberley with all its troops and forts."

Colonel Kekewich, in acknowledging receipt of Commandant Wessels's despatch, wrote, "Your desire being to obtain possession of Kimberley, you are hereby invited to effect the occupation of this town as an operation of war by the employment of the military forces under your command."

The invitation was a challenge.

On the morning of the 6th of November, the Boers fired two shots at Premier mine, and on the following day the first actual bombardment began, from a position about five thousand yards
from the mine. As the compound, containing over two thousand natives, was close to the fort and in the direct line of fire, all these men were taken down into the open mine, where they were protected by an embankment 150 feet high.

On the same day other Boer guns commenced to bombard Kimberley from a ridge nearly five thousand yards distant. The British guns replied intermittently with a few shots. Kimberley had no ammunition to waste. The distances were so great that the little popguns in the Kimberley forts frequently "turned turtle," owing to the great elevation at which they had to be fired in order to carry the distance. The projectiles fell more like meteors out of the sky than shells from modern guns. For the first few days the Boer shells fell short of the inhabited part of Kimberley. On the 11th a shell burst in Dutoitspan Road, in front of the Catholic church, and killed an old Kafir woman, which was the only casualty from the two hundred shells fired into the town on that day. Seventy shells were fired by the Kimberley artillery during the day. The Kimberley mounted troops also engaged the Boers on the same day near Otto's Kopje mine, and troops under Major
Peakman attacked the Boers on Carter's Ridge on their left flank.

The cessation of active hostilities on Sunday made it a welcome day of rest to all the besieged, and no doubt to the besiegers as well. It gave both sides the opportunity of praying long and hard that their enemies might be confounded. The first bombardment continued for five days, with no further serious casualties on the British side, and the townspeople, appalled at first, began to make light of the danger. More than half the shells fell without exploding, and many children as well as grown people ran up, after each shell struck, to carry off a trophy. These prizes and the fragments and fuses of exploded shells found ready purchasers. The military authorities issued an order forbidding people from collecting these shells and fragments, while a bombardment was going on, owing not only to the risk of death or maiming from the exploding shells, but to the greater danger of the explosion of the dynamite mines which
were laid around the town. The prohibiting order carried this warning, “These mines are at all times ‘live,’ that is, the fuses and firing arrangements are so arranged that the mines can be fired either automatically or by observation, and they might under certain circumstances be ignited by the enemy’s shells.” This order should have frightened the average Kimberley urchin, but its apparent effect was to make him all the more eager, for he seemed to think that he had a chance of finding a prize in one of those dynamite mines about which everybody was talking.

As the siege dragged along, some of the Imperial officers began to grow impatient. Anticipating the approach of Lord Methuen, they planned a sortie on the 25th of November which was fairly successful; for they took Carter’s Ridge, some three miles to the west of Kimberley, and captured thirty-three Boers, including nine wounded. The fighting continued all day, and resulted in a loss to the garrison of six killed and twenty-nine wounded, including Colonel Scott-Turner, and Captains Bowen
and Hickson-Mahony. Towards evening the Kimberley troops returned to town, as their ammunition was giving out and it was getting too late to send for more. This was the first fight that many of these men had been in, and their gallantry was greatly creditable, though they were unable to hold the ground they had won. The Boers published their losses as nine killed, seventeen wounded, and fifteen missing, instead of thirty-three who were brought into Kimberley.

On November 28th another attempt was made to drive the Boers from Carter's Ridge. Shortly after noon there was great activity in town, and troops were moving in various directions making ready for a sortie. The centre of the advance, commanded by Colonel Scott-Turner, moved out in the direction of the reservoir and thence along a ridge which gave a little cover. The first Boer redoubts were quickly taken, and then Colonel Scott-Turner sent for two guns to support him. He drove the Boers back until they reached their last redoubt, a small fortress dug in the rock, with a coping of sand bags arranged with loopholes. Colonel Scott-Turner led his last charge and took cover in a small redoubt, only sixty yards from
CONSTRUCTION OF "LONG CECIL" GUN.

Attachment for Elevating Screw

Rifling for 13 Calibres Length: Increasing First from 1 in 100 to 1 in 32 Right Handed

Rifling-Uniform Twist 1 in 32

Breech Block and Obturator.

As First Made

As Made for Axial Firing.

Cracked here

Shows where head broke off, on firing first shot, after alteration, the bolt drove back, knocking out plate, as shown, and was found also cracked at shoulder.

As Finally Made.
Shell for 4.1 inch B. L. Siege Gun (Long Cecil)

- Lead Safety Pins
- 10 lbs. Shearing Resistance
- Steel Safety Spring 3 lbs. Resistance
- Percussion Cap
- Muslin Disc
- Gun Metal Fuse Body
- Steel Plunger with Nipple
- Recess filled with Mealed Powder
- Cast Iron Rings
- Core Support Plugged

Shell for 2.5 inch R.M.L. Guns R.A & D.F.A.
the Boers. There the Boers had their Armstrong gun. The Diamond Fields Artillery were obliged to cease firing, owing to the danger of shelling Colonel Scott-Turner and his little body of men.

While this engagement was going on, a small troop of the Diamond Fields Horse attacked the Boer camp in the rear of their redoubt. This attack was successfully carried out by Captain Shackleton, who dealt the Boers a severe blow. He captured 149 loaded shells, a considerable quantity of gunpowder, a wagon and span (16 oxen), a Cape Cart, and the limber of the gun which Colonel Scott-Turner was trying to take. Among the prizes was a baboon, which proved to be the mascot of the company of Cape Mounted Police stationed at Vryburg, left behind when they evacuated the town somewhat hurriedly.

Meanwhile Scott-Turner and his men were in a most awkward position, lying in a shallow redoubt with its side partly exposed, for the redoubts occupied by the two opposing parties both faced east toward Kimberley, but the one occupied by the Boers was much larger and better built. It was impossible for any of the attacking party to show their heads without receiving
a volley from the Boers, and thus one after another of these brave men fell back dead, until finally Scott-Turner took a rifle and was about to fire, when he fell, shot through the head. Major Peakman fought his way with a small force to one of the redoubts, within speaking distance of the survivors. Here he learned that Scott-Turner had been killed, and he at once assumed command as senior officer. He sent a message asking for reinforcements, but, before they arrived, darkness had come on, and he decided to withdraw his men to Carter's farmhouse. On the following morning, ambulance wagons were sent out in charge of Captain Robertson under a flag of truce, to collect and bring in the dead. It was then ascertained that Kimberley had lost twenty-two killed and twenty-eight wounded, one of the latter being mortally hurt.

In these encounters, as in all other occasions of their service during the siege, the ambulance corps was notably efficient, and the Kimberley doctors, as a body, did excellent service, both in the field under fire and in the hospitals. Particular mention may fitly be made of Drs. Heberden and Ortlepp, who were attached to the mounted forces, and of Drs. Ashe, Mathias, McKenzie, and Watkins.

The fierceness of this engagement may be judged from
Rhodes's statement at a De Beers meeting, held shortly after the siege, "I take this opportunity of placing it on record that seventy citizen soldiers of Kimberley went to take the position, and out of that number there were only twenty who were able to creep away alive or unwounded after nightfall."

The 29th of November will long be remembered as the saddest day during the siege, when the brave men killed in this action were buried with military and civic honors.

In order to meet the wants of the women and children whose breadwinners had fallen in battle, a fund was started; to this De Beers generously gave the sum of £10,000, and is now erecting a monument on one of the most elevated parts of the town, where the heroes who fell in the defence of Kimberley are to find their last resting-place.

The object of these demonstrations was to detain as many of the besieging force as possible from leaving to join General Cronje at Modder River, and in this way to assist Lord Methuen in his advance to the relief of Kimberley. On December 1st Lord Methuen's first searchlight message reached Kimberley. This opening of communication was highly elating and all were eagerly expectant of the news. Word by word this message was
spelled out, "Please inform the Remount Department, Wynberg, the number marked on the hoof of horse issued to Surgeon O'Gorman of the Kimberley Garrison."

Imagine the disappointment upon receiving this seemingly frivolous message after the long ten weeks' investment. It was later reported that this communication was simply a test to ascertain whether the signals were passing between friends or enemies.

On December 11th Lord Methuen met with his first reverse in his march to Kimberley, where he was defeated by Cronje.

I watched this battle from the conning tower, but, as the distance was about sixteen miles, one could see only the bursting of the shells, the big yellow cloud when a Lyddite shell exploded, and the captive balloon giving information as to the position of the Boers. One could hear the roar of the cannon, which sounded like the breaking of the sea against a cliff. We waited anxiously for news of the battle, but for days none came. The suspense was the more racking from the spread of the report that, as soon as Lord Methuen arrived, there would be an enforced exodus of all the women and children and male non-combatants from
Casting Shells for Seven-pounders, De Beers Foundry.

The Soup Kitchen.
Kimberley. The carrying out of an order to this effect would inevitably have been attended, in my judgment, by great and needless suffering, and the reported determination was rightly resented by all the citizens who had borne so pluckily the strain of the siege.

At length, on December 18th, a week after the battle, we received the first authentic news that Lord Methuen had been defeated at Magersfontein. This unlooked-for reverse, so blighting to sanguine hopes, cast a deep gloom over the beleaguered town, but there was no lack of heart in its stubborn defence. Christmas came, and with it the “Best wishes for Christmas Day and in the coming New Year,”

from the High Commissioners, and also one from the Queen, “I wish you and all my brave soldiers a happy Christmas; God protect and bless you all.” These messages cheered the garrison and were given a most enthusiastic reception.

On New Year’s Day the mayor sent the following message on behalf of the citizens of Kimberley: “The inhabitants of Kimberley humbly beg to send your Majesty New Year’s greeting. The troubles they have passed through, and are still enduring, only tend to intensify their love and loyalty towards your Majesty’s throne and person;” to which the Queen replied, “Am deeply touched by your kind message and New Year’s
greetings. I watch with admiration your determined and gallant defence, though I regret the unavoidable loss of life incurred."

For some time after the repulse of Lord Methuen, siege life dragged on from day to day, with nothing very stirring to break the monotony. The various corps had their "At Homes," when tea would be served, and the Kimberley Regimental Band would enliven the throngs with martial music. Every little diversion from the dull routine of camp life was welcome.

To provide employment for as many of the inhabitants as possible, avenues were laid out and macadamized within the municipality of Kimberley and Beaconsfield, which add much to the convenience and beauty of the towns. In addition to this street work, Rhodes decided to make an avenue in commemoration of the siege and to be known as "Siege Avenue." Years before he had planted rows of grapevines ranging from 1000 to 2000 feet in length, which were trained upon trellises, but Siege
Avenue was designed to outdo anything in the line of vine and tree planting that had been done in South Africa. Fourteen trenches, each over 5100 feet long, were dug. The two centre trenches were for vines and were 14 feet apart. There were trenches on either side and at suitable distances for planting orange trees. The three outside trenches were for ornamental evergreen trees, such as the pepper, eucalyptus, Australian beefwood, and cypress, to serve as a protection to the vines and orange trees from the prevailing winds. Since the siege the vines and trees have been planted, and the wooden trellis has been erected, at a cost of nearly £3000.

When the work of digging the trenches was first started, several hundred natives were employed. These trenches were about a mile from the nearest fort. As soon as the Y. A. O. (young artillery officer) in charge saw them, he telephoned about in these words to the O. C. in the conning tower: "A large party of Boers digging trenches just north of Kenilworth. Shall I open fire on them?" The reply came, "Wait and ascertain if they are Boers." Y. A. O. to O. C., "I don't think they are Boers." A minute later Y. A. O. to O. C., "They are De Beers workmen digging trenches to plant trees."
The old vines and fruit trees at Kenilworth were of incalculable value to the people of Kimberley, for they bore immense quantities of splendid fruit, which Rhodes sent to the hospitals, to the military camps, and to the citizens generally as far as it would go.

In my own garden there must have been a ton and a half weight of beautiful grapes, which daily reminded one of the old saying, "It is more blessed to give than to receive," as one saw the look of joy on the faces of the women and children as they left the garden. My mulberry trees were also loaded with fruit, which was eagerly called for. Some substitute for butter or lard was particularly wanted, for neither of these was procurable in the town. De Beers again was able to meet this call. In the great warehouses of the company were thousands upon thousands of gallons of lard oil kept in stock — beautifully clear and sweet winter-strained lard oil. Hundreds of people came to the Company's stores daily for this supply. They fried their meat and bread in the oil, and found it much sweeter than most South African butter.

In view of the now obvious certainty of the prolongation of
the siege and the call for a gun of greater range and efficiency than any at the command of the garrison, the extraordinary task of the construction of the really formidable piece aptly named "Long Cecil" was undertaken by De Beers Company. It was designed by Mr. George Labram in De Beers workshops. Mr. Edward Goffe, chief draughtsman to the company, describes the making of the gun expertly:

"Long Cecil" was made from a mild steel billet, 10.5 inches diameter and 10 feet long, weighing 2800 pounds, this being turned and rough bored to form the inner tube.

The breech rings were forged from 6 inches × 2.5 inches Lowmoor iron. They were turned and bored, and then shrunk on in place, nine forming the first row shrunk on to the tube direct, and four more the second row over the breech, shrunk on over the first row. The trunnion ring, carrying the trunnions or bearings, was forged in one piece without weld, from a length of 6 inches square Lowmoor iron, and was shrunk on against a shoulder left on the tube. The final boring was done after all the rings were shrunk on, the calibre of the gun being 4.1 inches. The barrel was then ready for rifling. The rifling is a polygroove increasing twist, consisting of 32 grooves, each 1 inch wide and \( \frac{1}{16} \) inch deep, which, starting with a pitch of 1 in 100 at the breech end, and increasing to a pitch of 1 in 32 in a length equal
to 18 calibres — 73.8 inches, are uniform at that pitch for the remainder of the length. The curve of increase is the semi-cubical parabola.

The breech block was made of mild steel, screwed to fit the breech with a "V" thread, flattened top and bottom, of \( \frac{3}{4} \) inch pitch. The "De Bange" system of obturation was adopted, the mushroom-headed bolt being of mild steel, annealed in melted tallow, and bored for the friction firing tube. The pad was made of rings of sheet asbestos soaked in melted tallow.

!["Long Tom" en route.](image)

The carriage was made of steel plates \( \frac{1}{4} \) inch thick, cut to shape, and riveted together in pairs, with gun-metal blocks between, for trunnion and axle bearings. The wheels were taken from a portable engine, bushed with gun metal and bored to fit the axle, whose ends were covered with brass dust-caps.

The shells weighed 29 pounds each, loaded with their bursting charge of one pound of powder, and were fitted with the percussion fuse devised by Mr. George Labram.

The making of the gun was begun on the 26th of December, 1899. It was proved on the 19th of January, 1900, and went
into action January 23. From then up to the date of the relief of Kimberley 255 shells were fired from the gun, mostly at ranges approximately 5000 and 6000 yards, the distances of two of the positions of the enemy, which were easily reached with elevations of $12^\circ$ and $15^\circ$ respectively, with powder charge of 5 lbs. With the same powder charge another position 8010 yards distant was effectively reached with an elevation of $24^\circ 15'$.

The illustrations on previous pages show graphically how "Long Cecil" was made.

The cut on page 282 represents the finished gun ready to go into action. On page 278, the upper figure shows the general construction of the gun barrel; the lower figures on the same plate show the breech block and obturator. The rifling device is given on page 279, and on the same plate the boring and rifling tools are represented.

The upper figure on page 280 gives the details of the construction of the shells and fuse for "Long Cecil," and underneath is shown the shell made for the 2.5-inch popguns with which Kimberley was defended. The manufacture of these small shells was undertaken in November, and many were thrown into the Boer camps with "C. J. R.'s Compliments" stamped on them.

The powder for charging these shells was fortunately at hand. The old Central Company of Kimberley mine had a large stock of black powder which was used for blasting in the open mine, as far back as 1888. When De Beers Consolidated Mines took over this Company, the powder was removed and placed in a
magazine on the veld, a mile beyond the Company's washing machines. Shortly after the opening of the siege I had stock taken of the contents of outlying magazines and brought to light *three and a half tons* of good black powder of various grain. This discovery was of much service, for it enabled the garrison to respond more frequently to the fire of the Boers, and made the construction and use of "Long Cecil" possible.

At first, the shells cast in our foundry were not all perfect, and the bursting of some of them led to greater care in testing all under hydraulic pressure. Ring shells made by De Beers are shown on page 280. Rings with jagged or saw-toothed edges were first cast; these were stacked one over another in the mould, and the outer shell cast around them. When the bursting charge of powder exploded, these rings were broken into a hundred pieces and thrown in all directions.

The Boers evidently resented the firing of "Long Cecil," for on the 24th of January they kept up a fierce cannonade, throwing about five hundred shells into Kimberley. A French officer, who was at Kampfersdam during a part of the siege, says that "Long Cecil" did good practice, and with one shell killed seven Boers, only two less than the Boers killed with eight thousand shells. The heavy and continuous firing which took place
Effect of a 100-Pounder.

Effect of a 100-Pounder.
on the 25th of January and following days caused many to build “shell-proofs” for the protection of the women and children. On the morning of the 8th of February, at about eleven o’clock, I was in the conning tower, and noticed an immense volume of smoke belched forth from a gun on Kampfersdam tailing heap. I remarked to those near me that the Boers had brought a “Long Tom” against us at last. In a few seconds the bang of the gun was heard, followed a little later by a sound almost indescribable as the shell came whizzing through the air. It has been likened not unfitly to the roar of an express train passing at full speed. Then a cloud of red dust was seen where the shell had struck, shortly followed by the crash of the explosion. In the vicinity the air was filled with fragments of the shell or bullets of the shrapnel, which flew on with a singing “ping, ping, ping.” Twenty-five of these shells were fired on that day, many of which did not explode. One was brought in and measured, and found to be fifteen centimetres, or about six inches, in diameter.

The “Long Tom” which was brought to Kimberley was a Schneider gun which had been struck by a shell on the muzzle.
and broken. This gun was taken to Pretoria or Johannesburg, where the broken part of the muzzle was cut off and a band shrunk on the injured end. The illustration of this gun on page 291, on a railway truck en route from Pretoria to Bloemfontein, shows the method of moving these guns without a limber. The gun was noted for bad shooting. On the afternoon of the 9th of February the Boers turned the gun on the herd of cattle which were being driven in for the night. This shot missed the cattle by half a mile to the left. Three more shots were fired, all falling wide of the target at which they were aimed.

Shell-proof, constructed by the Public Works Department.

The illustrations here given of the effect of these shells are more graphic than words.

On the first day the big gun was fired, the Buffalo Club was struck and sustained considerable damage, and a few private buildings were more or less injured. On the 9th the firing of "Long Tom" commenced at daybreak, and was continued at intervals throughout the day until six p.m., when the last shot was fired. This shot killed George Labram, one of the most able men in the service of De Beers Company. He had entered his room in the Grand Hotel only a minute before. The shell passed through the roof and three brick walls before reaching
Labram’s room. During the same day the wife and son (fifteen months old) of Mr. Robert Solomon were struck by the fragments of a shrapnel shell, which burst as it came through the outer wall of the building in which they were temporarily staying. The child was killed instantly, but the poor mother was taken to the hospital, where she died, thirty-six hours afterward, from her injuries.

During Saturday the firing continued, and buildings in every quarter of the town were struck. The peril of the unprotected people was appalling. There was the greatest activity in build-

![Excavations in the Tailing Heaps at Beaconsfield, used as Shelters.](image)

ing shelters for the women and children. The tailing heaps were tunnelled, and the miners erected long rows of tunnel timbers against the débris embankments, and covered them with corrugated iron. Gangs of natives soon protected these galleries with débris several feet deep. Still there were thousands unprovided with any shelter except the thin roofs and walls of their houses, which were absolutely useless against a hundred-pound shell travelling at the rate of a thousand feet a second. When firing ceased, about midday, there was a sigh of relief from many hearts, for it was thought that firing would not be resumed until Monday morning.

The funeral of Mr. Labram was timed to leave the hospital
at eight o'clock in the evening, as it was thought unsafe to have the funeral by day. He was buried with full military honors, and, as the hour for departure from the hospital approached, the streets were thronged with anxious and sorrowful people. The troops consisted of regulars, the various volunteer corps, and members of the Town Guard. My carriage contained Colonel Kekewich, Mr. Rhodes, Mr. Pickering, and myself. Other carriages followed, and hundreds who were unable to procure conveyances, owing to the scarcity of horses, joined on foot.

Precisely at eight o'clock the procession moved from the hospital, but, before it had gone a hundred yards, the bugler in the conning tower gave the well-known notes which meant that the big Boer gun had been fired. The band was playing the funeral march at the time, so that few people in the immediate vicinity of the hospital heard the warning notes. Shortly, however, the boom of the cannon was heard, followed by that never-to-be-forgotten hiss of the shell passing through the air. Traitors in the town had given the Boers information as to the
time of the funeral, and doubtless signalled from some elevated place to the besiegers at Kampfersdam the moment the procession started. There was a sigh of relief as the fearful shell passed over the heads of the multitude, and fell harmless in vacant land behind the hospital. Colonel Kekewich gave orders for the band to cease playing, and that all carriage lights be put out. It was a grim and silent funeral. Shot after shot came thundering over into the town, as the procession passed through it. At last, as we approached the cemetery, we could see the flash of the gun as it was fired.

While the last rites were said, the voice of the venerable archdeacon was drowned by the roar of the gun and the hissing of the shells.

When the ceremony was over, every one hastened home to seek whatever cover could be found. Crowds of people were massed for hours behind flimsy walls, which could not protect them, but even this slight pretence of shelter was comforting. The terrible night of the 10th of February, 1900, will never be effaced from the memories of those who passed through it.

So great was the strain upon the nerves of the people that it was necessary that some one should come to their help, and as usual that “some one” was Rhodes. Early on Sunday morn-
ing he came to my house and said: "You told me, some time ago, that you could put a lot of people down in the mines, and I think the time has now come when we must do it. Will you get your mines ready so that the people can be sent down this evening?"

I supervised the work at De Beers mine, and my son was its director at Kimberley. Tunnels one thousand and twelve hundred feet below the surface were cleaned out—sanitary arrange-

ments were provided, and, early in the afternoon, both mines were ready for occupation. Rhodes had sent a notice about town which is given as an illustration on this page, and speaks for itself. Attention was called to it by the ringing of a bell. Crowds flocked to both shafts during the afternoon and evening; and before midnight nearly three thousand women and children were safely housed, deep down in the subterranean passages of the mines. There was discomfort, of course, in this rude lodging, but all were happy in the thought that they were beyond the sound of screeching shells, and out of danger.
I have never seen so much patience and pluck shown by women as was shown by those in the mines. There was no sign of fear in going down in the rough mine cages, and when they reached the station, they found to their joy that the tunnel was like a beautiful arcade, brilliantly lighted with electric rays. Food was served several times a day, and time went so quickly that dates were lost sight of and days and nights became hopelessly mixed. One lady asked me, "Is this yesterday or to-day or to-morrow?" When the glad news was brought to them that Kimberley was relieved, they scarcely believed it, and many preferred to remain in the mines rather than take any chances of hearing "Long Tom" give a parting roar, or the awful screech of a flying shell. On Friday morning all were brought to the surface, thankful for the few days of peace and safety.

The illustration on page 304 shows the people at the shaft waiting to be sent down. That all were taken down into the mine and brought up again without the least mishap speaks well for those who carried out the details at each mine.

The Boers fired a few shots between eleven and twelve o'clock on the 15th, from "Long Tom." They knew before we did that a British column was nearing Kimberley, for they had telegraphic communication between all their camps; and while the
column was slowly advancing they were using every effort to remove the big gun, which they did successfully. Over eight thousand shells had been fired by the Boers into Kimberley and its fortifications, with the result that, out of a total population of fifty thousand, only nine were killed, and the majority of these were women and children.

At two p.m. a huge cloud of dust rose in the distant south-east, and shortly afterward one could see mounted troops advancing, and a heliographic message informed the officer com-

\[\text{Too Late! These two Siege Guns arrived after the Siege.}\]

manding Kimberley that it was the relief column under command of Major-General Sir J. D. P. French. The news spread like wildfire, and from every place which afforded a view, thousands of eager eyes were scanning the veld for a glimpse of the troops. The few public conveyances which were left in Kimberley were quickly taken to convey people to meet the column.

As soon as I received the news, I made an effort to obtain a cab, but found it impossible. A small spring wagon drawn by a mule and driven by a Kafir passed my door at this time. Recognizing it as a De Beers fruit-and-vegetable wagon, I commandeered it, and in company with Captain Bowen was driven
MAJOR-GENERAL SIR J. D. P. FRENCH.
Who relieved Kimberley.
'I'he United States Consulate.

Women and Children waiting to be lowered down De Beers Mine.
to the Sanitorium, which afforded a good view of the advancing troops. With my field glasses I saw the troops slowly advancing, and as they rounded a hill near the farmhouse on De Beers farm, Benauwdheidsfontein, the Boer gun at Olifantsfontein, southeast of Premier mine, fired a few shots, but the relief column had a battery which soon silenced the Boer gun. Having telephoned for my light carriage and horses, I soon joined the
great crowd which thronged every road leading toward the advancing troops. It was seven o'clock before they got into camp. Thus Kimberley was relieved after a long and eventful siege of 124 days. My old friend, Colonel Rimmington of Rimmington's Scouts, was among one of the first arrivals. Thinking that I was doing him a good turn, I put him up at my house. I am sure he enjoyed the bath, but when I went to call him the next morning, at four o'clock, he was gone. Missing the bedclothes, search was made in the garden, and there the
poor old tired soldier, wrapped up in clean sheets and blankets, was lying on the ground, sleeping as only a weary soldier can sleep. He had found the house too stuffy after sleeping so long on the veld.

General French moved at daybreak the morning after his arrival, taking with him about half of his column and four batteries of field guns. He gave battle to the Boers north of Kimberley, and cleared them out of their late haunts. The Boers left one gun behind, an old Armstrong gun, the limber of which was captured November 25th. On Saturday morning at daybreak General French left for Paardeberg, taking those of his troops who had rested on Friday, and the others followed the next day.

It has often been asserted that Rhodes interfered with the military. He did suggest to Lord Methuen that there were more ways into Kimberley than the one over the Magersfontein and Spytfontein kopjes, and mentioned the route over which General French came when he relieved Kimberley. He proposed that small forts be built, every three or four miles, advancing from Modder River and keeping up the base of supplies at that place. His plan was substantially the blockhouse system, which the army later adopted, only that forts, instead of houses, would have been necessary, as the Boers then had cannon. The only reply to this suggestion was an order to the officers commanding Kimberley to have no communication whatever with Mr. Rhodes on military subjects.

Fortunately for the defence of Kimberley, Rhodes's energies
were unflagging, in spite of rebuffs. Throughout the siege no appeal for assistance was ever made to him, nor even a want intimated on the part of the garrison, that he did not do all in his power to meet at once. The formation of the Kimberley Light Horse was due to him. So, too, was the fortification of the village of Kenilworth and the outlying washing machines. The making of the gun "Long Cecil" was by his order. The employment of thousands of idle hands in street-making in and around Kimberley was at his suggestion, and paid for by De Beers Company, thus assuring a support more welcome than charity. The undertaking of the soup kitchen was his proposal. From the great De Beers dairy milk was supplied to the hospitals, the sick at home, and to a depot where it was distributed under the supervision of a committee. Fruit and vegetables from De Beers gardens were sent to the hospitals, to the camps, and to the poorer families of the town. New gardens were
started to enlarge the supply. The ice plant was kept constantly running, and ice furnished to the hospitals, the garrison, and the citizens generally. In everything contributing to the efficiency of the defence and the welfare of the people of Kimberley, Rhodes took the keenest interest, and, whenever possible, a most active part.

A few days before the relief column came in, there was a meeting of a considerable number of the leading citizens of Kimberley, with the object of sending a message to Lord Roberts to inform him of the situation and ascertain whether there was any immediate prospect of relief. Rhodes, the mayor and ex-mayor, a judge of the High Court, several members of Parliament, the author, and other citizens were present, and it was decided to send the following message to Lord Roberts, who was then at Modder River. The military censor at first refused
to send it, but the officer commanding finally decided to permit its transmission in an abridged form.

"Kimberley, 10th February. — On behalf of the inhabitants of this town, we respectfully desire to be informed whether there is an intention on your part to make an immediate effort for our relief. Your troops have been for more than two months within a distance of a little over 20 miles from Kimberley, and if the Spytfontein hills are too strong for them, there is an easy approach over a level flat. This town, with a population of over 45,000 people, has been besieged for 120 days, and a large portion of its inhabitants have been enduring great hardships. Scurvy is rampant among the natives; children, owing to lack of proper food, are dying in great numbers, and dysentery and typhoid are very prevalent. The chief food of the whites has been bread and horseflesh for a long time past, and for the blacks meal and salt only. These hardships, we think you will agree, have been borne patiently and without complaint by the people. During the past few days the enemy has brought into action from a position within three miles of us a six-inch gun, throwing a hundred-pound shell which is setting fire to our buildings, and is daily causing death among the population. As you are aware, the military guns here are totally unable to cope with this new
gun. The only weapon which gives any help is one locally manufactured. Under these circumstances, as representing this community, we feel that we are justified in asking whether you have any immediate intention of instructing your troops to come to our relief. We understand that large reinforcements have recently arrived at Cape Town, and we feel sure that your men at Modder River have, at the outside, 10,000 Boers opposed to them. You must be the judge as to what number of British troops would be required to deal with this body of men, but it is absolutely essential that immediate relief should be afforded to this place.”

The reply received from Lord Roberts was sent to Colonel Kekewich, and was as follows:

“I beg you will represent to the Mayor and Mr. Rhodes, as strongly as you possibly can, the disastrous and humiliating effect of surrender after so long and glorious defence. Many days cannot possibly elapse before Kimberley will be relieved, as we commence active operations to-morrow. Future military operations depend in a large degree on your maintaining your position a very short time longer.”

What message or messages were sent by the military from Kimberley that conveyed to the mind of Lord Roberts that there was even the remotest chance of the citizens of Kimberley surrendering to the Boers, will probably always remain a military secret. Suffice it to say, however, that such a thought never entered the minds of the men of Kimberley, who would rather have died in their trenches than have surrendered, so long as any scrap of food remained.

The saving of Kimberley from the attack of the Boers was due to the natural strength of the position and its improvised fortifications; to the courage of the citizen soldiers, and the small force of Imperial troops; to the indomitable spirit of Cecil John Rhodes, the chairman of De Beers Company, whose pent-up energies found vent in devising ways and means for adding to the plans of defence; to the forethought of the De Beers men in charge of buying food for man and beast, who laid in supplies
THE FUNERAL OF CECIL JOHN RHODES PASSING THROUGH ADDERLEY STREET, CAPE TOWN. APRIL 3, 1902.
THE BURIAL OF CECIL JOHN RHODES ON THE MATOPPO HILLS, RHODESIA. APRIL 10, 1902.
far in excess of any expected emergency; and possibly, least of all, to the disinclination of the Boers to attack energetically a fortified town so long invested by commandoes greatly outnumbering the garrison under arms.

It is plainly to be seen that Rhodes's view of the interests of South Africa and the drift of his anticipated confederation were inevitably antagonistic to the attitude and policy of the men controlling the South African Republic. In stretching the arm of Great Britain over Mashonaland and Rhodesia, Rhodes unquestionably blocked the extension of the Transvaal State and the schemes of Kruger. In this brief marking of progress and attainment I would not attempt any measuring of responsibility for the collision that finally resulted in the war just closed. South Africa is now completely under British Imperial control. Whatever view may be taken of the conflict, its practical outcome plainly clears the way for the systematic development of this vast territory under liberal colonial institutions.
Cecil John Rhodes did not live to see the ending of the contest so long maintained by the unyielding temper of the Boers. He died on March 26, 1902, near Cape Town, of the disease of the heart which had long clouded his hope of life.

His visionary political projects ran far beyond any exact defining or determination of method, but, in the main, "the lay of his ideas," to use his own phrasing, is clear. He would urge the union of all English-speaking people to dominate the world, transform barbarism to civilization, do away with poor and hampering government, maintain enduring peace, and promote universal progress. His last will and testament has proven that the advance of this union was at the core of his heart. The image of his fancy may never come into being, but he has, at least, done something for an uplifting union in the gathering of young scholars, representing all English-speaking people, in the ancient mother university, to recall their common inheritance and join their hands.

"Dreamer devout, by vision led
Beyond our guess or reach,
The travail of his spirit bred
Cities in place of speech.
So huge the all-mastering thoughts that drove—
So brief the term allowed—
Nations, not words, he linked to prove
His faith before the crowd.

"Here, till the vision he foresaw,
Splendid and whole, arise,
And unimagined Empires draw
'To council 'neath his skies.
The immense and brooding Spirit still
Shall quicken and control.
Living he was the land, and dead,
His soul shall be her soul!"

— Rudyard Kipling on the burial of Cecil Rhodes.
APPENDICES
APPENDIX I

The underground haulage system described on page 324, Vol. I, is being superseded by two other systems. In De Beers and Kimberley Mines, where the blue ground has not to be trammed very far before it is dumped into the passes, side tipping trucks, holding 20 cubic feet of ground and drawn by an endless wire rope, are used. The trucks are drawn up an incline as they get near to the shaft and are then detached from the rope and run by gravitation to the shaft, where they are both tipped and righted again automatically.

In Dutoitspan, Bultfontein, and Premier Mines, where the distances to tram in the mines themselves are much greater, the 20-cubic-feet trucks will be drawn by electric locomotives, which will be installed under the trolley system. The tipping into the chutes at the shafts will be done automatically, as described above.
APPENDIX II

WINDING ENGINES FOR THE MAIN SHAFT, KIMBERLEY MINE

This plant was designed by me for De Beers Consolidated Mines Limited, and built by Messrs. James Simpson & Co., of London, and consists of a pair of inverted vertical tandem compound-condensing engines, driving two reels, which are capable of carrying 1800 feet of flat ropes each. The principal dimensions of these engines are as follows, viz.:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of high-pressure cylinders, two</td>
<td>19.5 in.</td>
</tr>
<tr>
<td>Diameter of low-pressure cylinders, two</td>
<td>34 &quot;</td>
</tr>
<tr>
<td>Stroke of all cylinders</td>
<td>48 &quot;</td>
</tr>
<tr>
<td>Diameter of each air pump, two</td>
<td>24 &quot;</td>
</tr>
<tr>
<td>Stroke of each air pump</td>
<td>16 &quot;</td>
</tr>
<tr>
<td>Diameter of steam cylinder of the reversing engine</td>
<td>7 &quot;</td>
</tr>
<tr>
<td>Diameter of oil cataract of the reversing engine</td>
<td>4.75 &quot;</td>
</tr>
<tr>
<td>Stroke of reversing engine</td>
<td>18 &quot;</td>
</tr>
<tr>
<td>Diameter of each high-pressure steam pipe</td>
<td>6 &quot;</td>
</tr>
<tr>
<td>Diameter of each low-pressure steam pipe</td>
<td>10 &quot;</td>
</tr>
<tr>
<td>Diameter of each exhaust pipe to the condenser</td>
<td>14 &quot;</td>
</tr>
<tr>
<td>Diameter of each high-pressure valve</td>
<td>6 &quot;</td>
</tr>
<tr>
<td>Diameter of each low-pressure valve</td>
<td>8 &quot;</td>
</tr>
<tr>
<td>Diameter of each high-pressure piston rod</td>
<td>3.5 &quot;</td>
</tr>
<tr>
<td>Diameter of each low-pressure piston rod</td>
<td>4.5 &quot;</td>
</tr>
<tr>
<td>Diameter of crank-pins</td>
<td>5.5 &quot;</td>
</tr>
<tr>
<td>Length of crank-pins</td>
<td>7 &quot;</td>
</tr>
<tr>
<td>Diameter of each main bearing</td>
<td>14 &quot;</td>
</tr>
<tr>
<td>Length of each main bearing</td>
<td>32.5 &quot;</td>
</tr>
<tr>
<td>Diameter of main crank-shaft in the middle</td>
<td>16 &quot;</td>
</tr>
<tr>
<td>Smallest diameter of each reel</td>
<td>9 ft. 1 1/8 &quot;</td>
</tr>
<tr>
<td>Size of flat ropes used</td>
<td>3 5/8 in. by 8 1/6 &quot;</td>
</tr>
<tr>
<td>Capacity of blue ground skips</td>
<td>100 cubic feet</td>
</tr>
</tbody>
</table>
These engines were intended to hoist six loads, each weighing 1600 lbs., from the 1000-foot level in 45 seconds, including filling, starting, discharging, and stopping; but they do it in from 30 to 35 seconds.

All the steam cylinders are fitted with the Corliss valve gear, having vacuum dash-pots, the cut-off being effected by the same lever that works the throttle valves.

Reversing is effected by ordinary links worked by eccentrics fitted on the tail-shafts; the reversing engine being fitted with a floating lever so that the motion of the piston coincides exactly with the motion of the small hand lever.

The two high pressure cylinders exhaust into the receiver, which is 5 ft. diameter by 18 ft. long, fitted with sixty-eight 2-inch wrought-iron tubes, through which live steam from the high-pressure jackets, but at a reduced pressure, is constantly circulating. The object of this receiver is to supply the low-pressure cylinders with a considerable volume of dry steam to facilitate a quick starting away. An 8-inch balanced throttle valve admits steam to the high-pressure cylinders, and a similar valve, 12 inches in diameter, admits steam from the reheater to the low-pressure cylinders.

Each high-pressure cylinder is jacketed with live steam at full boiler pressure, the water of condensation together with a certain amount of steam passing through a Watts pressure regulator, which reduces the pressure in the jackets of the reheater and low-pressure cylinders to about 30 lbs. The final water of condensation is discharged automatically by a displacement trap into the hot well.

Each air pump of the ordinary marine type is worked off the crosshead. The condenser, 6 ft. diameter by 16 ft. long, fitted with 125 wrought-iron tubes 3\(\frac{1}{2}\) in. outside diameter and 16 ft. long, is situated just outside the winding-engine house. All the water pumped from the mine passes through this condenser on its way to the floors.

A circulating pump on the end of one of the tail-shafts supplies water for jet injection whenever the mine pumps are not supplying sufficient water to condense the steam.

L. I. SEYMOUR,
Mechanical Engineer for D. B. C. M. Ltd.
APPENDIX III

REPORT ON PUMPING PLANT FOR KIMBERLEY MINE

The new plant consists of a vertical triple-expansion condensing engine, having cylinders 15\(\frac{1}{2}\) in., 23\(\frac{1}{4}\) in., and 37 in. diameter respectively, with a stroke of 36 in.

The high and intermediate pressure cylinders are arranged tandem, over one crank, the low pressure working on the other, which is placed at the opposite end of the crank-shaft and at an angle of 90° with the other.

A double acting air pump is driven by a rocking lever from one cross-head and a feed pump in the same manner from the other engine.

A cast steel spur-wheel, 3 ft. 9 in. pitch diameter, is keyed on the engine shaft, and drives a second shaft 27 in. diameter by gearing with a spur-wheel 30 ft. pitch diameter made of cast iron, with teeth 6 in. pitch by 30 in. face. The gears were made by Fraser & Chalmers, of Chicago, U.S.A., the crank-shafts by Sir J. Whitworth, of Manchester, and the rest of the work, including the pumps, by Messrs. J. Simpson & Co. Ltd., of London. A cast-steel crank is keyed on the second motion shaft, and drives the T bob by a pitman with 35 ft. centres.

On the nose of the bob is hung the spear rod 1250 ft. long, of hard pine, 14 in. square for the first 500 ft., 12 in. square for the second, and 10 in. square for the remainder.

The total weight of the rod, including strapping plates and poles, is 61 tons, which will be partially balanced by a counterweight on the top bob, and partly by a second bob placed at the 1200-ft. level.

Attached to the spear rod at the 250 ft., the 500 ft., the 750 ft., the 1000 ft., and the 1200 ft. levels are cast-iron plungers 14 in. diameter, having a stroke of 10 ft., each of which forces the water to the next station above through a riveted steel pipe, 14 in. diameter, with joints riveted together.

The foundations for the driving machinery are made of concrete, with the proportion of cement to stone of 1:9 on the average.

L. I. SEYMOUR, Mechanical Engineer.
APPENDIX IV

The relative values of South African coals are shown in the following table, exhibiting tests made with the Beeley boilers at De Beers mine:

ENGLISH COAL

<table>
<thead>
<tr>
<th>Date</th>
<th>Coal Description</th>
<th>Pounds of feed-water evaporated per lb. of coal from and at 212° Fahr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr. 29.</td>
<td>Nixon's Steam Navigation coal</td>
<td>11.67</td>
</tr>
<tr>
<td>July 16.</td>
<td>Nixon's Steam Navigation coal (2nd test)</td>
<td>11.11</td>
</tr>
</tbody>
</table>

SOUTH AFRICAN COAL

<table>
<thead>
<tr>
<th>Date</th>
<th>Mine, Location</th>
<th>Pounds of feed-water evaporated per lb. of coal from and at 212° Fahr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov. 7.</td>
<td>Vaal Drift Mine, Transvaal</td>
<td>4.515</td>
</tr>
<tr>
<td>1891.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March 24.</td>
<td>Indwe, Colonial</td>
<td>7.090</td>
</tr>
<tr>
<td>March 25.</td>
<td>Lewis and Marks, Transvaal</td>
<td>6.734</td>
</tr>
<tr>
<td>June 29.</td>
<td>Newcastle, Natal</td>
<td>8.520</td>
</tr>
<tr>
<td>July 20.</td>
<td>Kroonstad, Free State</td>
<td>7.084</td>
</tr>
</tbody>
</table>

The relative cost and service of Welsh and Indwe coal delivered at the mines are approximately as follows:

A ton of 2000 pounds Welsh coal cost: £7 0 0
A ton of Indwe coal: £1 19 0

Welsh steam coal will evaporate about eleven pounds of water per pound of coal from and at 212° Fahr., and Indwe coal about seven pounds. Indwe coal is, therefore, worth about 60% of Welsh coal, and costs about £3 4s. for the same evaporating value contained in a ton of Welsh coal costing more than double this sum.
## DE BEERS AND KIMBERLEY MINES

<table>
<thead>
<tr>
<th>Year Ending</th>
<th>Number of Loads of Blue hoisted</th>
<th>Number of Loads of Blue washed</th>
<th>Number of Carats of Diamonds found</th>
<th>Value of Diamonds produced</th>
<th>Average Number of Carats per Load</th>
<th>Average Value per Carat</th>
<th>Average Value per Load</th>
<th>Cost of Production per Load</th>
<th>Number of Loads of Blue on Floors at close of Year exclusive of Lumps</th>
<th>Dividends paid, Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 31, 1889 prior to Consolidation</td>
<td>[944,706]</td>
<td>712,263</td>
<td>914,121</td>
<td>[901,818]</td>
<td>s. d.</td>
<td>s. d.</td>
<td>s. d.</td>
<td>s. d.</td>
<td>s. d.</td>
<td>183,190</td>
</tr>
<tr>
<td>March 31, 1890</td>
<td>2,192,226</td>
<td>1,251,245</td>
<td>1,450,805</td>
<td>2,330,179</td>
<td>63</td>
<td>1.15</td>
<td>10.87</td>
<td>25</td>
<td>37.75</td>
<td>9</td>
</tr>
<tr>
<td>March 31, 1891</td>
<td>1,978,153</td>
<td>2,299,318</td>
<td>2,090,515</td>
<td>2,974,070</td>
<td>90</td>
<td>0.69</td>
<td>29.6</td>
<td>29.37</td>
<td>8</td>
<td>10.5</td>
</tr>
<tr>
<td>June 30, 1892 *</td>
<td>3,338,553</td>
<td>3,239,134</td>
<td>3,035,481</td>
<td>3,031,542</td>
<td>99</td>
<td>0.72</td>
<td>25.6</td>
<td>23</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>June 30, 1893</td>
<td>3,090,183</td>
<td>2,188,626</td>
<td>2,229,805</td>
<td>3,239,378</td>
<td>86</td>
<td>1.05</td>
<td>29.6</td>
<td>30</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>June 30, 1894</td>
<td>2,999,431</td>
<td>2,577,400</td>
<td>2,308,463</td>
<td>2,820,172</td>
<td>39</td>
<td>0.80</td>
<td>24.5</td>
<td>21.06</td>
<td>6</td>
<td>10.8</td>
</tr>
<tr>
<td>June 30, 1895</td>
<td>3,255,727</td>
<td>2,854,817</td>
<td>2,435,541</td>
<td>3,105,057</td>
<td>13</td>
<td>0.85</td>
<td>23.6</td>
<td>21</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>June 30, 1896</td>
<td>2,668,109</td>
<td>2,357,026</td>
<td>2,312,721</td>
<td>3,105,382</td>
<td>14</td>
<td>0.91</td>
<td>26.9</td>
<td>24</td>
<td>4.5</td>
<td>6</td>
</tr>
<tr>
<td>June 30, 1897</td>
<td>2,515,889</td>
<td>3,011,288</td>
<td>2,709,422</td>
<td>3,722,099</td>
<td>33</td>
<td>0.92</td>
<td>26.1</td>
<td>21</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>June 30, 1898</td>
<td>3,332,688</td>
<td>3,259,702</td>
<td>2,603,250</td>
<td>3,451,214</td>
<td>15</td>
<td>0.80</td>
<td>26.6</td>
<td>21</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>June 30, 1899</td>
<td>3,504,899</td>
<td>3,311,773</td>
<td>2,345,466</td>
<td>3,471,060</td>
<td>12</td>
<td>0.71</td>
<td>29.7</td>
<td>20</td>
<td>11.5</td>
<td>6</td>
</tr>
<tr>
<td>June 30, 1900</td>
<td>1,673,664</td>
<td>1,522,108</td>
<td>1,000,364</td>
<td>1,794,222</td>
<td>01</td>
<td>0.67</td>
<td>35.1</td>
<td>23</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>June 30, 1901</td>
<td>2,120,397</td>
<td>2,196,873</td>
<td>2,000,455</td>
<td>3,095,833</td>
<td>01</td>
<td>0.76</td>
<td>39</td>
<td>7</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>June 30, 1902</td>
<td>2,652,459</td>
<td>1,601,858</td>
<td>1,499,294</td>
<td>3,484,217</td>
<td>11</td>
<td>0.76</td>
<td>40</td>
<td>5</td>
<td>35</td>
<td>6</td>
</tr>
<tr>
<td>June 30, 1903</td>
<td>2,370,503</td>
<td>2,561,940</td>
<td>1,574,189</td>
<td>3,819,653</td>
<td>10</td>
<td>0.76</td>
<td>40</td>
<td>5</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37,347,577</strong></td>
<td><strong>35,615,951</strong></td>
<td><strong>30,551,957</strong></td>
<td><strong>46,170,997</strong></td>
<td><strong>9</strong></td>
<td><strong>9857</strong></td>
<td><strong>39</strong></td>
<td><strong>27</strong></td>
<td><strong>25</strong></td>
<td><strong>11.1</strong></td>
</tr>
</tbody>
</table>

* These figures are for a period of fifteen months. ** Taken over from De Beers Mining Company. *** Taken over from Central Company. 
† Includes £520,000 bonus dividends. ¶ In addition to this the Life Governors received £838,020.
## PREMIER MINE

<table>
<thead>
<tr>
<th>Year Ending</th>
<th>Number of Loads of Blue hauled</th>
<th>Number of Loads of Blue washed</th>
<th>Number of Carats of Diamonds found</th>
<th>Value of Diamonds produced</th>
<th>Average Number of Carats per Load</th>
<th>Average Value per Carat</th>
<th>Average Value per Load</th>
<th>Cost of Production per Load</th>
<th>Number of Loads of Blue on Floors at Close of Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 30, 1897</td>
<td>271,777</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>271,777</td>
</tr>
<tr>
<td>June 30, 1898</td>
<td>1,146,984</td>
<td>691,722</td>
<td>189,356</td>
<td>196,659 18 8</td>
<td>.27</td>
<td>20 9.3</td>
<td>5 8.2</td>
<td>2 7.1</td>
<td>727,039</td>
</tr>
<tr>
<td>June 30, 1899</td>
<td>2,032,771</td>
<td>1,662,778</td>
<td>406,762</td>
<td>577,360 11 7</td>
<td>.30</td>
<td>22 10.1</td>
<td>6 9.8</td>
<td>2 3.3</td>
<td>1,097,032</td>
</tr>
<tr>
<td>June 30, 1900</td>
<td>980,410</td>
<td>736,929</td>
<td>220,762</td>
<td>276,191 6 6</td>
<td>.30</td>
<td>25 0.2</td>
<td>7 5.9</td>
<td>2 7.5</td>
<td>1,340,313</td>
</tr>
<tr>
<td>June 30, 1901</td>
<td>1,571,631</td>
<td>1,517,981</td>
<td>447,399</td>
<td>610,831 4 10</td>
<td>.205</td>
<td>27 3.7</td>
<td>8 0.6</td>
<td>3 0.9</td>
<td>1,393,063</td>
</tr>
<tr>
<td>June 30, 1902</td>
<td>1,932,140</td>
<td>1,752,189</td>
<td>551,437</td>
<td>873,203 9 2</td>
<td>.30</td>
<td>33 5.9</td>
<td>9 11.6</td>
<td>3 5.2</td>
<td>1,573,914</td>
</tr>
<tr>
<td>June 30, 1903</td>
<td>1,987,513</td>
<td>1,989,508</td>
<td>594,809</td>
<td>1,021,276 17 10</td>
<td>.30</td>
<td>34 4</td>
<td>10 3.2</td>
<td>3 3.7</td>
<td>1,571,859</td>
</tr>
<tr>
<td>Total</td>
<td>9,923,056</td>
<td>8,351,107</td>
<td>3,545,523</td>
<td>8 7</td>
<td>.2058</td>
<td>28 8.4</td>
<td>8 5.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## BULTFONTEIN MINE

<table>
<thead>
<tr>
<th>Year Ending</th>
<th>Number of Loads of Blue hauled</th>
<th>Number of Loads of Blue washed</th>
<th>Number of Carats of Diamonds found</th>
<th>Value of Diamonds produced</th>
<th>Average Number of Carats per Load</th>
<th>Average Value per Carat</th>
<th>Average Value per Load</th>
<th>Cost of Production per Load</th>
<th>Number of Loads of Blue on Floors at Close of Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 30, 1901</td>
<td>148,086</td>
<td></td>
<td>65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>148,086</td>
</tr>
<tr>
<td>June 30, 1902</td>
<td>353,042</td>
<td>20,194</td>
<td>4,186</td>
<td>6,817 5 6</td>
<td>.21</td>
<td>30 4.7</td>
<td>6 9</td>
<td>6 6.4</td>
<td>480,934</td>
</tr>
<tr>
<td>June 30, 1903</td>
<td>318,410</td>
<td>317,185</td>
<td>76,531</td>
<td>118,102 3 0</td>
<td>.24</td>
<td>30 10.2</td>
<td>7 5.4</td>
<td>5 9</td>
<td>482,159</td>
</tr>
<tr>
<td>Total</td>
<td>819,538</td>
<td>337,379</td>
<td>81,124</td>
<td>125,065 13 6</td>
<td>.24</td>
<td>30 9.8</td>
<td>7 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX V (Continued)

TAILINGS AND DÉBRIS

<table>
<thead>
<tr>
<th>Year Ending</th>
<th>No. of Loads of Tailings washed</th>
<th>No. of Carats of Diamonds found</th>
<th>Value of Diamonds produced</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 30, 1901</td>
<td>265,239</td>
<td>50,147½</td>
<td>£ 58,484 12 6</td>
</tr>
<tr>
<td>June 30, 1902</td>
<td>1,131,816</td>
<td>202,830</td>
<td>251,870 12 3</td>
</tr>
<tr>
<td>June 30, 1903</td>
<td>1,347,115</td>
<td>227,477</td>
<td>281,433 18 0</td>
</tr>
<tr>
<td></td>
<td>2,764,170</td>
<td>480,454½</td>
<td>591,788 2 9</td>
</tr>
</tbody>
</table>

SMALL DIAMONDS RECOVERED FROM OLD CONCENTRATES

<table>
<thead>
<tr>
<th>Year Ending</th>
<th>No. of Carats of Diamonds found</th>
<th>Estimated Value of Diamonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 30, 1902</td>
<td>18,728</td>
<td>£ 4,682 0 0</td>
</tr>
<tr>
<td>June 30, 1903</td>
<td>2,672</td>
<td>£ 116 0</td>
</tr>
<tr>
<td></td>
<td>21,400</td>
<td>£ 5,388 0 0</td>
</tr>
</tbody>
</table>

Total production since formation of the Company, £50,438,759 11 11 d.
<table>
<thead>
<tr>
<th>Period</th>
<th>Loads of Blue Ground hauled</th>
<th>Loads of Floating Reef and Stones hauled</th>
<th>Total Loads hauled</th>
<th>Total Loads Blue Ground deposited</th>
<th>Total Loads of Ground washed, including Fine Ground from Mine and Lumps</th>
<th>Diamonds produced (Carats)</th>
<th>Amount realized</th>
<th>Average Value per Carat</th>
<th>Average Yield per 100 Loads Blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 1, 1891–March 31, 1892</td>
<td>1,218,958</td>
<td>366,189</td>
<td>1,585,147</td>
<td>821,599</td>
<td>1,156,095</td>
<td>110,171</td>
<td>195,271</td>
<td>4 9</td>
<td>35 5.383</td>
</tr>
<tr>
<td>April 1, 1892–March 31, 1893</td>
<td>1,559,799</td>
<td>239,091</td>
<td>1,798,890</td>
<td>1,108,111</td>
<td>1,457,014</td>
<td>172,020</td>
<td>330,781</td>
<td>5 0</td>
<td>39 7.01</td>
</tr>
<tr>
<td>April 1, 1893–March 31, 1894</td>
<td>1,689,832</td>
<td>351,183</td>
<td>2,041,015</td>
<td>1,275,899</td>
<td>1,693,637</td>
<td>203,780</td>
<td>382,986</td>
<td>4 1</td>
<td>37 7.71</td>
</tr>
<tr>
<td>April 1, 1894–March 31, 1895</td>
<td>1,810,946</td>
<td>293,611</td>
<td>2,104,557</td>
<td>1,364,647</td>
<td>2,045,415</td>
<td>232,872</td>
<td>373,579</td>
<td>8 2</td>
<td>31 1.013</td>
</tr>
<tr>
<td>April 1, 1895–March 31, 1896</td>
<td>1,623,148</td>
<td>223,684</td>
<td>1,846,832</td>
<td>1,154,507</td>
<td>1,904,070</td>
<td>205,063</td>
<td>377,521</td>
<td>2 6</td>
<td>36 9.60</td>
</tr>
<tr>
<td>April 1, 1896–March 31, 1897</td>
<td>1,951,021</td>
<td>195,506</td>
<td>2,147,527</td>
<td>1,392,478</td>
<td>2,176,650</td>
<td>220,212</td>
<td>385,371</td>
<td>17 6</td>
<td>35 0.10</td>
</tr>
<tr>
<td>April 1, 1897–March 31, 1898</td>
<td>2,238,983</td>
<td>182,520</td>
<td>2,421,503</td>
<td>1,587,509</td>
<td>2,245,206</td>
<td>234,433</td>
<td>386,557</td>
<td>7 0</td>
<td>33 3.141</td>
</tr>
<tr>
<td>April 1, 1898–March 31, 1899</td>
<td>2,590,014</td>
<td>260,625</td>
<td>2,859,639</td>
<td>1,855,813</td>
<td>2,758,682</td>
<td>288,931</td>
<td>498,797</td>
<td>15 3</td>
<td>34 0.310</td>
</tr>
<tr>
<td>April 1, 1899–March 31, 1900</td>
<td>1,117,383</td>
<td>183,663</td>
<td>1,301,046</td>
<td>815,816</td>
<td>1,670,935</td>
<td>183,241</td>
<td>373,701</td>
<td>17 8</td>
<td>49 9.16</td>
</tr>
<tr>
<td>April 1, 1900–March 31, 1901</td>
<td>43,857</td>
<td>69,871</td>
<td>113,728</td>
<td>125,956</td>
<td>150,359</td>
<td>18,002</td>
<td>37,079</td>
<td>1 3</td>
<td>41 2.32</td>
</tr>
<tr>
<td>April 1, 1901–March 31, 1902</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>April 1, 1902–March 31, 1903</td>
<td>212,006</td>
<td>101,009</td>
<td>313,015</td>
<td>103,426</td>
<td>365,624</td>
<td>29,302</td>
<td>79,439</td>
<td>10 7</td>
<td>54 2.65</td>
</tr>
</tbody>
</table>

* This embraces the period of the War.
APPENDIX VII

FOSSILS

Fossil Fish (page 126, Vol. II)

Mr. O. Smith Woodward of the Natural History Department of the British Museum writes of the fossil fish, "I have made a preliminary examination of the specimen, and find that most of the fragments are atherstonia. I fear they are all too imperfect to be worthy of description."

Fossil Reptile (page 118, Vol. II)

A photograph of a fossil lizard appears on page 118, Vol. II. This was found in a boulder in (De Beers) Premier Mine at a depth of 60 feet. Since the photograph was taken the whole of the backbone and the articulation of some of the ribs and one of the hind-limb bones have been uncovered.
APPENDIX VIII

ARTIFICIAL DIAMONDS

M. Moissan describes the method of procedure in making microscopical diamonds as follows: —

A small charcoal crucible is filled with broken bits of iron and carbon of sugar, placed in a furnace wherein a heat of 4000° to 5000° C. is generated by two electrodes connected with a powerful generator. When thoroughly heated, the crucible is removed from the furnace and plunged into water. This process is similar to that demonstrated by Sir William Crookes (see page 139). M. Moissan relates that the removing of the diamond from the centre of the solid iron is a delicate task which takes nearly three weeks. “That I have obtained diamonds there is no doubt, but they can be seen only by the aid of the microscope.”

It has recently been contended by Mr. George Friedel that high temperature is an essential condition to the formation of the diamond. He is also of the opinion that the greatest importance should be given to the quick cooling of the iron containing the carbon. His experiment consisted of placing two electric carbons as shown in the sketch; one was solid, the other had a hole through the centre. A strong electric current was passed through the carbons, forming an arc at $A$. A piece of iron wire was fed slowly through the hollow carbon and was melted into globules, which fell into a dish containing quicksilver and water. Upon dissolving these globules the residuum was examined under a microscope and found to contain infinitesimally small crystals which were determined to be diamonds.
APPENDIX IX

ON THE OCCURRENCE OF DIAMONDS

In Griqualand West. — Mention has been made of some of the smaller mines in the Kimberley and Barkly West Districts.

In the Kimberley District Otto's Kopje Mine has not been worked during the last year. The yield of the ground has evidently been too small to pay the cost of extraction, as the Company has been reconstructed several times. From all accounts it is a true pipe or crater carrying diamonds. The mine is situated about a mile and a half north-west of Kimberley.

Kamfersdam Mine. — This mine is situated about 3½ miles north and west of Kimberley. The output for 1902 was returned as 320,213 loads of blue ground. The number of men employed was 42 whites and 550 natives. The ground yields about 6 carats per 100 loads; the diamonds being of an inferior quality averaging about 22 shillings per carat.

In the Barkly West District which comprises that part of Griqualand West lying on the west side of the Vaal River, the returns for the year 1902 showed that 38,510 carats of diamonds were found, valued at £130,099. In the Frank Smith Mine work was restarted in July, 1902. This mine comprises about 450 claims and is being worked in the open. The quality of the diamonds is excellent, averaging at the present time about 60 shillings per carat. The average yield of the ground is about 5 carats per 100 loads. A test of 900 loads of blue ground gave 90 carats of diamonds.

Otto's Prospect Mine. — This is a small mine joined to the Frank Smith Mine by a narrow neck of blue ground. Very little work has been done in this mine and but little is known as to the yield of the ground. These mines are situated about 50 miles west of Kimberley.

The Leicester Mine. — The mine contains 100 claims. It is a true pipe and the quality of the diamonds is good; unfortunately the yield is very low, averaging only 2 to 3 carats per 100 loads. The number of
APPENDIX IX

loads hauled during the year 1902 is given at 8000 weekly. The Leicester property consists of two pipes adjoining one another. One is a very much larger pipe than the one above, but it contains no diamonds.

Newlands Mine.—No work was done during the year 1902.

Other Mines.—There are several so-called mines or prospects which have been before the public at various times, but the amount of development work does not amount to very much, and in the Inspector of Claims Report he classes them as "abandoned mines, unleased."

Professor Bonney mentions the eclogites of the Kimberley or Barkly Districts.

Large boulders of this rock occur in all the mines at Kimberley, and after reading Professor Bonney's monograph I caused a few truck loads of the rock to be gathered from the waste heaps and had them crushed and washed, but no diamonds were found. Quite a number of specimens of diamonds and garnets cemented together have been found, but in most specimens which have come under my observation it is difficult to determine whether the diamond has grown into the garnet or the garnet into the diamond. A diamond was recently (January 9, 1904) found in (De Beers) Premier Mine which has a small garnet embedded in it. The diamond weighs 114 carats, and the garnet is estimated to weigh about half a carat. It appears to fill the hole in which it is embedded. The diamond is of cubic crystallization, with nearly half of the cube wanting. The part of the diamond in which the garnet is buried has numerous depressions similar to the one containing the garnet, and one is led to think that these depressions were also filled with small garnets, or in other words, the diamond crystallized upon a nest of garnets. The value of the stone, £40, is rather too great for a cabinet specimen. It is of a peculiar plumbago color and semi-transparent. All of the diamonds crystallized in cubic form which have been found of late in Premier Mine are of this peculiar color.

Professor Lewis says: "Kimberley diamonds have been found sometimes to have optical anomalies due to strain. . . . Fizsan thought this strain to have been caused by the unequal distribution of heat during cooling, but Jaunetaz (Bull. Soc. Min. de France, II, 1879, p. 124) holds that the strain is due to compressed gas in the interior of the crystal."

Professor Lewis says: "Perhaps the most interesting chemical observation concerning the 'blue ground' was that made by Sir H. E. Roscoe. He found that on treating it with hot water an aromatic hydrocarbon could be extracted. By digesting the 'blue ground' with ether and
allowing the solution to evaporate, this hydrocarbon was separated and found to be crystalline, strongly aromatic, volatile, burning with a smoky flame, and melting at 50° C.

"That the rock was a true igneous lava and not a mud or ash is indicated by the fact that the minerals and their associations are those characteristic of eruptive ultra-basic rocks." He gives several other reasons for having formed this opinion ("The Matrix of the Diamond," page 52). Professor Lewis further states that "the Kimberlite is shared by no other terrestrial rock. In structure it resembles meteorites of similar composition. If the ground-mass of Kimberlite were replaced by native iron, it would be nearly allied in both structure and composition with meteorites known as Chondrites."

**Rock similar to Kimberlite.** — Mr. Arthur W. Rogers, geologist to the Cape Government, informs me that during the year 1903 he examined some volcanic pipes in the Cape Colony which were in many respects like the Kimberley pipes. Some of them were filled with melilite basalt in close connection with a breccia similar to the blue ground at Kimberley. He thinks that these pipes point to the age of the Kimberley mines, which he believes to be of the cretaceous or later age.

In Bohemia a rock occurs which contains every mineral known in the blue ground of Kimberley. I was shown by Dr. Stelzner two cases containing these minerals, and, in every instance except one, the Bohemian minerals corresponded with those from Kimberley. I had previously presented the Mining Academy at Freiberg with a few small diamonds which were in the collection of Kimberley minerals, but the corresponding box in the Bohemian case was empty.

The conclusion that one may draw from this is that Kimberlite does not always carry diamonds, and I am borne out in this conclusion by the fact that there are numerous pipes resembling those at Kimberley in every respect, except that they contain no diamonds.

**Occurrence of Diamonds in America.** — The occurrence of diamonds in many of the states of North America is well authenticated. The largest of these weighed 23½ carats, and was found near Richmond in the state of Virginia. It is an off-colored stone and of no great value.

It is a remarkable fact that in many of the districts where alluvial gold is found, diamonds occur. In North Carolina, South Carolina, and Georgia numerous diamonds have been found in the alluvial gold diggings. In California in many of the counties where placer and hydraulic gold mining has taken place, diamonds have been found. The author can
vouch for the correctness of some of these determinations, as the crystals were found in a mine under his personal supervision at Cherokee in Butte County, where diamonds are known to have been found as early as 1853. Mr. George F. Kunz gives an interesting description of the diamonds of California and the localities in which they are found.¹

IN THE ORANGE RIVER COLONY

*Koffyfontein Mine.* — This mine is situated in the Orange River Colony about 50 miles from Kimberley. It contains about 1200 claims. The mine is well equipped, and since the war has been worked on a large scale. The yield of the ground is poor, averaging from 4 to 5 carats per 100 loads. The quality of the diamonds is good, and they are valued at 55 shillings per carat.

*The Lace Mine.* — The Lace Mine is situated in the neighborhood of Kroonstad in the Orange River Colony. The yield of diamonds has been about 10 carats per 100 loads. The quality of the diamonds is poor.

DIAMONDS IN THE TRANSVAAL

Mention is made on pages 162 and 163 that diamonds had been found in both the alluvial along the Vaal River and in alluvial and in pipes at Rietfontein near Pretoria. The Rietfontein mines are referred to by Professor G. A. F. Molengraaff (see pages 134–136).

As the Transvaal mines have of late become a factor in the production of diamonds, a short history of them will be interesting.

The properties of the Transvaal Diamond Mining Co. (now the Montrose D. M. Co.) and the Schuller D. M. Co. were discovered in 1898, and the remarks of Professor Molengraaff mentioned on pages 134–136 were in reference to the nature of the diamond-bearing rock in these mines. The Transvaal D. M. Co. is reported to have produced about 9000 carats from 11,500 loads of 16 cubic feet.

The Schuller Company from its beginning to October, 1903, found 12,655 carats of diamonds from 38,015 loads. The diamonds in its mines occur in the alluvial wash. Although the mines were discovered in 1898, there is no record that the rock underlying the alluvial deposits contains diamonds.

The discovery of diamonds, even in small quantities compared with the Kimberley output, gave an impetus to prospecting and company

¹ "Gems and Precious Stones," by George F. Kunz, New York, 1892.
promotions. The Boer War interfered with the development of these mines. During the year 1899 four companies were registered. After the occupation of the Transvaal by the British, 13 companies were registered during the year 1902 and 35 during the year 1903, with an aggregate capital of nearly £2,000,000 sterling.

The Premier (Transvaal) Diamond Mining Company was registered on December 1, 1902, with a capital of £80,000. According to the published report of a correspondent of The Statist, the work which had been done up to the end of October, 1903, consisted of an oval excavation 300 by 400 feet which was being mined to a depth varying from 15 to 25 feet. The first 6 feet is described as being a clayey red earth, and below this the color changes to yellow earth which carries a considerable quantity of boulders and broken rocks. Up to the present time the diamonds produced have come from the above-mentioned opening, although several smaller openings have been made. A bore hole has been put down more than 1000 feet. I have seen sections of the core from this hole. It resembles blue ground somewhat, but is of an entirely different nature from the blue ground of the Kimberley District and appears to be much harder. It resembles the sample of so-called diamond-bearing ground rock from the Schuller Mine described by Professor Molengraaff. It is also reported that shafts have been sunk in various places on the mine, which show blue ground in depth. Some of the blue ground has been tested, but the results of the test or tests have not been made known to the public. Opinions differ as to the probable yield of the blue ground. It is claimed that the yield of the blue ground is very poor and disappointing. In the report of the Government Mining Engineer of the Transvaal, for the year ending June 30, 1903, it is stated that “a considerable concentrating action appears to have taken place on most of the diamond mines in the Pretoria District, the soil near the surface often being very rich in diamonds. I am not aware, however, that any instance has been recorded where the blue ground has been proved payable.” The nature of these deposits or concentrations is peculiar. If the ground in which the diamonds are found were the result of the slow disintegration of the pipe itself, which is directly underneath the alluvial, one would expect to find the ground lying upon the yellow or the blue ground the richest in diamonds. In the case of the (Transvaal) Premier Mine the rich concentrate is on top, and a much poorer layer of yellow clay containing boulders and broken rock lies upon the blue ground. One might argue, therefore, that the
rich deposit is a wash from another source, and that the diamonds contained therein are due to the concentrating action of ages and may have no connection whatever with the underlying rock. It does not follow that rich alluvial diamond diggings betoken rich diamond-bearing pipes.

It has been shown that the top layer of clayey red earth in the (Transvaal) Premier Mine is rich in diamonds, that the yellow earth below it is comparatively poor, and that the yield of the blue ground is either unknown, or if known to those interested, has not been made public. The yield of the Premier Mine is said to be phenomenal, but a study of the published figures will show that the method adopted for calculating the yield of the ground is unique in South African diamond mining. At Kimberley practically all the top ground from De Beers Premier Mine was sent to the washing machines and the total yield of diamonds was divided by the total number of loads sent to the machines. In the Pretoria District, it is authentically reported that the ground is first sorted in the mine before being loaded and a very considerable portion of the ground is rejected. This is quite the proper course to pursue, for it would be useless to wash stones and waste. The good ground is then loaded into trucks and sent to the washing machines. The ground which passes through the one and a half inch mesh of the cylinder screens goes into the pans; the remaining portion, consisting of coarse lumps and clay, is rejected. The yield of the ground is based upon the results of the fine ground only. By this means of calculating, the yield per load of original ground is doubled or trebled. Mention is made of this so that the reader may see how results of yield are obtained in different localities.

### DIAMOND PRODUCTION IN THE TRANSVAAL DURING THE YEAR 1903

<table>
<thead>
<tr>
<th>Month</th>
<th>Carats won</th>
<th>Value £</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1,060.50</td>
<td>1,703</td>
</tr>
<tr>
<td>February</td>
<td>1,485.00</td>
<td>1,932</td>
</tr>
<tr>
<td>March</td>
<td>1,319.31</td>
<td>1,788</td>
</tr>
<tr>
<td>April</td>
<td>1,695.13</td>
<td>2,172</td>
</tr>
<tr>
<td>May</td>
<td>11,523.25</td>
<td>14,743</td>
</tr>
<tr>
<td>June</td>
<td>15,424.88</td>
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</tr>
<tr>
<td>July</td>
<td>16,792.75</td>
<td>23,667</td>
</tr>
<tr>
<td>August</td>
<td>16,750.75</td>
<td>22,769</td>
</tr>
<tr>
<td>September</td>
<td>20,331.50</td>
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</tr>
<tr>
<td>October</td>
<td>28,783.63</td>
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</tr>
<tr>
<td>November</td>
<td>29,631.00</td>
<td>39,841</td>
</tr>
<tr>
<td>December</td>
<td>26,484.75</td>
<td></td>
</tr>
</tbody>
</table>
The average value of the diamonds per carat for eleven months was 27s. 4d. The quality of the diamonds in the Pretoria District is poor, the percentage of bort and rubbish being abnormally great. Valued on the same basis, diamonds from the Pretoria District are worth only about 54 per cent of those from De Beers and Kimberley Mines.

Professor Molengraaff considers the formation a true diamond-bearing breccia of igneous origin, though he reports that "there is no typical yellow or blue ground"; but he says "this is easily explained partly by the difference in mineralogical composition between the Elandsfontein (Transvaal) Premier rock and the true Kimberlite and partly by the numerous fragments of foreign rocks derived from the walls surrounding the diamond pipes." He further states that the diamonds come "from a peridotitic rock" which "is somewhat different from typical Kimberlite." In other words the rock in which the Transvaal diamonds are found resembles the blue ground of Kimberley, but is of quite a different nature.
GLOSSARY

Assagai . . . . . . A spear or javelin used by South African natives.
Berg . . . . . . . . A mountain.
Biltong . . . . . Dried venison.
Blind Klippe . . . Bright stones.
Boer . . . . . . . . An emigrant farmer or countryman residing in the Dutch republics.
Boys . . . . . . . . All native workmen are called boys.
Burg . . . . . . . . A village or town.
Commando . . . . A small military force.
Drift . . . . . . . . A ford of a river.
Fontein . . . . . . A spring of water or fountain.
Groote or Groot . . Great or large.
Impi . . . . . . . . A regiment of native warriors.
Karroo . . . . . . Dry table-land of South Africa covered with the Karroo bush.
Kaross . . . . . . A robe made of the skins of animals, with the hair on, tanned by natives and sewn together with sinew.
Kloof . . . . . . . A ravine or cañon.
Kopje (pronounced koppie) . A small hill.
Kraal . . . . . . . . A group of native huts. An enclosure for the safe keeping of cattle and sheep; a corral.
Laager . . . . . An encampment.
Modder . . . . . Mud or muddy.
Pan . . . . . . . . A small lake or pond, with no outlet.
Pont . . . . . . . . A ferry-boat.
Poort . . . . . . . A short passage between hills or mountains.
Riem . . . . . . . A thong of rawhide made soft by rubbing with grease.
Spitz Kopje . . . A pointed hill.
Spoor . . . . . . . The track left by animals or wagons.
Spruit . . . . . . . A small stream or brook.
Taal . . . . . . . . The South African Dutch patois.
Trek . . . . . . . . To travel or migrate.
Trekbok . . . . . South African antelope, which migrate in thousands, seeking food.
Trektouw . . . . . A rawhide rope to which oxen are fastened for drawing a wagon.
Tronk . . . . . . . Jail or police station.
Tsetse . . . . . . . A fly which follows the big game, especially the buffalo. Its sting is deadly to all domestic animals, but not to man.
Veld (pronounced felt) . Grass pasture land, often erroneously written veldt.
Vlei . . . . . . . . . Swampy ground or a small pond which contains water during the rainy season.
Voetgangers . . . . Name given to young locusts migrating before their wings have grown.
Voortrekkers . . . . Pioneers or Boers who first settled in the interior of South Africa.
Vrouw . . . . . . . A wife, a woman.
Witte Bergen . . . . White Mountains.
Zeeke-Vlei . . . . . Sea-cow (hippopotamus) hole.
Zwarte Bergen . . . . Black Mountains.
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