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## Placer Mining in the Klondike

The Unusual Conditions Prevailing in the District Have Produced Many Interesting New Methods. Costs of Mining are Steadily Falling

BY JOSEPH B. TYRRELL\*

In the summer of 1896, marvelously rich gold-bearing gravels were discovered in the extreme northwestern corner of the Dominion of Canada, almost under the Arctic circle. The region in which the discoveries were made was very remote from the nearest city or center of civilization, and was practically isolated for the greater part of the year, and although vague rumors of a rich gold strike filtered to the outside world during the following winter, it was not until the summer of 1897, when the steamer from

varies of the Yukon river and other alluvial mines in countries farther south. The gravel was frozen into a solid mass, and remained frozen summer and winter alike, and at the same time it was almost everywhere covered by a layer, from 2 ft. to as much as 100 ft. in depth, of vegetable mold or "muck," which was also frozen into a solid mass. The gravel had to be first thawed, and the development of the most economical methods of thawing had been a dominant factor in profitable mining in the Klondike.

vogue, depending on whether the claims were worked by a pit or a "cut" open to the surface, or by a shaft or shafts and tunnels or chambers underground.

### GROUND SLUICES

The first method, usually known as "ground sluicing and shoveling in," involved expensive preparation before the pay-dirt could be reached. A narrow ditch was dug in the muck lengthwise of the claim, and a part or the whole of the water of the adjoining brook was turned



VALLEY OF INDIAN RIVER—THE BANK SHOWS THICKNESS OF MUCK

the mouth of the Yukon river, bearing its load of gold, tied up to the wharf in the city of Seattle, that the world learned that a great new gold-bearing country had been discovered in the north.

The miners who reached the golden Klondike, and secured mining claims there, found themselves surrounded by conditions to which most of them were entire strangers. As in other placer camps, the native gold was lying free in the alluvial gravel, and consequently the mining properties were classed as "placer mines," but there was a very vital difference between these mines on the tribu-

Note—From a paper entitled, the "Development of Placer Gold Mining in the Klondike," read before the Institution of Mining Engineers, London, with photographs contributed by the author.

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For a time imagination and inventive genius seemed to run wild throughout the camp, and almost every claim had its own peculiar methods of procedure. The more important methods that have survived have been described and illustrated by C. W. Purington in his report on "Methods and Costs of Gravel and Placer Mining in Alaska," published by the United States Geological Survey.

For two years, after gold was discovered by George Carmack on the banks of Bonanza creek, mining was almost exclusively confined to the gravel deposits in the bottoms of the valleys, and was performed entirely by hand, with the assistance of such simple implements as the pick, shovel, wheel-barrow and windlass. Two general methods of mining were in

into the ditch by a wing-dam. The water rapidly deepened the ditch to the level of the bottom of the muck, or the top of the underlying gravel, and men were set to pick down the muck and ice from the sides of the ditch into the running water below, by which it was in part dissolved and in part carried away down the stream. As the ditch was thus widened, the water was kept flowing against one side by little dams, and in this way an area, from 100 to 200 ft. in length and 50 ft. or more in width, was freed from its covering of muck, and the underlying sand and gravel were laid bare to be thawed by the sun and warm winds and rain of the remainder of that summer or of the following summer.

Of the gravel so exposed, the upper portion usually contained so little gold

that it was of no value. It was, therefore, shoveled into wheel-barrows, and wheeled away and dumped to one side, all the ground being removed until the gold-bearing layer near the bed-rock was reached. A dam was then built in the stream some distance above the area of uncovered gravel, which, being now lower than the surrounding part of the bottom of the valley, or than the bed of the

in horizontal dimensions, was picked down through the frozen muck to the sand or gravel. As a rule, the muck flakes off easily, and much of it is so free from grit that it will not even blunt the point of the pick. As soon as the shaft was sunk to the gravel, a fire was built in the bottom of it, and after this fire had burned out, and the gases arising therefrom had risen to the surface, the gravel that had been

When bed-rock was reached, fires were built against the face of the gravel, green timber being piled on the dry wood to keep down the heat as much as possible, and the gravel and bed-rock were hoisted to the surface as before and piled up in a dump. During the following spring, when the water was flowing in the adjoining creek, it was diverted into sluice-boxes and led past the dump (the surface of which, as it was thawed by the sun and atmospheric agencies, was scraped off and shoveled into the water in the boxes, the rate at which this pay-dirt could be handled being determined by the rapidity with which the dump thawed.

Exact accounts were rarely kept in the Klondike in those days, except by the banks, so that it is difficult to determine the precise cost of much of the mining that was then done, but it is safe to say that it varied from £2 to £5 (\$10 up to \$25) and more to the cubic yard.

Such underground mining, with the help of wood fires, could only be carried on in winter, for at that time of year the air in the drifts, though at freezing point, was much warmer and lighter than the air above, which was probably 50 deg. F. lower in temperature, and the noxious gases formed by the fires would quickly rise to the surface and be dissipated.

But the miners were determined, if possible, to prospect and work their claims whether the season was summer or winter, and after a number had been overcome



GIANT IN ACTION, ADAMS HILL

stream itself, was known as the cut, and a flume was built from this dam to sluice-boxes, which were strung on a proper grade across the top of the cut. Water was turned into the flume and sluice-boxes, and the pay-dirt was then shoveled, usually in two stages, from the bottom of the cut into the sluice-boxes.

This shoveling-in was a slow and expensive process, for wages were uniformly 6s. (\$1.50) an hour. An average gang of six men, working in a cut, and shoveling dirt into sluice-boxes in two stages, would thus handle 15 to 20 cu.yd. in a day of 10 hours, making the cost of handling the pay-dirt alone from £1 4s. to 18s. (\$6 to \$4.50 a cu.yd.). In some of the richest mines this tremendous expense was a trifling matter compared to the great value of the output. For example, a clean-up was seen at one mine, after a force of six or eight men had been working for three shifts of 10 hours each, the yield being eight gold pans full of clean gold. The owner, at the time, was obliged by law to pay a royalty of 10 per cent. of this gross output, and the return made by him of the value of this clean-up was £9000 (\$45,000).

#### DRIFTING

The other method of mining in vogue at that time, chiefly on claims where the muck and underlying barren gravel were deep, was conducted as follows: In the winter season, a shaft, about 3x6 ft.



CLEAN-UP, ADAMS HILL

thawed by the fire, extending probably to a depth of from 12 to 18 in., was dug out and hoisted to the surface with a bucket and hand-windlass. Another fire was then built in the bottom of the shaft, the gravel being afterward removed as before, and so the work went on until bed-rock was reached. One and sometimes two fires were lit in a shaft each day.

and killed by gas the following plan was adopted: A shaft was picked down through the frozen muck to the gravel as before, and then a big fire was built on the surface close to the top of the shaft in which a number of large rocks were heated. These were then thrown to the bottom of the shaft and covered with moss or brush. Next day, the moss, brush and

rocks, now cool, were hoisted to the surface with a windlass and as much of the gravel as the hot rocks had thawed was also dug up and hoisted, after which hot rocks were again thrown down the shaft and the process was repeated until the bed-rock was reached.

Such were the methods of mining practised in the Klondike in 1897 and 1898, and such are still the only methods available in remote districts to which machinery cannot be transported.

**STEAM THAWING PLANT**

But men soon began to recognize that while shallow ground might still be worked by hand with a possibility of profit, deep ground, which must necessarily be undermined, must be thawed in some other way than by wood fires or hot rocks if it was to be mined quickly and cheaply, and that the great majority of the mining claims in the country were underlain by deep ground.

Many plans were suggested and tried, but, so far as the writer is aware, John McGillivray, a mining engineer from San Francisco, California, was the first to adopt the method which has since come into very general use. In the winter or spring of 1899, he took a small steam-boiler to a mining claim on Sulphur creek, and there began thawing the frozen gravel by steam, the method adopted being about as follows: The shaft was picked down through the muck, and near it the boiler was set up on the surface. A

"point," which was then pushed into the gravel to its full extent, and allowed to remain there for several hours, during which time steam was supplied from the boiler to the tip of the point penetrating into the gravel.

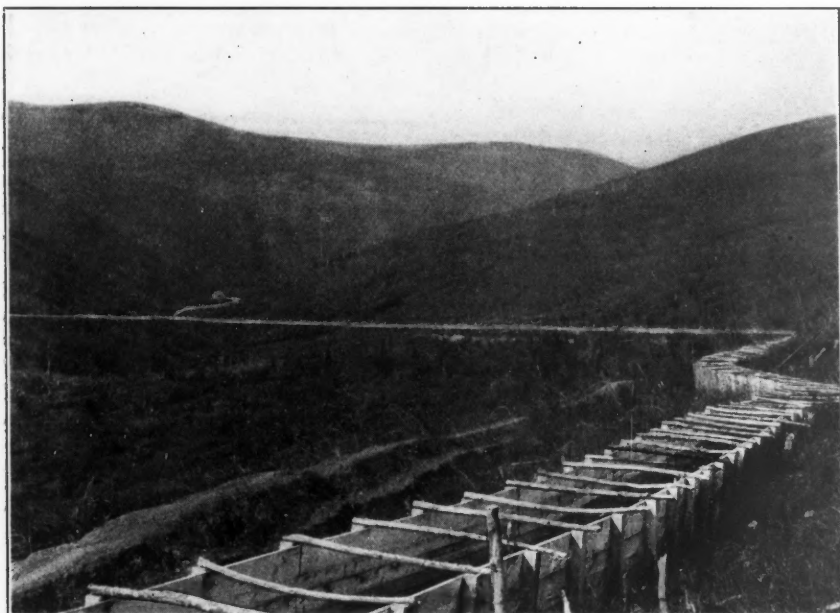
From this little boiler has developed the efficient steam thawing plant in use at the present day, in so many of the placer mines of the Yukon Territory and Alaska:

the gravel or bed-rock with a heavy mallet, the steam being kept up to a pressure of 80 or 100 lb. per sq.in., so that there may be no danger of pebbles or chips of rock wedging in the hole at the tip.

There are many occasions on which the steam thawer is now used, other than for extracting the frost from the pay-dirt in the drifts. Shafts are sunk with it, either by driving short points vertically into the



DRILLING IN WINTER, INDIAN RIVER



FLUME FROM ADAMS CREEK

small iron pipe was connected to the boiler and run down to the bottom of the shaft, where it was connected by an india-rubber hose to a loose piece of 1/2-in. pipe pinched in at the point. Steam was raised in the boiler to a pressure of 20 or 30 lb. per square inch, a valve which had been set in the pipe was opened, and steam was let into the loose pipe, known as the

It consists of a boiler of 25 to 50 h.p., not too heavy, iron piping, the steam hose, and points, 5 ft. or more in length, made of double-thickness hydraulic steel pipe, with a tip of very hard steel in the end of which is a hole 1/4 in. in diameter, and a heavy steel head into the side of which is welded a hollow nipple on which the steam hose may be clamped. This point is driven into

ground and digging out the thawed dirt from time to time, or by driving a long point, from 20 to 30 ft. long, vertically down through the muck and gravel to bed-rock, steaming it for a day or two, and then digging out the whole of the thawed dirt at once, making a circular shaft. The dumps of pay-dirt extracted during the winter, and again frozen hard, are thawed in order to enable the miners to make full use of the heavy rush of water in the spring to wash the gold from the gravel. The uncovered gravel in the open cuts is thawed in order to hasten the work in summer, or to prolong the mining into the autumn, etc.

**PUMPS**

In a number of mines, pulsometers are used underground to thaw and break down the face of the gravel in the drifts, the water in the sump being pumped over and over again against the face of the gravel, breaking it down and washing it back a short distance, the process being assisted by a man with a rake, the water being gradually heated by the absorption of the steam into it. In other mines, a similar result is attained by pumping the water with a duplex pump from the sump against the face of the gravel, the water being first slightly heated by steam direct from the steam pipe.

**DAWSON CARRIER**

The final and greatest improvement in the mechanical moving of the pay-dirt was

accomplished by the invention of the self-dumping cable-tram, or "Dawson carrier," carrying a bucket with a capacity of from 9 to 11 cu.ft. By its means one man at the hoisting engine can raise from the shaft, and either pile up in a conical dump, or empty into a sluice-box, as much dirt as eight or ten miners underground can pick down and wheel to the hoisting bucket.

By its assistance, the pay-dirt in solidly frozen ground can be mined from tunnels and drifts, hoisted and sluiced for about 12s. (\$3) a cu.yd., with wages at

time, and while a small quantity of water is allowed to flow through the boxes, the gold is carefully separated with wooden paddles and brushes from the gravel, which was caught with it in the riffles.

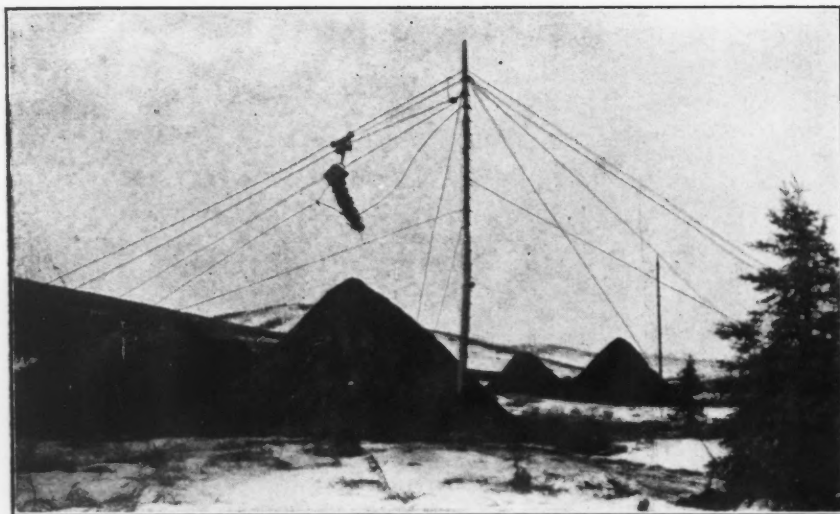
#### REMOVAL OF BARRENS

The modifications of the methods of open cutting and ground sluicing adopted in 1897 and 1898 have been usually on well known engineering lines, and have not exhibited the same originality as that evinced in the underground mining methods. Stripping the muck from the gravel

and legitimate extent, by using water under natural pressure for this work. The water can readily be obtained at sufficient elevation from tributaries of the main streams, and undoubtedly, before long, the only method of stripping that will be recognized as economical and rational will be by the use of such water delivered under pressure from an hydraulic giant.

#### REMOVAL OF PAY-DIRT

After the barren gravel was removed, the pay-dirt was either shoveled into sluice-boxes set in the bottom of the cut, the water used being afterward raised by a centrifugal pump to the general surface level; or the sluice-boxes were set over the cut, and the pay-dirt was shoveled, usually in two stages, into them; or the sluice-boxes were set above and to one side of the cut, and the pay-dirt was shoveled into wheel-barrows and then wheeled and emptied into a car which was hauled up an incline and its load tipped into the sluice-box; or it was wheeled to a bucket which was hoisted by a swinging derrick; or it was wheeled to and emptied on an india-rubber belt conveyer, which discharged into the sluice-box; or it was wheeled to a bucket which was hoisted by the Dawson self-dumping cable carrier and emptied into the sluice-box. The latter is now much the most common method of conveying the pay-dirt from the mine to the sluice-boxes.

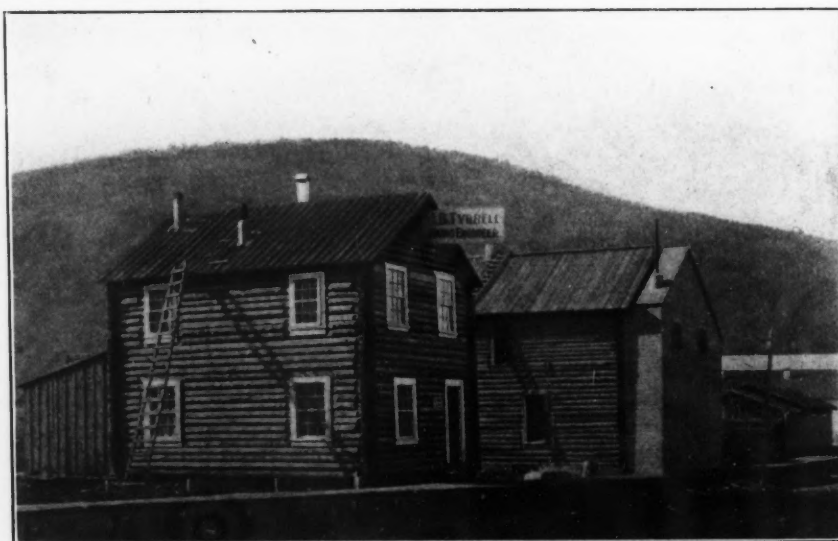


DUMPS OF PAY DIRT ON GOLD RUN CREEK

£1 4s. (\$6) a day of 10 hours, and dry spruce wood for fuel at £2 (\$10) a cord.

#### GOLD-WASHING PLANT

The gold-washing and separating apparatus in use in the Klondike has remained practically unchanged throughout the life of the camp. Leaving the "rocker" out of consideration, it consists of a string of sluice-boxes, each 12 ft. long, and 12 or 14 in. wide at the upper end, and 2 in. narrower at the lower end. These boxes are placed so that the small end of one box just slips into the large end of the one below it, and are supported and braced so as to have a grade of from 6 to 9 in. to each box. In the middle of the string, there is usually one box much larger than the others, called a "dump-box," in which a man stands with a heavy "sluice-fork," to stir the gravel and throw out any rocks too large to run easily through the smaller boxes. In the bottoms of all these boxes, small rounded poles, called "riffles," are laid lengthwise, and are fastened together by short transverse strips every 6 ft. Water varying in quantity from 250 to 700 gal. a minute is turned into and allowed to flow through the sluice-boxes, and as the pay-dirt is shoveled or emptied into them, it is carried along by the water, and the gold settles to the bottom and is caught between the riffles, while the gravel and sand is discharged from the lowest box at the tail of the sluice. The riffles are raised and taken out from time to



ONE OF THE OLDEST HOUSES IN DAWSON

is still generally accomplished by diverting the stream into a number of new channels, and picking down the banks. In one instance, the muck was stripped off very successfully by using a force-pump, and directing a stream of water from a small nozzle upon it. In this way, the light vegetable material was washed down into the stream as fast as it thawed, and the whole body of muck was quickly removed. But no one seems to have carried this method of removing muck to its full

#### HILL-SIDE CLAIMS

Comparatively early in the history of the camp, it was recognized that there were gravels rich in gold lying above, and often high above, the present bottoms of the valleys. These were at first attacked with rockers, the water in many instances being carried up several hundred feet in pails from the creek below. The owner of one of the richer of these claims would often have from six to ten men with rockers working for him, but on account of

the great expense of such work no attempts were made to mine ground that would yield less than £3 to £4 (\$15 or \$20) to the cu.yd.

After the narrow belts or rich and shallow ground along the edges of the benches or terraces had thus been shoveled off and washed in rockers, the miners began to run adits into the hills along the top of the bed-rock, and to bring out the pay-dirt to the "rim" to be washed in a rocker. But this process of mining and hand-washing proved entirely too slow and expensive; so the pay-dirt was mined and brought out to the mouths of the adits, where it was piled up for a time, and was then either run in a chute down the hill to a sluice set near the creek, and supplied with water from it, or in the event of its not being possible to dump tailings on the creek claim, a pump was installed, and water was pumped up the hill and allowed to run down again through the sluice-boxes, being often used two or three times over by different parties in its descent.

At a still later date, ditches, sometimes several miles in length, were dug to bring water from tributary streams at a sufficiently high elevation to wash these dumps of pay-dirt from the benches.

The methods of mining adopted on this terrace, or so called "hill-side" claims, were for the most part very similar in character to those used in underground mining in the creek claims. An adit was run along the top of the bed-rock to the rear boundary of the claim, or as far as pay-gravel could be found, and drifts were driven at regular intervals at right angles to it. The intermediate pillars were then taken out, a certain amount of timbering being usually necessary to support the roof while the pay-gravel from these pillars was being recovered. In most of these mines, the ground was frozen and had to be thawed with steam points; but in some cases, generally where the overburden of barren gravel was more than 200 ft. thick, the ground was not frozen. In some instances, however, the claim which the miner desired to work did not extend to the rim, so that it could not be worked from an adit, and in that case



BLOCK RIFFLES, ADAMS HILL

it was necessary to sink a shaft and mine in the same manner as in the bottom of the valley, the chief differences being that the shaft was usually deeper, and the expense of obtaining water for washing the gravel was very much greater.

In other instances, after the value of the gravel in these bench deposits had been proved by tunneling, water was pumped up from the creek in the bottom of the adjoining valley to heights of from 50 to 100 ft. above the level of this gravel, and was then delivered against it through hydraulic giants, thus washing it off the rocky bench on which it lay, the water with its load of gravel being directed in its flow through cuts in the bed-rock, and then through sluice-boxes. The enormous expense of installing such a pumping plant in a region so remote and difficult of

access, and the great cost of fuel after the plant had been installed, soon proved that such a method of mining was too expensive, even for the very rich ground that was being operated upon; but it also proved that hydraulic methods of mining were quite feasible in the Klondike, and that the frost in the ground was no bar to the employment of such methods.

DITCHES

Attention was then turned to the problem of obtaining a supply of water by gravity sufficient to enable the miners to carry on effective hydraulic operations on these benches. Most of the ditching accomplished up to the present time has been erratic and disjointed, and has supplied water to the hydraulic giants for but a few weeks in each season; but this correct principle has been recognized, that the proper supply of water is the run-off from the adjoining higher country, and that the most economical way of obtaining water is by collecting this run-off and storing it in reservoirs in the gulches, from which it can be drawn when required.

The average annual precipitation in the Klondike region is between 10 and 12 in., about 4 in. of this being in the form of snow. Experience has shown that about three-quarters of the snow on the ground in March, and about one-half the rainfall can be figured on as run-off, or, say, in all about 6 in. in the year, equal to 13,939,200 cu.ft. of water to each square mile of catchment-area, or 6452 twenty-four-hour miner's inches of water. With a duty of 5 cu.yd. to the miner's inch, which is rather below the average so far attained in that country, this quantity of water will wash down 32,260 cu.yd. of gravel.

The area of the watershed of Bonanza creek is roughly 90 square miles, two-thirds of which, or 60 square miles, is well above the level of the highest of the bench deposits, and the run-off from this extensive tract, if caught and fully utilized, would thus be sufficient to hydraulic away nearly 2,000,000 cu.yd. of gravel. If to this were added the run-off from 40 square miles of hills drained to the Yukon river, which could readily be brought round into the valley of Bonanza creek at



A SMALL HYDRAULIC INSTALLATION

a considerable elevation, the total quantity of water so made available would be sufficient to wash down more than 3,000,000 cu.yd. of gravel each year.

#### DREDGING

One other plan of gravel-mining on a large scale, dredging, is only applicable to the low-lying alluvial deposits in the bottoms of the valleys. There are now five dredges in the Klondike, all built on the ladder-and-bucket principle, and more are being installed. They handle all the gravel, and, if properly managed, save very nearly all the gold, at a very much lower cost than the material can be handled in any other way, except with a hydraulic giant, where there is abundance of water and dumping ground. They are under the disadvantage, however, of not being able to work in frozen ground. In one case, this difficulty was overcome by thawing the ground with long steam-pipes in front of the dredge, but this added enormously to the cost of the work, and practically excluded the possibility of mining very much of such low-grade ground as would pay handsome profits elsewhere. The absence of large boulders makes the gravel very easy to move with a dredge when it is free from frost, and the air will quickly take the frost out of the gravel, if the muck which almost everywhere covers it is removed.

The cost of alluvial mining in the Klondike has gradually decreased from the time of the discovery of the camp ten years ago until now, and mining claims that were once valueless have two or three years afterward, with improved methods of mining, yielded fortunes to their owners. He would be a rash man indeed who would say that even the best methods of placer mining now in use cannot be improved upon, and it is not improbable that ten years hence, when the enormous cost of the mining of the past few years has been forgotten, and when methods of handling gravel are still further improved upon, men will wonder that miners could have ever passed over and neglected such rich gold-bearing deposits as are now lying unworked in the Klondike.

### Origin of the Nickel Ore Deposits of the Black Forest

By A. W. G. BLEECK\*

In the south of the Black Forest, in the grand duchy of Baden, two occurrences of pyrrhotite with 12 per cent. of nickel were formerly worked, one near the village of Horbach, the other at Totmoos. As the demand for nickel has grown considerably and prices are very high, both deposits have attracted especial notice of late, and E. Notton, of Cologne, has promoted a company which will shortly begin mining operations. The ore seems to

\*Mining engineer, Ballygunge, Calcutta, India.

occur over a wide area and mining ought to pay well.

E. Weinschenk, professor of practical geology at the Ludwig-Maximilian University of Munich, and the writer were recently called upon to report on the ore and its mode of occurrence. The result of these investigations will shortly be published by E. Weinschenk in a detailed treatise—a treatise which will command considerable interest, as similar deposits of pyrrhotite occur near Sudbury, Canada, and at Roeros, Norway, which are being worked with considerable profit. The similarity of all these occurrences is so marked that the explanation given by E. Weinschenk on the geological origin of the deposits may undoubtedly be applied to all and will be welcomed as the most satisfactory one yet published.

#### NATURE OF THE DEPOSITS

The ore, the so called horbachite, together with flakes of copper pyrites, is disseminated in a norite or occurs in real veins and pockets of various sizes in the same rock. The norite has been penetrated from all sides by a multitude of veins of pegmatite, aplite and granite and forms irregular masses of various sizes embedded in the granite.

Evidently these masses of older eruptive rock were torn from their original positions by a later intrusion of granite, the molten magma closing round them. It will be readily understood that these detached portions of norite show a highly altered condition, owing to contact-metamorphism. E. Weinschenk has made a careful study of the altered rocks and gives a detailed description in his treatise.

#### GENESIS OF THE ORE

On examining the granite with the microscope, pyrrhotite in various quantities was found disseminated through it. Pieces of granite taken from near the contact with the norite showed a considerable amount of ore; others taken from various places contained but few grains.

Evidently the ore formed part of the granitic magma. Before or during the eruption a differentiation within the magma itself took place, the greater part of the ore being separated from the granitic matter. After the intrusion of the granite, but before the aplites and pegmatites forced their way through, the ore invaded the all but solidified granite and filled up the fissures in the norite.

There can be no doubt as to the molten state of the ore at this time. The component minerals of both granite and norite show unmistakable signs of magmatic corrosion by the ore. The latter seems to be most closely disseminated in the norite wherever conversion of pyroxene into uraltite has taken place, in other words, wherever the norite has been altered by contact-metamorphism.

It is remarkable that such large quantities of ore should have concentrated round the masses of basic eruptive rock.

There can only be one explanation of this phenomenon. These rocks are very ferruginous, containing such accessory minerals as ilmenite and magnetite in considerable quantities. It is quite possible, therefore, that the local concentration of the pyrrhotite around the norite was brought about by magnetic currents which were excited in and around the detached portions of norite by the intrusive masses.

#### PRACTICAL CONCLUSIONS

The practical conclusions to be drawn from this investigation are, in short: when working on an ore deposit of the Horbach type, the ore should be looked for around and in the basic eruptive rock, more especially in the areola of the contact between granite and this rock.

### Mining in Chile

Consul A. A. Winslow reports from Valparaiso that the mining interests of Chile are very extensive and are growing rapidly.

This is especially true in the extreme southern part, where about \$400,000 worth of American mining machinery, in the shape of dredges and steam shovels, is employed in extensive placer mines. Many of the claims are rich, and the deposits cover a strip of country 50 by 150 miles, extending over into Argentina and to and upon the island of Tierra del Fuego. This country is rich in copper deposits, which are just beginning to be developed, and the future of this part of the republic seems particularly promising, since extensive deposits of lignite are found in close proximity to both the copper and gold deposits. In one case the bed of lignite was found to be 15 ft. thick. Punta Arenas is the center of this mining country, and is growing very rapidly. It now has a population of about 10,000, a gain of about 3000 during the past year.

### Metal Production of Wyoming

According to the preliminary report of the State Geologist of Wyoming the production of metals for the years 1905 and 1906 was as follows:

	1905	1906
Copper, pounds.....	2,420,629	50,000
Gold, value.....	\$23,100	\$25,000
Silver, ounces.....	2,700	2,000
Iron, tons.....	534,879	600,000

The falling off in copper production in 1906 was due to the burning of the reduction works of the Penn-Wyoming Copper Company at Encampment in March, 1906 (this being the only producing plant in the State at the present time), the amount given being returns from test shipments from various properties. Repairs are in active progress and the smelting department will be blown in in January, 1907, and an active campaign inaugurated for next year.

Several other mills are seriously considered and it is confidently believed that this year touched the low-water mark and now begins a steady yearly increase.

# The Mineral Industry of Brazil

The Government is Seeking Means to Increase Interest in Mining.  
Gold, Manganese Ore and Diamonds Now Constitute Chief Products

BY M. ARRAJADO R. LISBOA\*

Brazil has been known as a country of varied and abundant mineral resources since its discovery. The country was opened and explored by adventurers seeking mineral wealth, and for some centuries it was Brazil that provided Europe with the greater part of its gold and diamonds. Many and complex causes have prevented the extraordinary activity of the early colonial times from developing into an important mineral industry.

The question of the development of the industry has recently been discussed in the Brazilian Parliament. Deputy Pandiá Calogeras presented a bill for the establishment of a new mining law and an exhaustive study of the mineral industry of the country.<sup>1</sup> This work is a source

The state of Minas has been the center of the gold-industry activity in the country. Gold here appears in alluvial deposits or in several types of veins and rocks.

At Campanha and S. Gonçalo, districts of southern Minas-Geraes, gold occurs in gneiss. Some veins of the district of Ouro-Preto, having the appearance of ordinary quartz veins, are considered by Dr. Hussak as auriferous granitic apophyses. The same type of auriferous lode is found at Diamantina (S. Joao da Chapada, Bandeirinha). At Gongo-Socco, Maquiné, etc., gold occurs in a soft hematitic quartz schist (micaceous iron ore) named locally *jacutinga*. The auriferous *jacutinga* of Candonga, at S.

tion of the company. The dividends between 1842 and 1867 were at the rate of 25 per cent., the capital being £135,000. Between 1875 and 1881, after the first disaster, dividends amounting to 30 per cent. per annum were declared. After the reopening of the mine in 1886 dividends were declared varying between 10 and 5 per cent. per annum. The capital of the company now is £646,000.

Other companies such as the Ouro-Preto Gold Mines of Brazil and Sao Bento Gold Estates explore auriferous veins of different characters with less satisfactory results. The gold-dredging industry is beginning to attract attention. In Matto-Grosso a dredge is working on the river Coxipo with profit. In Minas at present there are two dredges at work on the Rio das Mortes and Ribeirao do Carmo. The impulse that the industry may gain in the country depends largely upon the result of these operations.

The Guiana placers have furnished great quantities of gold, but lately the production has fallen off.

## DIAMONDS AND CARBONS

With the discovery of diamonds in South Africa and the development of the industry in that region diamond mining in Brazil has suffered greatly and has been almost paralyzed. The Brazilian diamond is recognized as superior to the South Africa product. As yet, the matrix of the mineral has not been encountered. In central Brazil it occurs in ancient conglomerates.

The diamantiferous district is very large. It extends from Matto-Grosso to Bahia, crossing the states of Goyaz and Minas-Geraes, which is the principal center of the industry. A French company until recently explored the Boa-Vista mines, near Diamantina, and at present an English company operates the Agua-Suja mines, Bagagem, but operations are still in the installation stage.

Lately several diamond-dredging claims of Brazil, on the river Jequitinhonha, the diamantiferous river, have been examined by American companies. On the river Coxipo, in Matto-Grosso, many diamonds have been gathered with the gold, and with appropriate plant, diamond dredging may offer very satisfactory results, when competently directed.

Carbons exist in the diamantiferous district of Bahia, named Chapada Diamantina. There is no systematic exploration, the diamonds being found by the *garimpeiros*, or washers, who employ primitive



WASHING DIAMOND GRAVEL AT AGUA FRIAS

of information which will be of advantage to all those interested in the mineral industry of Brazil.

## GOLD

The most important auriferous region in Brazil extends from Bahia to Goyaz, occupying an enormous area of the state of Minas-Geraes. Auriferous districts of more or less importance exist also in the States of Matto-Grosso, Rio Grande, S. Paulo, Paraná, Ceará Pará, and Maranhao and in Brazilian Guiana.

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<sup>1</sup>Joao Pandiá Calogeras, "As minas do Brasil e sua legislação."

Miguel de Guanhaes, is considered by Dr. Hussak to be characteristic contact-metamorphic, auriferous deposit. At Morro-Velho gold occurs in lode of sulphides and carbonates. The S. Joao del Rey Gold Mining Company, which works this lode, is the most important mining enterprise in the country.

The Morro-Velho mine has been worked since colonial times. Exploration by the present English company began in 1834, and is, therefore, the oldest gold mine in actual operation in the world. It experienced two great disasters, each of which necessitated the complete abandonment of the workings and a financial reorganiza-

processes. Carbons being of comparatively high value, their presence in the diamondiferous alluvials of Bahia with the diamond has given an added importance to these deposits during the last few years.

#### MANGANESE

The manganese industry is a new one which has recently taken great strides. As there is not in the country a metallurgical industry, all the ore is exported to Europe and North America.

The principal exportation centers are in Minas-Geraes and Bahia, but the industry in this last State still awaits development. In Minas there are two districts. That of Burnier, located 500 km. from the sea by railway, contains manganese deposits included in the metamorphic rocks and associated with limestones and iron ores. The ore exported yields from 50 to 55 per cent. metallic manganese, and contains from 10 to 20 per cent. water. It is comparatively free from phosphorus.

The Lafayette district has an ore of a different nature; it appears in fissure veins and has been formed by the decomposition and leaching of a rock containing manganiferous garnets. The ore exported gives from 49 to 51 per cent. metallic manganese, 3 per cent. silica and 0.08 phosphorus.

In Burnier the manganese deposits are worked by underground operations. Timbered levels are driven into the ore. In the Lafayette district the workings are open-cast. Morro da Mina at Lafayette and Uzina Wigg at Burnier are the two most important manganese mining properties of the country, both worked by native capital. Besides these there are explorations in Piquiry, now exhausted, and at S. Gonçalo. Other installations are being made at Entre Rios, all in the district of Lafayette.

A large manganese ore deposit was prospected in Matto-Grosso, near the Bolivian frontier, by the same firm that explored the Piquiry mine. This deposit is situated some miles from the river Paraguay and offers favorable working and transportation conditions. An exploration will enable one to form an opinion as to the importance of the deposit and the real value of the ore. There are said to be many millions of tons in sight.

#### IRON

Iron deposits are abundant in Brazil. Oxides of iron constitute one of the common derivative in the metamorphic grounds of Minas, Bahia, Goyaz and Matto-Grosso, and there is no doubt that these deposits constitute one of the greatest iron-ore reserves in the whole world.

For lack of mineral fuel the iron industry is not developed. Iron is manufactured by direct methods in a small way in the interior of the country, but there is only one blast furnace in the country, producing from 2 to 5 tons of pig iron daily with charcoal fuel. When the manufac-

ture of iron by electricity becomes an economic reality, no country in the world will offer more advantageous conditions for the development of the industry, not only because of the abundance and superior qualities of the ores, but also because of the available sources of hydraulic power.

Kilburn Scott is of the opinion that Brazilian iron ores could be exported to England and the United States at a profit, providing mining were done on a large scale and the handling of the ore were carried out in the economical way which obtains in the Lake Superior region.

#### COAL

A considerable area in the south of Brazil, and limited areas in the north and west, are covered by Permian rocks containing coal beds. For many years the occurrence of coal in the south has been known and more than one exploration has been attempted, but without important results. Lately, by the initiative of the minister of industry, Dr. Lauro Muller, the attention of the government has been called to this industry and an American expert, I. C. White, has been engaged to study the subject. The results thus far have been promising.

Professor White studied the carboniferous basins in south Brazil and made experiments concerning the preparation of the coal in briquets. It is already known that the carboniferous basins in south Brazil constitute one single basin, which is therefore extensive, stretching from S. Paulo to Rio Grande do Sul. The most promising beds are situated in the State of Sta. Catharina and Rio Grande, and drilling operations undertaken by the government appear to give very encouraging results. Professor White thinks the briquets manufactured from Brazilian coal can compete with the Cardiff product.

Brazilian coals briquetted in Germany gave the following results: 77 to 79.27 per cent. carbon; 0.7 to 0.9 per cent. sulphur; 8 to 9 per cent. ash; calorific power, B.t.u., 13,669, determined by calorimeter, and 13,903 calculated.

#### COPPER

Copper ores have been encountered in many places in Brazil. However, only in Rio Grande do Sul have deposits been the object of small explorations. In this State the principal copper deposit is that of Camaquan, exploited by a Belgian company. According to H. Kilburn Scott one of the lodes of the Camaquan mine contains copper pyrites, the gangue being quartz with heavy spar. The other deposits are similar, with copper-glance near the surface, and bornite, copper pyrites and some iron pyrites lower down. Some tons of ore sent to England gave from 28 to 30 per cent. copper. Near Caçapava is another copper deposit, the Primavera mine, a quartz vein containing copper-glance and pyrites. At Cerro Martino there is a copper deposit, 86 miles from Rio Negro, giving, according to Mr.

Scott, from 7 to 25 per cent. copper. Copper ores are also found at Cerro do Geraldo, Lavas and Quarahim.

In the State of Bahia, in the district of Villa Nova da Rainha, copper ores have recently been encountered in an eruptive decomposed rock as carbonates of copper. In Ceará, Maranhao and Paraná, copper ores are found, but no study by a competent expert on these occurrences has been made.

#### MONAZITIC SANDS

Rich deposits of monazitic sands are found along the Atlantic ocean. These deposits are situated on the Federal foreshores and the explorations are monopolized by two concessioners. The beach sands contain 70 to 80 per cent. of monazite. A plant was recently erected for the concentration of monaziteiferous gravel found in quantity along the banks of the Rivê Parahyba. This treatment of river ground is entirely a new industry and if successful will revolutionize the Brazilian trade in monazite. The following minerals and metals occur in Brazil: Tourmalin, precious beryl, cymophane and triphane, topaz, garnets, in the State of Minas-Geraes; oxide of zirconium and other rare earths at Bahia, Minas Espirito-Santo and Rio de Janeiro; galena, in Minas-Geraes; palladium associated with gold in Goyaz and Minas; platinum in Minas and Pernambuco; mica and asbestos in Minas and Bahia.

#### Testing Slate

Methods of testing the elasticity, absorption, fissility, and resistance of roofing slates have been in use for many years. In recent years, however, more exact methods have been devised. All such methods have been brought together in the bulletin (No. 275) on the slate deposits and slate industry of the United States which T. Nelson Dale, of the United States Geological Survey, has recently prepared.

Tests are given for determining the sonorosity, cleavability, cross fracture or "sculpting," character of cleavage surface, presence of lime, the color and discoloration, the presence of clay, of marcasite, of magnetite, the strength, toughness or elasticity, density or specific gravity, the porosity, hardness or abrasion, and the corrodibility of slates.

One of the most satisfactory and decisive tests of slate is the microscopic analysis. A thin section of slate examined under the microscope will suffice to show the character of the cleavage, the presence of false cleavage, if any, the probable durability, or indurability of the color, as well as the presence of any mineral constituents likely to determine its other qualities. Mr. Dale quotes Merriman to the effect that chemical analyses give only imperfect conclusions regarding the weathering qualities of slates and do not satisfactorily explain their physical properties.



# Placer Mining in French Guiana

Dredging for Gold on the Elysee Placer Has Been Highly Successful. A New Installation Promises Still Better Results

BY LEON DELVAUX\*

The French colony of Guiana, which for a long time was considered suitable only for a convict settlement, is now attracting increased attention in Europe as a gold-producing country. Taking into account the very crude methods used so far in French Guiana, the present output, which averages 4000 kg. a year, all derived from alluvial workings, shows clearly how rich the ground is and leads one to the belief that, with the aid of capital, mechanical appliances and proper

design, with but a few wooden riffles, and they are very short. There is no regularity in the feed of water and gravel. The clay leaves the sluice nearly in the same state as it enters. In fact, the wonder is that the miners are able to catch any gold at all by such methods. Moreover, the so called prospecting only consists of a few pannings made at random. The miner who depends upon the salt meat and flour which he has brought with him must return to the coast as soon

most favorable season of the year only a small part of the ground can be washed. In the upper portions of the creeks no water is available for the natives, who never use either pumps or long flumes. In the lower part the gravel is covered with water and therefore beyond the reach of the shovel.

The capacity of these native plants is very small. A party of 12 workers, including four diggers, do not treat more than 6 to 8 cu.yd. per day. Still, the



MACHINERY ON THE WAY TO ELYSEE PLACER

management, French Guiana could become in a few years an important gold producer.

#### NATIVE METHODS

Until last year the whole of the alluvial gold produced in the colony was obtained from sluicing. It has been told again and again how this device is ineffective, specially as it is applied in the Guianas. The sluices are of the simplest

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as he has exhausted his supplies. As a consequence he is not inclined to lose even a few days in prospecting work.

Another disadvantage of the crude methods used is that they can be applied only during a short period of the year. In the dry season most of the workings have to be stopped as a result of the scarcity of water. On the other hand, in the hight of the rainy season the paddocks are often flooded and the sluices are often carried away. Even during the

values are so high that I saw such a party getting in one day 860 grams (about 29 oz.) of gold in a place which is in no way exceptional in Guiana. And I do not speak of remote valleys, where such a yield would leave but a small margin for profit.

The means of transportation are in no way better. There is no road, not even a mule trail, and scarcely any hunters' tracks. All the supplies, food, tools, etc., have to be brought from the coast up the

rivers in canoes which carry from one to two tons. This system, besides being very expensive, involves constant delay and great loss by dampness, theft, etc.

#### DREDGING

These difficulties are common to most of the countries in South America, and they would not be worth mentioning if we were not to report at the same time that

type. There are two water-tube boilers, of 35 h.p. each; a vertical compound engine; a belt-driven centrifugal pump with a horizontal engine and a Worthington pressure pump. The fuel used is wood, supplied in any quantity by the surrounding forest. The discharge of the buckets is made through a revolving screen to a sluice fitted with riffles. The revolving screen is

1902, represents an early type, and that the new dredges will undoubtedly show great improvement and be much better adapted to local requirements. But in spite of the small capacity of the buckets, and of the defects of the washing plant, the output averages in normal run 45 grams (1½ oz.) per hour. Returns of 500 grams per day of 10 hours were not infrequent. The yield actually recovered from the ground (including gravel and overburden) exceeds six francs per cu.m. (about \$0.90 per cu.yd.).

#### NATURE OF DEPOSIT

The gold is very coarse and as a consequence very easy to save. As a matter of fact, the washing plant of the dredge in its first state was so defective that all fine gold was certainly lost, but I do not believe that the fine gold formed any important part in the total. The coarseness of the gold is not surprising, if we consider that the reefs which, by their disintegration, formed the alluvial deposits are only from 500 to 1000 yd. from the dredging field. Nuggets weighing from 10 grams up to 45 (⅓ to 1½ oz.) were found almost daily.

Some logs were found buried in the ground; but, although they caused some delay (from 5 to 30 or 40 minutes each), they were never of such a size or hardness as to cause damage, and they could be handled easily with the crane placed on the forepart of the dredge.



ELYSEE DREDGE NO. I

they have been overcome, and that a new era of industrial development seems open for French Guiana.

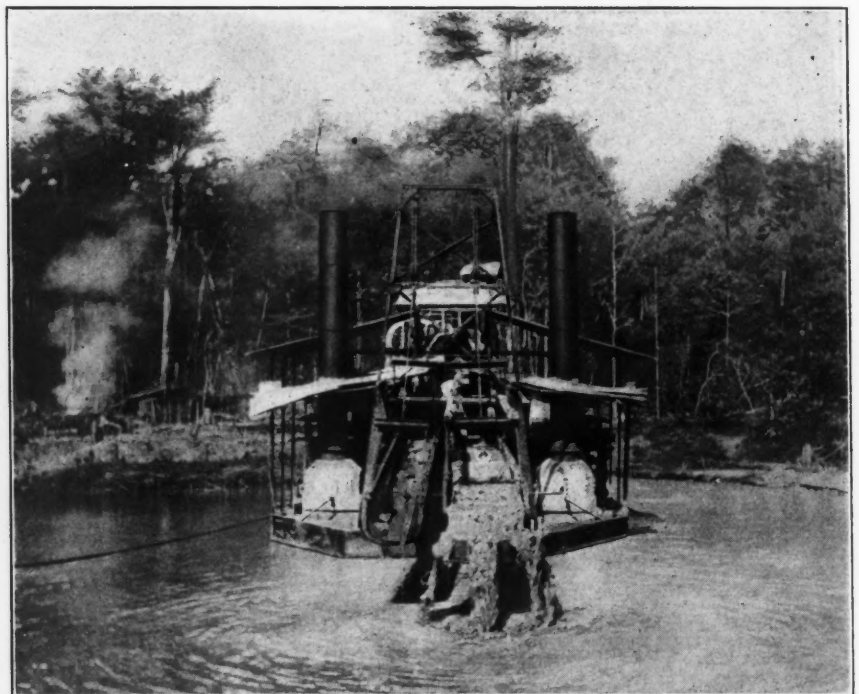
Various attempts had been made previously to replace the old and obsolete sluicing plants by mechanical contrivances, among others by dredges. One dredge, built by D. Levat, on the Courcibo river, had given for some time steady and satisfactory returns, but was sunk during a flood, through the carelessness of the people in charge.

All attempts had been unsuccessful, mostly for lack of sufficient capital and honest and able management; and it was commonly asserted that successful dredging was impossible in French Guiana, when the South American Goldfields, an English company mainly supported by French capital, started its operations. A dredge was built in Holland, in sections, the heaviest weighing only 600 kg., and carried to the Elysee placer, on the Lezard river, about 120 miles from the coast.

It was erected and started in July, 1905. It has been in service since, and although the washing plant was not so effective as could have been desired, and some alterations had to be made, it has afforded the absolute proof that gold dredging is not only a possibility in French Guiana, but a paying industry.

#### ELYSEE DREDGE, No. I

The Elysee No. I dredge is of the bucket type, the buckets having a capacity of 2 cu.ft. They are of the open-connected



REAR VIEW OF ELYSEE DREDGE NO. I

the only part that gave trouble, but it gave a lot. It was much too light in construction, and the bearings were not protected at all against the sand and the water. The hull was made of timber, now being replaced by steel. It should be borne in mind that this machine, designed in

Boulders were fairly uncommon, and of a comparatively small size. The bed-rock consists of white or bluish clay, derived from the decomposition of the diorite. The first inch or so on the top of the bed-rock is very rich and must be carefully washed. The clay is fairly sticky,

but its disintegration in the screen is hastened by the friction with the quartz pebbles contained in the gravel bed.

Above the bed-rock, which is usually found at a depth of 12 to 16 ft., lies a bed of loose gravel, quartz, pebbles, etc., mixed with coarse sand, and containing most of the gold. This bed, easily removed by the buckets, varies in thickness from a few inches up to 2 ft., and is covered with sand or soil, barren or nearly so. The yields mentioned above are average yields referring to the total depth. The yield in the gravel is much higher.

**QUARTZ AND BLACK SAND**

In addition to the free gold actually recovered from the gravel, recent tests and experiments have shown that a further quantity of gold can be obtained from the quartz pieces found in the gravel and also from the black sands which in some parts are very abundant (up to one-tenth of the total quantity of alluvium). From the quartz pieces eliminated through the screen only the pebbles showing visible gold were selected by hand and crushed in a prospecting stamp mill; and they frequently yielded in gold 1/10 of the value recovered through the sluice from the fine sands during the same time. As to the black sands, some samples were assayed by Morin Brothers, assayers to the Bank of France, and yielded from 1 1/2 oz. up to 15 oz. to the ton. Experiments are now going on in order to collect them in quantity.

for a new dredge, with 3-cu.ft. buckets and steel hull 80x28x6 ft., was drawn up for the same company by the writer with the assistance of Gerard Dufour and L. C. de la Marlière. The work was entrusted to Lobnitz & Co., of Renfrew (Scotland), and the whole of the plant is now on its way to French Guiana. The bucket chain is of the open-connected type, the maxi-

pulley; one 10-in. centrifugal pump, directly connected with a vertical compound engine, and sending the water to the screen through the condenser; and two Worthington pressure pumps for breaking by means of a strong jet the lumps of clay in the screen, and washing the soil out of the tree roots before lifting the trunks.



TRANSPORTING SECTIONS OF THE SCREEN



SLUICING PLANT ON THE ELYSEE PLACER

The dredging field on the Elysee placer consists not only of the bed of the Lezard river, which is from 5 to 9 yd. wide, but of the entire width of the valley, which ranges from 100 to 400 yards.

The results of that dredging experiment were so encouraging that a specification

mum dredging depth being 20 ft. The main engine is of the horizontal compound "Marshall dredging" type. There are one Babcock & Wilcox boiler, one dredging winch with seven drums, one warping winch for driving the logs to the shore by means of a wire rope and a jack

The screen is of the adjustable Lobnitz pattern; the useful length is 16 ft., the diameter 4 ft. 6 in., and the holes range from 2/8 in. at the upper end to 5/8 in. at the lower. The screen discharges the fine material on ten tables (five on each side) fitted with cocoa matting and expanded metal, and the oversize material to a nugget collector and thence to an elevator of the bucket type.

The dredged material, falling out of the buckets, can be sent either to the revolving screen or to a sterile shoot, when it is barren overburden. This is done by means of a moving plate, mounted on an axle and driven by an outside lever. In the latter case the screen is stopped and the soil is led through the sterile shoot directly into the elevator buckets.

**THE ELYSEE PLACER**

The Elysee placer, where the first dredge was erected, and for which the second one is also destined, aggregates 7500 hectares (about 15,000 acres) and according to the prospecting work already done affords a field sufficient for at least ten dredges. While it is known as one of the rich claims in French Guiana, it is by no means an exception, and the great amount of gold that has been taken out of all districts in the colony by means of the very crude methods previously alluded to, leads one to the belief that most of these districts will afford valuable dredging fields.

The unsatisfactory state of affairs outlined at the beginning of these notes, as regards transportation, can be improved at a comparatively small expense. We put a steam launch in commission on the Mana river about eighteen months ago, and we are now able to perform in two or three days a journey which consumed thirteen days on my first voyage. The launch can ply on the river during seven or eight months each year, reducing to about one-third, not only the length of the journey, but also the cost of the freight. A petroleum launch for passenger traffic, and also for towing freight boats, is now being

### The Production of Cement in Great Britain

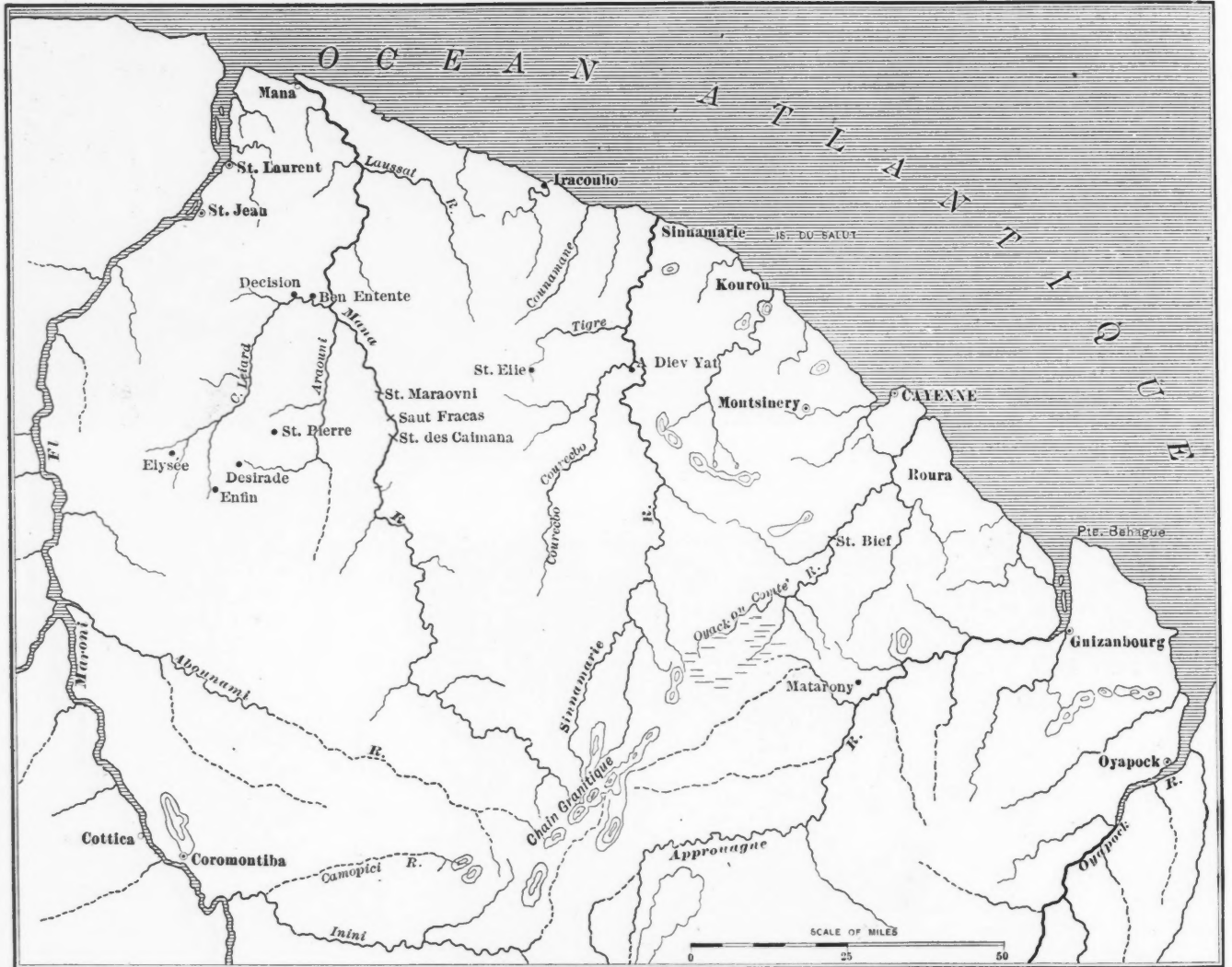
A correspondent of *Cement Age*, a well known cement engineer of London, writes as follows concerning the cement industry:

"New works, designed and laid out throughout with every detail in accordance with latest ideas and unincumbered with having interest to pay on obsolete kilns, buildings and plant, stand a far better chance of dividend-earning capacity than the older factories.

24 companies as only one) is 119, and the total average present annual production of the lot may be taken as 18,826,000 barrels.

"In addition to this, the total barrels imported by Great Britain during the past 12 months has been 1,140,276, or 315,342 less than during the preceding year, due in all probability to the country of origin being busy and getting better prices elsewhere than when dumping their surplus stuff here, and which may, unless English prices drop too low to prevent it, again begin to increase when the boom ends.

"The total exports for the past 12



MAP OF FRENCH GUIANA SHOWING THE LOCATION OF THE ELYSEE PLACER

added to the "fleet."

#### VEIN MINING

In these brief notes I have not referred at all to the reefs. The reason is that they have scarcely been looked for, all the interest being centered, as it is usually the case in undeveloped countries, in placer mining. But reefs exist in French Guiana. Very promising work has been done on some of them, notably at Adieu-Va, Elysee and St. Elie, and a thorough investigation would undoubtedly lead to interesting discoveries.

"Four new works have been erected and will be in full operation by the end of the year, and are placing about 12,000 more barrels weekly on the home market, and there at least two other works projected on a larger scale which will produce, if started, over 30,000 bbl. weekly to add to the same overflooded sale area.

"To show how the English market is already over supplied, we may note that the total number of cement firms with works at the present time in England (treating the Associated Company with

months ending Oct. 1 have amounted to 3,659,710 bbl., which is a substantial but only temporary increase over the figures of the last few years, and must certainly not be looked upon as permanent.

"If the total make is 18,826,000 bbl. as stated above, and the imports for the past 12 months are 1,140,276, it makes a total of 19,966,276 bbl. to be disposed of. From this deduct 3,659,710, the total barrels exported during the past 12 months, and it leaves 16,306,566 bbl. for home consumption."

### The Traylor Iron Jig

In the progress made in recent years in mining and milling machinery, there are few machines, formerly accepted as standard, which have not been improved upon in one way or another. The old Hartz jig, which has remained practically unchanged for generation after generation, seems to have been one of the exceptions, considered by the average mill man as incapable or unworthy of improvement.

The efficiency of the old jig was never questioned. In fact it was rarely, if ever, known. The machine was used principally in an intermediary capacity, treating the coarser minerals, recovering such values as came within its province, and passing the finer materials to concentrating tables, vanners or stratifying tables. It never seems to have occurred to anyone that the jig could be made to fill a position of prime importance and that it could be used in almost every concentrating plant for treating ores varying in size from  $\frac{3}{4}$  in. to as fine as 60 mesh, realizing a high percentage of recovery.

In the plant now being installed by the Utah Copper Company, in Utah, jigging machinery has been given the consideration which it deserves. The plant will be equipped with seventy-two standard all-iron jigs supplied by the John A. Traylor Engineering Company, Denver, Colo.

In principle the Traylor jig does not differ from the Hartz type. It merely embodies the principles of jigging in every detail, discarding the bulkiness of the old form and doing away with its rocking, cradle-like plunger. The floor space covered by a single, three-compartment Tray-

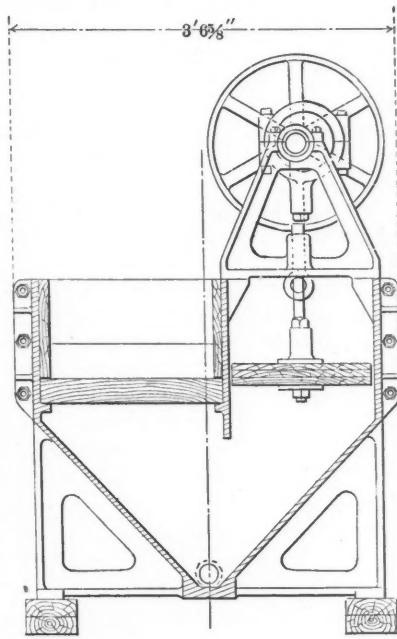


FIG. 1. SHOWING ECCENTRIC AND PLAN OF TRAYLOR JIG

lor jig is 8 ft.  $\frac{1}{2}$  in. x 3 ft. 3 in., whereas a Hartz jig of three compartments requires 9 ft. x 5 ft. 6 in. floor space. The Hartz jig in height is ordinarily from 5 ft. to 6 ft. to the top of the hutch or tank, and 7 ft. to 8 ft. from the floor to the plunger shaft, whereas in the Traylor, the top of the hutch is 3 ft. from the floor and the center of the shaft is only 4 ft. 3 in. from the floor. The iron jig is entirely accessible to an operator standing on the floor, and there is no need of a step ladder to see the bed.

The old Hartz jig has an eccentric rod attached rigidly to the center of the plunger, which cannot, therefore, lower or lift the plunger in a horizontal position, its motion being irregular, and the sides striking the walls of the plunger compartment. The result of this movement gives an irregular jigging effect upon the screen bed, a defect which may be observed in treating fine ore containing talc, a mass of compact material forming in the corners and along the sides of the screen cloth.

In the Traylor Standard iron jig the plunger's motion is controlled by guides, which insure a uniform movement. Every portion of the screen bed is uniformly agitated and the plunger may be made to fit very snugly in its compartment, thus utilizing all the water beneath the plunger floor and reducing the quantity of fresh water required. Less power is also required, owing to the fact that the plunger is not allowed to touch or drag against the sides.

The iron jig is equipped with a parallel adjustable eccentric in such a way that the length of the stroke may be increased or diminished without disturbing the alignment. The bearings are long, and are fitted for ring oiling, with an oil chamber having the capacity of a pint. The journal bearings are extra long, supporting a heavy shaft, and are rigidly supported to an extra heavy pedestal, which is bolted securely to the iron hutch.

A number of mills are now installing this improved jig, which is said to operate on 10 per cent. less power, to require from 5 to 15 per cent. less water, and to handle

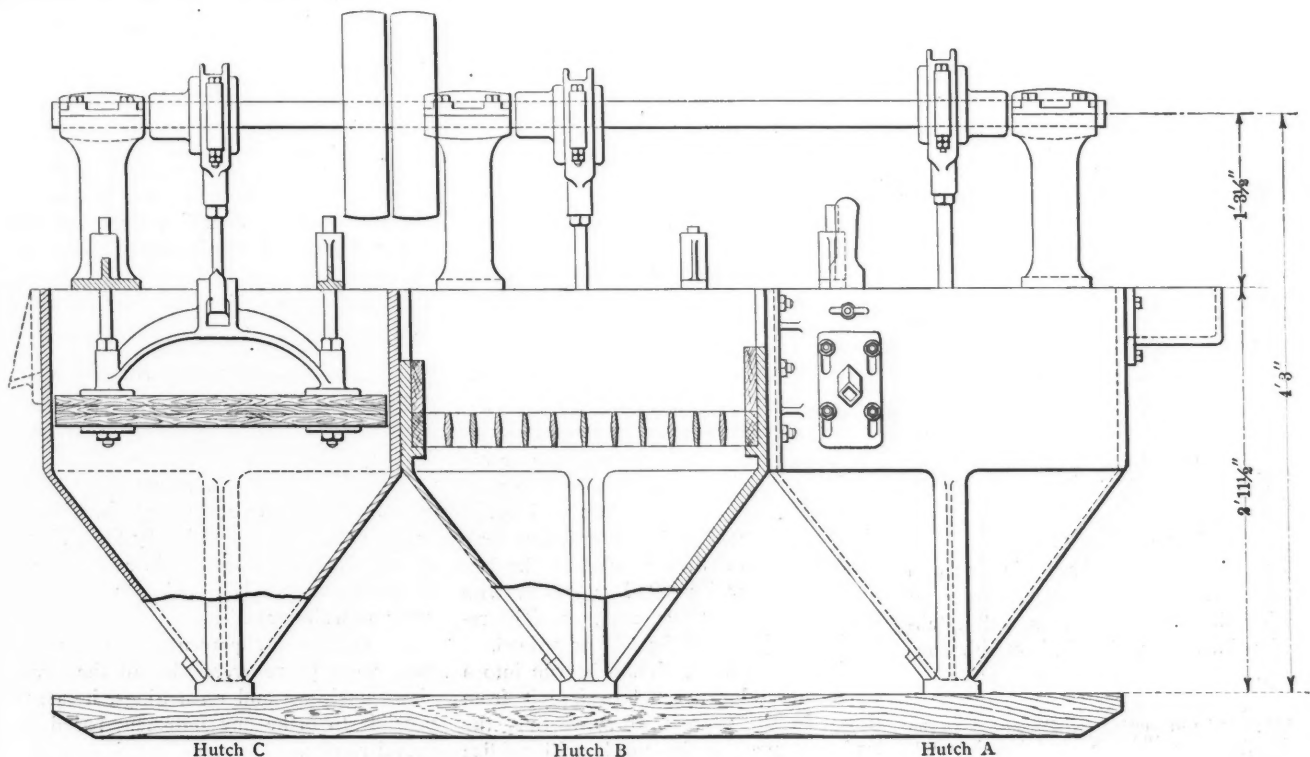


FIG. 2. SHOWING PLUNGER AND GUIDES OF IRON JIG

from 10 to 25 per cent. more ore than the old type of jig.

In the illustrations, Fig. 1 represents a vertical cross section of the new jig; Fig. 2, a vertical longitudinal section; and Fig. 3, a horizontal section. The plunger and guides are shown in Fig. 2.

### Method of Smelting Cobalt Ores \*

BY HIRAM W. HIXON†

The smelting of the cobalt ores and the recovery of the valuable metals has proved a difficult problem. This paper is submitted with the object of inducing the smelting of these ores in Canada.

Miners, being by nature suspicious of smelters who will not pay the full market value of the metals, have attempted to treat their ores with the hope of recovering greater profits. The success of this plan is doubtful as the many conflicting

1. The ores should be sorted and the metallic silver separated for direct smelting by cupellation with lead or melted in crucibles and poured into bars to be sold to refiners.

2. The ore should be ground in a dust-proof ball mill to such a fineness that it can be accurately sampled.

3. The ground ore should be roasted in a suitable furnace to expel the arsenic and sulphur.

4. The gases from this roaster should pass through a long sheet-iron dust chamber in order to cool them, and then be passed through a bag house, where all the dust and volatilized arsenic will be recovered.

5. The roasted ore should then be briquetted with a strong bond of red clay and lime water and dried or frozen, after which it should be smelted in a blast furnace with about an equal weight of galena or lead concentrates containing about 50

the converter slag, except that portion of the lead which is volatilized along with the remaining arsenic. These will pass off with the flue gases and should for safety be passed through the bag house as they are both poisonous.

The converter slag will, therefore, contain the greater portion of the cobalt as oxide, and in order to recover, it should be resmelted in a separate blast furnace with a portion of the briquetted flue dust from the roasting of the ore.

The flue dust highest in arsenic should be used, as the recovery of the cobalt would depend upon the formation of a cobalt speiss or arsenide of cobalt.

This would be separated from the slag in the same manner as the matte and its further treatment for cobalt would be by chemical methods after roasting to expel the arsenic, which should be recovered in the bag house in the same manner as first described.

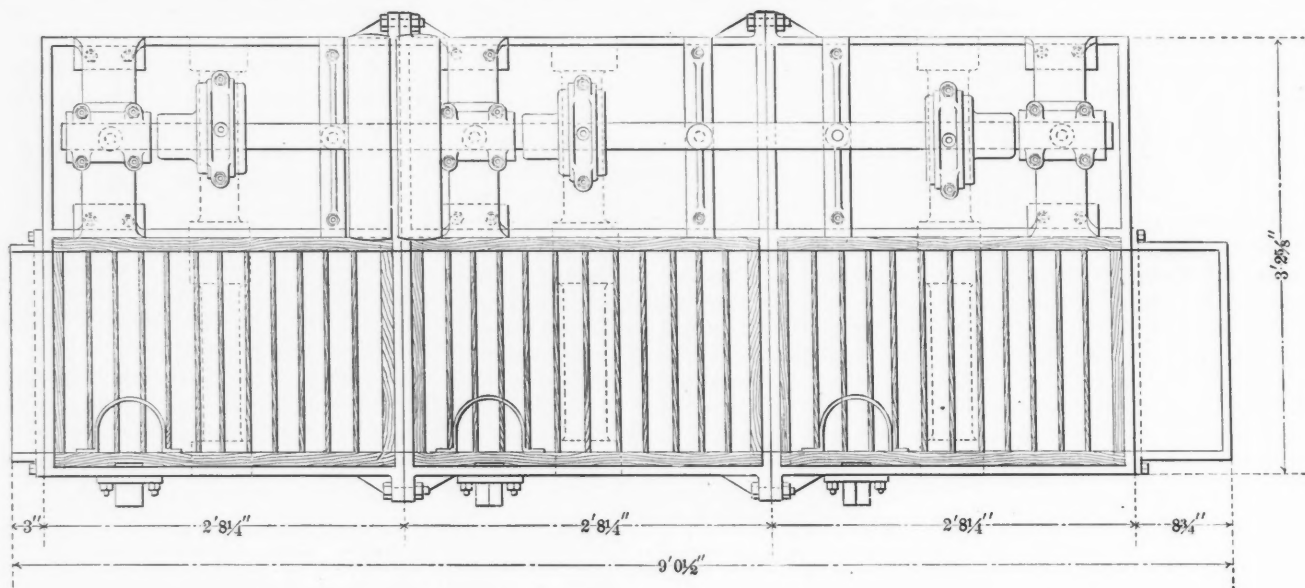


FIG. 3. PLAN OF THREE-COMPARTMENT TRAYLOR JIG

interests naturally become restive unless immediate results are obtained and cash returns follow the shipments of ore.

The nature of the problem will not admit of such results, and the time necessary for the treatment of the ores as well as their great value necessitates a locking up of a large amount of working capital. This is not satisfactory to the average mine promoter who wishes to pay dividends on a large capitalization in order that he may sell stock to the public and "get rich quick" from the profits on the stock.

#### METHOD PROPOSED

The writer's experience in custom smelting business suggests a system of smelting these ores based on well established principles, which is herewith submitted:

\*Paper to be presented for discussion at the Toronto meeting, 1907, of the Canadian Mining Institute.

†Manager, Victoria mines, Ontario.

to 60 per cent. lead. The necessary iron and lime would have to be added to the charge to produce a slag of the proper composition.

The sulphur for matte formation would be supplied by the galena and the arsenic remaining in the ore will form some speiss.

The base bullion resulting from this smelting could be sold to lead refiners, or refined to separate the silver.

The matte and speiss will contain all the nickel and cobalt that can be recovered from the first smelting and also some lead and silver. This matte and speiss should be accumulated until sufficient for a special run and then ground in the ball mill, roasted and smelted separately with more lead to free it from silver. The resulting bullion could be sold or refined.

The second matte should be run into a converter and converted to free it from iron. In the process of converting, the lead and most of the cobalt will oxidize at the same time as the iron and go into

The flue dust containing arsenic would have to be roasted separately to sublime the arsenic which should be recovered in a separate flue and bag house provided for that purpose.

The arsenic would be marketed as white arsenic.

#### ADVANTAGES OF THE SYSTEM

By the scheme outlined, the silver would be produced either as silver or in base lead bullion.

The nickel would be produced as high-grade nickel matte containing some cobalt suitable for further refining by the Orford, Mond, or other processes; the cobalt would be produced as cobalt speiss, and the arsenic as white arsenic.

As regards the percentage of metals that could be recovered by all these various smeltings and resmeltings, it is not possible to make any statement based on actual results.

The smelters who have bought these

ores have not seen fit to give out any information, but the fact that they have allowed nothing for nickel, cobalt or arsenic is significant. To make even an attempt at a partial recovery of each of the metals is a long, tedious process and the most complicated, from a metallurgical standpoint, that has been presented for solution. Under these conditions any association of miners attempting to smelt their own ores is hardly likely to succeed.

For the economical working of this plan the smelter should be located at North bay, where lead concentrates from the western mines can meet the ores. A working capital of at least half a million dollars would be necessary and the plant would cost at least two hundred thousand dollars.

often enable an experienced man to make valuable suggestions, after a merely cursory examination.

I remember a case which illustrates this point. It was a prospect situated in one of the roughest parts of New Zealand, which contained outcrops of very good ore. The owners had run a cross-cut about 200 ft. from a point below the principal outcrop, with the intention of cutting the lode at a vertical depth of about 50 ft. They had done this without opening out or sinking on the outcrop. The writer was sent up by a development company, with instructions to examine and if good to bond and to lay out prospecting work. When on the ground I decided at once that the prospect was worthy of attention. I traversed and noted the ground for about one

### The Verschoyle Pocket Transit

By W. DENHAM VERSCHOYLE\*

There are few mining engineers who have not, at one time or another, had occasion to use a pocket instrument. In the experience of everyone and especially those whose practice has taken them outside the pale of civilization, the prismatic compass, the Abney level, the Brunton transit have had a place.

After traveling long distances to look at a prospect in some out-of-the-way place, it usually pays to obtain all the information possible, even though at the time it may appear that such information will be of little use. Thus when the locality is reached it gives little extra trouble to jot down in a note-book every change of formation encountered, the bearing and dip of cleavage, veins, dikes, etc., the bearing of prominent distant points, and the surface grades encountered. The information thus obtained in one or two traverses of any ordinary group of claims, when roughly plotted, will often enable valuable deductions to be made as to the geological conditions, which in conjunction with observed topographical considerations, may

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FIG. 1. VERSCHOYLE TRANSIT

hour, and found that the cross-cut was roughly paralleling the lode, and with a prismatic compass and an Abney level laid off a cross-cut which eventually cut the lode in about 50 ft., at a vertical depth of over 40 ft., disclosing 10 ft. of ore worth about 18 dwt. The work was done by the owners themselves, who used the direction

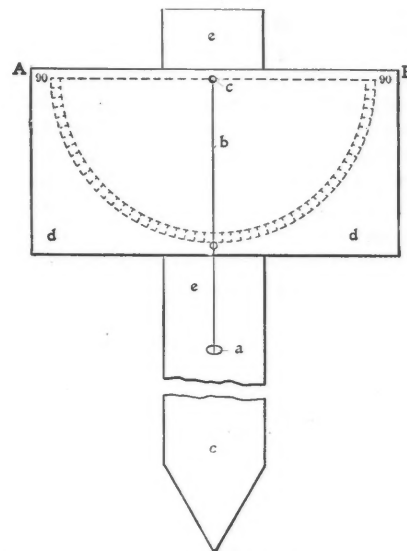


FIG. 3. DEVICE FOR TAKING OBSERVATIONS WITHOUT INSTRUMENTS

A-B, sight line; a, stone; b, string; c, 2-in. nail; d, 1-in. board, which can be rotated about c; e, stake.

pegs put in as the result of this survey, they having refused the terms offered.

In keeping a set of mine plans, particularly where it is customary or convenient to "post" the mine at certain intervals, say once a week or once a month, a rough approximation of the direction of some particular work is often required, and this can generally be obtained, with sufficient accuracy, by means of a pocket instrument. The results, when penciled in on the plans, show the position without having to make a special trip with the theodolite, or having to wait for the ordinary exact survey.

It often occurs that, in opening a mine the question of expense, together with the smallness of the operations, are decisive arguments against the investment in an instrument of great accuracy. The pocket instrument fills the bill for the time being, and in this stage of a mine when there is not much steel about to effect the needle, remarkably close work can be done with it.

The Verschoyle Pocket Transit presents certain novel features. Fig. 1 shows the instrument folded, as it would be carried in the pocket or in its sling. In Fig. 2 it is ready for use. The sight arm can be rotated through any vertical angle, and is held at any point by the friction of its bearings. The magnetic bearing is readable in the face of the prism at the same time that the target is visible along the line of sight, and at the same time just below the figures appearing in the prism a small level bubble is visible which on being centered, and the needle coming to rest, the work of obtaining the bearing and vertical angle of any distant point is finished, one observation alone being necessary.

The most important new features are that while weighing and costing little more than an ordinary prismatic compass, any angle, vertical or horizontal, can be observed with ease, and both are obtained

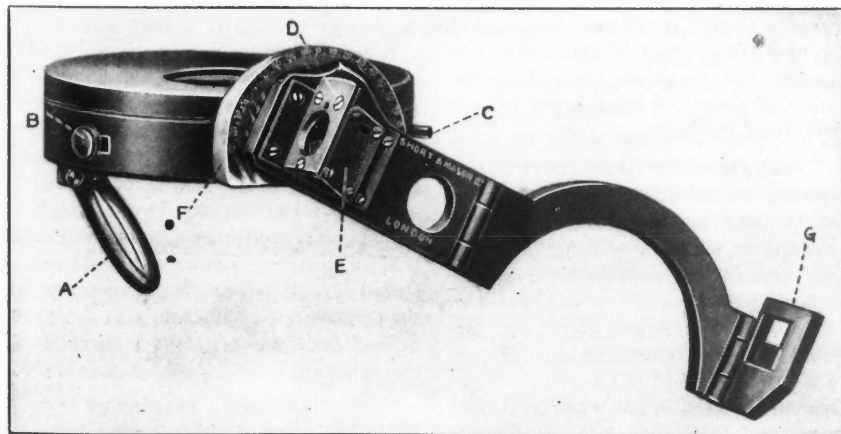


FIG. 2. VERSCHOYLE TRANSIT, OPENED FOR USE

A, thumb loop; B, needle lifter; C, needle brake; D, back sight hole; E, prism box; F, vertical arc; G, fore sight.

with one observation. The illumination for underground work is excellent, and a surface line can even be turned down a vertical shaft, if necessary. It is arranged for use as a level for grading, and as a clinometer, and in a few seconds it can be fixed to a tripod, upon which there is a divided plate for measuring angular degrees.

The writer remembers being caught without an instrument many years ago in an outlying camp, where a survey was urgently needed. He fortunately had a pocket-book, which contained the necessary tables, and with the help of a pocket compass for the horizontal angles, and the device illustrated in Fig. 3 for the vertical, he made the necessary traverse, which was only 10 inches out, when the work was completed. It is a long step from this rough device to the pocket transit, and yet it is very doubtful whether had this instrument, or even a high-priced theodolite been at hand, the survey would have been more accurate or more satisfactory.

### Thawing Dynamite

In "Blasting Talks No. 1" the Aetna Powder Company of Chicago discusses the thawing of dynamite and suggests a thaw house which is of simple construction.

Dynamite freezes at 42 to 50 deg. F. and will freeze hard at times when water or moist earth does not freeze at all. Sometimes it will not freeze until the temperature is down to about 35 deg. owing to the protection of the boxes and to the fact that the absorbents used for holding the nitroglycerin are poor heat conductors. For the same reason it sometimes does not thaw readily at a temperature of 50 or even 60 deg.

When dynamite is completely frozen the cartridges are hard. In this condition it may refuse to explode at all, even when a strong cap is used, and it surely will not develop anything like full strength. It must be carefully and thoroughly thawed to make sure that it will explode and do good work.

At temperatures considerably above the freezing point, dynamite will chill and must be slightly warmed in order to do satisfactory work; and the blaster should make sure that it does not again become chilled or frozen while being carried to the drill holes and loaded.

It is well known that dynamite can often be burned in open air without explosion; but practically all the accidents which have happened in thawing can be traced to a mistaken idea that dynamite can be safely burned under all conditions and that any exposure to heat, short of actually setting fire to the cartridges, is safe. It is true that a dynamite cartridge can be ignited with a match and completely burned without explosion, "most always," and this is because only the part of the cartridge that is burning becomes

hot; the gases pass away freely and the

#### CAUSES OF EXPLOSIONS

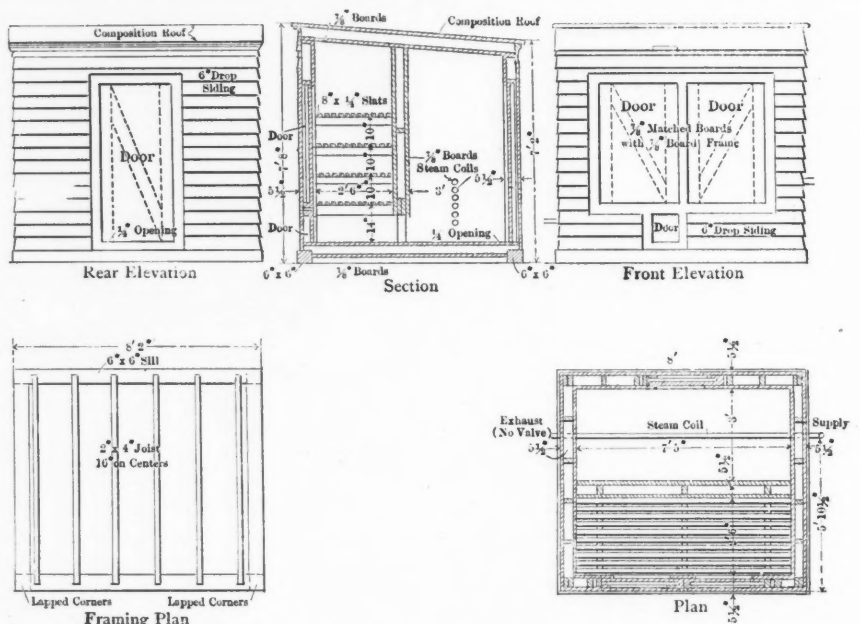
balance of the cartridge remains cool. If this same cartridge were laid against a hot steam pipe or smoke stack the chances are that it would explode before it could take fire. It is absolutely certain that if allowed to get really hot, it would explode from the slightest jar or from the blow of a tamping rod. Cartridges heated in sand have been known to explode from simply rolling them about in the sand. Cartridges set on end around a fire have been known to explode from falling over. A bunch of cartridges laid on top of a brick-covered boiler to thaw, took fire and exploded when struck by the end of a board in the effort to knock them off the boiler.

All these accidents were the result of using a heat which could not be controlled, and the cartridges reached a very high temperature before the man in charge be-

Certainly it would reduce the explosive force by half.

Dynamite left for a day in a thaw house filled with escaping steam has been found to have taken up 18 per cent. of moisture. It is not known exactly how much water is required to render dynamite non-explosive, but 5 per cent. of water greatly reduces the explosive force of any dynamite, and cartridges which contained 12 per cent. of moisture have been rendered non-explosive.

For thawing quantities of ten or fifteen pounds of dynamite at a time, the well known "Rundle" pattern of thawer is most suitable. The cartridges are inserted in tubes and the thawer filled with hot water, which completely surrounds each cartridge. The cover assists in retaining the heat and the dynamite may be carried to the work in the thawer and kept in good condition for hours. On no account



PLAN AND ELEVATION OF THAW HOUSE FOR DYNAMITE

came aware of it. The remedy is to use a source of heat which cannot possibly rise above 100 deg. even when neglected.

Chemists tell us that dynamite begins to undergo a change at 158 deg. F. and from above that temperature becomes more and more sensitive to shock, until at a temperature of about 356 deg., it will explode simply from the heat.

#### DYNAMITE NOT WATERPROOF

Another mistaken idea is that dynamite is water proof, and therefore any amount of soaking or steaming will not injure it. Many blasters will deliberately soak dynamite in hot water for a half an hour, or thaw with live steam, under the supposition that such treatment does not injure it.

Dynamite soaked in hot water for fifteen minutes and then allowed to steam for half an hour has been found to have taken up over 10 per cent. of water, an amount that would possibly make it non-explosive.

should the thawer be placed over a fire, or should any attempt be made to heat water in the thawer while there is dynamite in it. It is better not to heat water in it at all.

A good thawer, with a capacity for a case of dynamite at a time, can be made by burying a box in a pit filled with green manure which should be rammed hard and must be occasionally renewed. An iron pipe is used for a ventilator as well as a handle for lifting the cover. Such an arrangement will thaw dynamite in the coldest weather. Dynamite should not be stored in it longer than necessary for thawing, because the dampness from the ground and manure would in time injure the dynamite.

#### DANGEROUS PRACTICES

The majority of blasters who find such apparatus as described too small, use some kind of a thawing arrangement which is either dangerous or likely to damage the



dynamite. Some place the cartridges in a barrel and cover with hot water, or even use live steam; others employ a low-lying box, covered with earth or manure, and heat it with exhaust steam or live steam. Still others provide a building that is excellent for the purpose if properly used, but will permit the house to be used by the workmen as a workshop, or as a place to prepare primers, or as a loafing room.

#### EXCLUSION OF TOOLS

Tools should never be permitted to be used in a building where dynamite is being thawed, for it is almost impossible to prevent small particles of the explosive from being scattered about and a blow would explode them under certain conditions. Primers should never be prepared in a thaw house; even the most careful man will sometimes leave a cap where it may cause trouble. A thaw house should be so arranged that the floor can be kept clean and occasionally scrubbed with hot lye. The slats or shelves on which cartridges are laid should be removable and subjected to the same treatment. The wood will, in the course of time, take up some nitroglycerin which may be much more dangerous than the dynamite.

#### SYSTEM FOR HEATING

The heating system can easily be so arranged that dangerous temperatures can never be reached; it can be kept clean so that there will be little or no danger from this source. The pamphlet gives plans and elevations for a thaw house, having two compartments, one containing shelves upon which the dynamite is placed through doors opening directly outside and the other containing the coils for heating with steam or hot water.

The heating compartment containing the coil of pipe is the only part of the building that a man can get into and this can be prevented, if the superintendent wishes, by keeping the back door locked, to be opened only for the purpose of cleaning the floor or looking after the steam pipes. A strict rule should be made requiring all dynamite to be removed from the thaw house and the building thoroughly cleaned before attempting any repairs of any kind. Frequent sweeping of the floor should be required. A good thermometer should be placed where it would be seen every time the front doors are opened.

This thaw house, if built of wood, might be exploded by a rifle ball. Whether or not there is danger from this source depends on local conditions. If such an accident is feared, the building should be made of concrete or brick and either with iron doors or an earth barricade in front of the doors.

The house has a normal capacity of about 500 lb. of dynamite at a time, when the cartridges are laid out on the shelves, although 1000 lb. or more can be crowded in if the dynamite is not taken from the

boxes. It is inadvisable to crowd the capacity of the house and the cartridges will thaw more satisfactorily if they are spread out on the shelves instead of being piled high or left packed in boxes. If the structure is not large enough it is better to build a larger house. The design is such that it can be built the same width and height, but twice as long.

The plan of air circulation provides for the heated air rising until it fills the space above the pipes, then overflowing under the partition, passing upward between the cartridges and out through the ventilator just beneath the roof.

The use of the steam coil is optional. A hot-water coil may be used or the ordinary form or radiator such as is used in dwellings may be put in. If steam heat is used there should be no valve at the outlet, for someone might close it. An opening should be left in the exhaust end of the pipe just large enough so that the steam pressure can never rise above 10 lb.

The floor may be made double as shown in the plan or a single floor may be used; in the latter case it is better to fill the space below the floor with cinders.

### White Pass & Yukon Railway Company

The statement of earnings of the White Pass & Yukon Railway Company for the fiscal year ended June 30, 1906, is of a more satisfactory character than that for the previous year. There was an all-around increase in receipts. The company's railroad service carried 14,157 passengers during the year, as compared with 11,773 in 1905, and the freight amounted to 34,119 tons, as compared with 33,225 tons in the preceding period. The company's river steamers carried 900 passengers more during the period reviewed than in the corresponding period in 1905. There was also an increase of 3000 tons shown in the river-freight returns.

The year 1905 was marked by greater progress in the development of the mineral resources of the Yukon territory and Alaska than any previous year since the discovery of the Klondike goldfields. In Alaska the output and population of the Tanana goldfields almost equaled that of the Klondike, and the numerous smaller mining camps along the river all showed increased activity, while many new ones sprang into existence. These camps contributed satisfactorily to the company's traffic, notwithstanding that they are more easily reached than Dawson is from the mouth of the river.

On the Canadian side of the boundary the change from hand to machine work for the recovery of the gold made steady progress, and particular attention has been paid to dredging where the ground is suitable. The company transported the material for a number of large dredges

in 1905, and some of them were in successful operation before the close of the season and gave a great stimulus to this method of gold recovery. The railway connecting Dawson with the chief mining creeks was commenced in 1905 and it is hoped may be completed and opened to traffic in 1906.

The other Canadian placer goldfields have all shown increased activity, especially Atlin, which district is now almost entirely on a machine basis, with a largely increased output.

By far the most important and interesting feature in the development work of 1905 was in the Windy Arm district, between Lake Bennett and Windy Arm, a peninsula about 18 miles in length and 10 to 12 in width. Silver and gold ores of great extent and running high in values have been discovered at many places in this peninsula and a large amount of work has been done on a number of these properties, demonstrating large orebodies. An aerial tramway was installed at one mine to carry ore down to the lake, and a number of others are contemplated. It seems probable that, should equally encouraging results be obtained in 1906, a large smelter will be built at some point on the lake, and it will become necessary for the company to take active measures to be properly equipped to furnish adequate and satisfactory service to these mines. With this in view, surveys have already been made for alternative lines from Log Cabin and from Caribou to the Windy Arm mines.

### Gold Nuggets with Concentric Structure

At a meeting of the Royal Society of New South Wales, Dec. 5, 1906, Professor Liversidge described two gold nuggets from New Guinea, showing a concentric structure. The nuggets presented the usual external appearance, but when sliced, polished and etched with aqua regia they showed in parts a concentric structure, but no macro-crystalline structure. Out of a very large number of gold nuggets examined for several years past, these two are the only ones which have shown a lamellar structure. Apparently the layers of gold were deposited within a cavity, in the same way as agates are built up by the deposition of layers having been deposited around a central nucleus. The gold in one was 88.95 per cent., and silver 1 per cent., and the other 88.25 per cent., and silver 1.05 per cent.

A. P. Low, director of the Dominion Geological Survey, in an account of a trip to Ungava, on Hudson bay, reports the discovery of large areas of iron ore similar to those of the Lake Superior district. Mining will be easy and cheap, and ample water power is available.

# Coal Mine Gases and Barometric Pressure

Changes in Atmospheric Pressure seem to be a Common Cause of Colliery Explosions. Why Many Accidents Occur on Monday

BY FLOYD W. PARSONS

Since the recent publication of collected data tending to establish the possibility of concurrent action on the part of mine gases and fluctuations in atmospheric pressure, I have continued to investigate and discuss the subject with coal-mine managers and find a generally accepted belief in the ideas advanced. The serious explosions of the past few weeks afford an opportunity to collect detailed data which may add weight to the deductions previously drawn.

## TWO RECENT EXPLOSIONS

On Jan. 29, at the Stuart mine in Fayette county, West Virginia, occurred one of the most serious disasters recorded in recent years. The terrific force of this explosion was probably due to the presence of inflammable dust, for which this field is famous. The accident, however, was probably initiated by the firing of a quantity of gas.

As to the action of the barometer at this mine, the rough figures will sufficiently explain: On Jan. 26 an area of rising barometer was moving toward this district, and on the 27th and the morning of the 28th the barometer had risen from 30.16 to about 30.55. The pressure fell during the day; the explosion happened in the afternoon. Late that same night (the 28th) the barometer had fallen to 30.29.

Early on the morning of Feb. 4, at one of the Davis Coal Company's mines, near Thomas, West Virginia, another serious explosion occurred, resulting in the death of many miners. The barometer on Feb. 2 was 29.82; the reading at 8 a.m., Feb. 3, was 30.16; the pressure at 8 p.m. on Feb. 3 had risen to 30.41; on the morning of the explosion, Feb. 4, there was a release in pressure, the barometer dropping to 30.29, while on the following day the barometer readings showed a pressure of 29.92. Basing conclusions on the foregoing data, it seems reasonable to believe that both these explosions were largely influenced by atmospheric pressure.

## ARGUMENTS AGAINST THE THEORY

The principal argument contradicting the connection between barometric pressure and the increased outflow of gas in a mine, thus causing an explosion, is based on the fact that a mine fan creates artificial pressure in the workings, and that atmospheric changes are secondary to the fluctuations caused by the mechanical ventilator. Observation seems to show that, although the pressure in a mine is

somewhat different from that outside, the variations in this pressure, both underground and on the surface, are uniformly the same. Several conditions act to cause this difference in underground and surface pressure; one important influence is due to the loss of moisture sustained by the intake air as it passes along the main airway, the moisture being taken up principally by the dust accumulated on the sides and roof of the gangways.

With a fan running at a constant speed, as is usually the case, it is evident that the heavier the air, the more its tendency to drag and the greater the friction along the airway. Although greatly exaggerated, we might compare the flow of heavy dry air in a mine to the movement of molasses (eliminating the quality of viscosity) when pumped through a pipe. Also the travel of light air with much humidity could be likened to the flow of water when pumped in a similar manner; in the former case it is plain that the pressure on the sides of the containing pipe would be greater.

## GALLOWAY'S OBSERVATIONS

An important research dealing with the relation of gas outflows and barometric pressure was made some years ago by Professor Galloway and Robert Scott, in Great Britain. The results were published in the *Quarterly Journal of the British Meteorological Society* for October, 1874. The total number of explosions under observation was 294, while the number of lives lost was 163. The following table based on the data collected shows concisely the part played by atmospheric pressure in precipitating explosions:

Year.	Total Number of Explosions	Percentages Due to Changes in		
		Pressure.	Temperature.	Other Causes.
1868-70	550	49	22	29
1871	207	55	19	26
1872	233	58	17	25

The more important of the conclusions and advance opinions drawn from these investigations follow:

First, it is the initial disturbance of pressure after a period of high barometrical readings that causes most explosions.

Second, the atmospheric changes which occur on a Sunday, when the mines are idle, cause an exceptionally dangerous state, when the workings are entered the following morning. This accounts for some of the fatal explosions which have occurred on Monday mornings.

Third, the areas of barometrical depression are usually more or less circular in shape, and vary in diameter from 50 to perhaps several hundred miles. Over the whole region covered by such a system of depression, the barometer falls according to the character of the disturbance, and according to the position of the respective station or colliery, as the case may be, with regard to the path taken by the center of the storm, or points of lowest pressure; the fall being necessarily greater the more central the situation of the mine.

Fourth, all motion of the air takes place between areas of low and high pressure, termed respectively "cyclonic" and "anti-cyclonic." The air is either whirling into a cyclonic area, or whirling out of an anti-cyclonic area. It is evident, therefore, that a southerly wind may make its appearance either on the east side of a cyclonic area, or on the west side of an anti-cyclonic area. In the former case, it will be accompanied by a low and falling barometer, a high temperature and a large amount of moisture in the air; while in the latter case, the several conditions will be more or less directly reversed.

Fifth, the examination of the reports of any single mine in which fire-damp is found only occasionally, appears to show that the gas comes and goes in a seemingly unaccountable manner; and when the variation of the barometer during the period over which the report extends has been carefully studied beforehand, it is found that sometimes a sudden fall of atmospheric pressure has taken place without causing gas to appear, and sometimes gas has suddenly appeared in considerable quantity when the pressure was high and steady. If, however, the reports of a number of mines are placed side by side, so as to eliminate the influence of local causes as far as possible, and compared with the state of the atmospheric pressure during the period to which they refer, it is found that there is a remarkable correspondence between the appearance and disappearance of fire-damp and the fall of the barometer.

The results of Mr. Galloway's observations are shown graphically in Figs. 1 and 2 which accompany this article. These diagrams seem to prove conclusively the coincidence between the recorded explosions and the changes of pressure and temperature.

The diagram shown in Fig. 1 may be interpreted as follows: The dark line is the curve of the barometer, the faint line that of the thermometer. The explosions

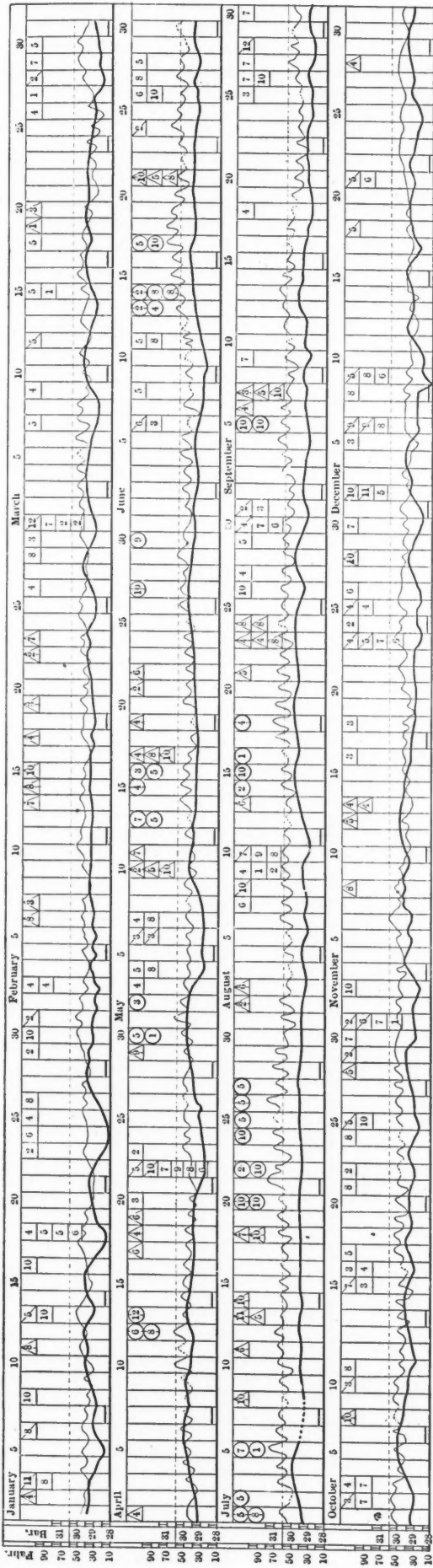


FIG. 1. COLLIERY EXPLOSIONS COMPARED WITH THE BAROGRAM AND THERMOGRAM

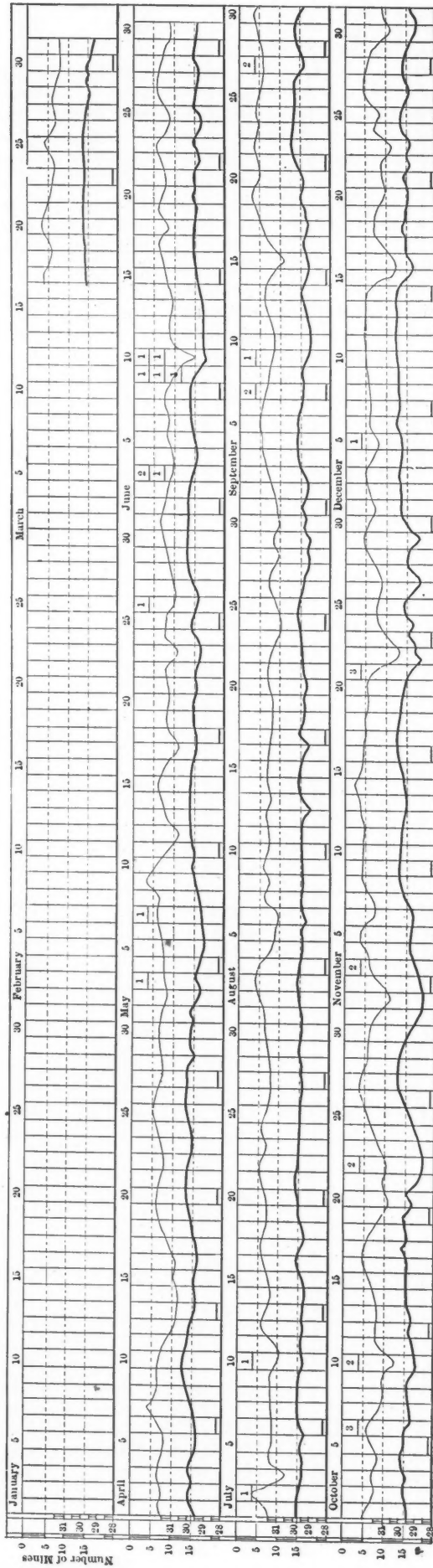


FIG. 2. THE BAROGRAM COMPARED WITH THE OCCASIONAL APPEARANCE OF FIREDAMP IN 35 MINES

due to a fall of the barometer are shown by squares, while the district in which the respective explosions occurred are indicated by figures. The explosions which are apparently due to a rise of temperature are shown by circles. Those accidents which are not caused by either agency are shown by triangles. The bar across the symbol for an explosion indicates that it was fatal. Sundays are marked by a line near the base of the diagram.

It will be noticed that the sudden fall of the barometer on Jan. 18 produced four explosions on the 19th, while the more gradual depression of the 24th caused four accidents distributed over as many successive days. The barometric depression at the end of February resulted in four explosions on March 1, while the general depression on the 21st of April was followed by six explosions on the 22d. These latter explosions, occurring on Monday morning following the atmospheric changes of Sunday, go to verify the statement previously made.

The data from which the chart in Fig. 2 was made were taken from the report books of 35 coal and iron-stone mines in the coal measures. The investigators rejected 59 other books that were thought unadaptable because fire-damp was mentioned as being always present, or as only occurring at long intervals.

A glance at the diagram is sufficient to show that notwithstanding the want of care with which many of the earlier reports were made up, the curve of fire-damp for the first 5½ months from the beginning rises and falls to a certain extent with the barometric curve; but it is believed that the correspondence between the variations of the two curves during the last four months is so unquestionably apparent as to prove conclusively that the variations of atmospheric pressures have a marked influence on the rate at which fire-damp escapes from the fissures.

An investigation was carried on which covered the circumstances under which twenty non-fatal explosions and one choke-damp accident took place in mines whose reports are embodied in the chart. Each accident has been entered at its proper date in the diagram, and is represented as a square, with the number of men injured marked on it. Two of the accidents—May 7 and Nov. 2—took place on the second day after the barometer had reached its lowest point, and was again rising; 13 took place when the barometer was falling fast, and the remaining 6 when the decrease of pressure was only slight.

#### THE ACTION OF OCCLUDED GASES

In considering the foregoing facts two incidents showing the peculiar action of those gases occluded in coal are of interest. Some time ago at one of the Delaware, Lackawanna & Western Coal Company's collieries, a miner entered a

pocket, where the coal was dumped after being mined, and previous to loading into the railroad cars. The workman carried a lighted torch, which fired a quantity of gas which had accumulated; he was severely burned by the explosion which followed. In another case, experiments were being carried on to determine the specific gravity of a certain coal, and the difference shown by the results obtained caused more careful investigations to be made. A quantity of finely powdered coal was placed under a hood, closed securely airtight, and connected with a vacuum pump. It was found that under the hood a quantity of gas would still accumulate which was undoubtedly released by the powdered coal. These experiments go to show in what close confinement the gases in certain coals are held.

When experiments carried on in a practical way at certain mines have been completed, it is to be hoped that further conclusive data will be available, and will help to clear away many of the disputed points. In the meantime superintendents, managers and engineers who are interested in the investigations should frankly express their opinions. A discussion of experiences would certainly prove of great value at a time when efficient remedies are sorely needed.

### Air-tight Dam for Underground Mine Fires\*

By M. DELAFOSSE

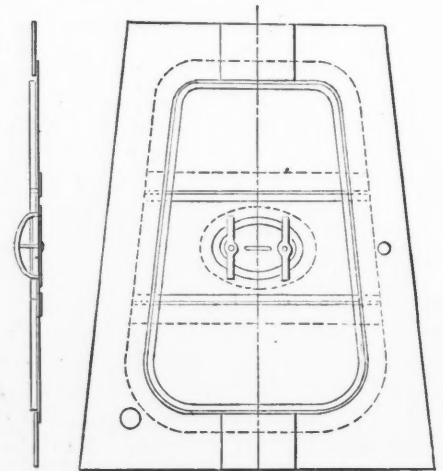
The frequent occurrence of fires in coal mines, has made it necessary to provide proper means for sealing off the affected portion of the workings; in carrying out this work, the stopping that is built should not only be of a permanent character, but it must also be installed easily and rapidly.

The dam, shown in the accompanying illustration, consists essentially of two portions, one fixed and the other movable. The fixed part comprises a trapezoidal frame of boiler-plate about 12 mm. in thickness, measuring for the main entries 1.40 m. in width at the top, 2 m. at the base, and 2.40 m. in height. The frame is provided with an opening, of similar shape, but with the angles rounded, 1 m. wide at the top, 1.30 m. at the level of the floor, and 1.80 m. high. This opening is for the purpose of allowing traveling to continue on the road with the frame in position, an arrangement which may be advisable in seams likely to fire. In such a case the frame is installed in a groove in the side, floor, and roof of the gallery varying from 0.15 m. to 0.20 m., care being taken to choose points where the surrounding strata are of a solid character.

The center portion fits into the opening in the frame, and is secured by butt joints. It is locked by means of bolts and ren-

dered airtight by the application of red lead, after which the frame is reinforced by means of quick-setting cement. Should it be necessary to isolate the district, the three sections comprised in the movable portion of the dam can be fitted and secured in the frame in a very short space. Each of these three sections is constructed with flanges on the inner surface, extending 12 cm. in each direction; they are further reinforced round their outer circumference by angle irons 40x40 mm., destined at the same time to contain the mastic material by which an airtight cover is provided.

Each section is 0.60 m. in height, the middle section being inserted last of all and secured by means of a butt joint, 0.10 m. in height, on the sections already placed in position, the workmen up to then being on the inner side of the dam in order to place the bolts in position. The center section is for this purpose provided with



ELEVATION OF AIR-TIGHT DAM

a man-hole 0.50 m. by 0.35 m. to provide an exit for the men after this has been effected. It is then locked in position by a self-closing plug similar to that employed in steam boilers, and finished off with a mastic joint.

The dam can be provided, if necessary, with two holes as shown in the illustration, the upper hole to enable the introduction of compressed air to force back the noxious gases; the lower hole to permit the passage of water until the dam is finally closed. The holes are then plugged off.

For a gallery 1.70 m. in height, using, in the construction of the frame, plates 12 mm. in thickness, and in that of the inner sections, plates 8 mm. in thickness, a total weight of about 412 kg. of iron will be used. It is believed that the dam can be secured in position, under the most adverse conditions, in the space of five or six hours.

The British consul at Tunis calls attention to the importance of iron-ore deposits in that country.

\*Abstract of paper read before the Société de l'Industrie Minière, Paris.

# Use of Electricity in Anthracite Mining

Considerable Saving of Power Results From Use of Series and Parallel Controller; Rheostat Does Not Overheat and Life is Prolonged

B Y H . M . W A R R E N \*

## THE WOODWARD MINE INSTALLATION

The electrical equipment of the Woodward mines at Kingston, Penn., which is a typical example of an isolated direct-current station, is so arranged that bare copper cables run from the feeder panel of the switchboard on poles for about 400 ft., where they connect to lead-covered paper-insulated cables suspended in a borehole. These cables loop in at each vein to a dry place, where they are connected to distributing bus bars from which the various feeders are controlled. The combined weight of the cables in this borehole is approximately seven tons.

\*Electrical engineer. Delaware, Lackawanna & Western Railroad Company, Scranton, Penn.

The electrical equipment in the mine consists of ten electric locomotives, nine electrically operated hoists and six electric pumps. The total rated h.p. is 1796. Two types of locomotives are used, one weighing about 13 tons, the other about 6½ tons. The heavier one is equipped with two 50-h.p. (railway rating) motors controlled by series and parallel controller. It will develop a drawbar pull of 4500 lb. at a speed of about 7½ miles per hour when the motors are operated in multiple and 5200 lb. for a short period with the rails sanded.

When the motors are operated in series the speed is approximately 3.2 miles per hour at the rated drawbar pull. The use of a series and parallel controller elimin-

ates a considerable loss of power which would otherwise be lost in heating the rheostats when it was necessary to operate at half speed or lower, and therefore increases the life of the rheostats. These locomotives are used for long and heavy haulage on the main gangway.

## GATHERING LOCOMOTIVES

The 6½-ton locomotive is equipped with two 25-h.p. (railway rating) motors with series and parallel controller, and, in addition, has an automatic reel device, which is used when the locomotive collects from and delivers cars to the chambers. Lightweight rail, usually about 25 lb. to the yard, is used in the chambers, but no trol-

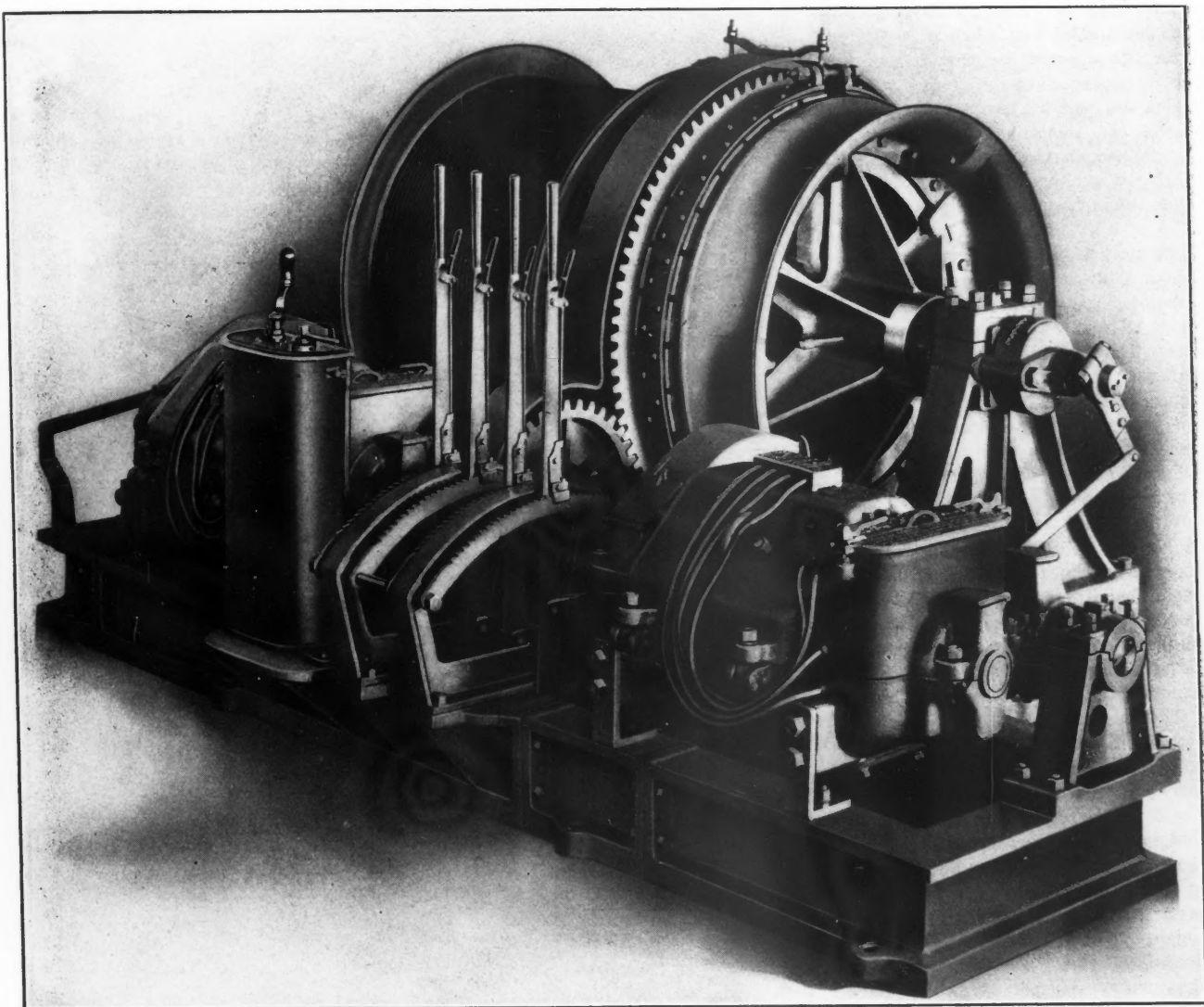


FIG. 1. DOUBLE-MOTOR HOIST



FIG. 2. GATHERING LOCOMOTIVE

ley wire, as the cable on the reel is used instead. This reel contains about 500 ft. of insulated cable and when it is desired to run into a room the free end of the cable is hooked over the trolley wire in the gangway and the locomotive runs into the chamber, unreeling the cable as it goes. When the locomotive comes out, the cable is automatically reeled up.

This locomotive will exert a drawbar pull of 2500 lb. The speed with the motors in multiple is approximately 7 miles per hour at the rated drawbar pull. With the motors in series the speed is approximately 3.8 miles per hour and the momentary drawbar pull with the rails sanded about 2700 lb. Fig. 2 shows this type of locomotive.

The first gathering locomotive of this type was installed in the Cayuga mine of the Lackawanna Company, in June, 1902, where it was given a thorough trial. The results were so satisfactory that orders were placed for others, and this company has now about 80 of them in operation.

As an indication of what may be expected of them in actual operation, the conditions under which two of these are working will not be out of place. One is handling the cars between the foot of the shaft and a branch about 4000 ft. away, and distributes the cars to twelve chambers, some of which vary from 5 to 17 per cent. to the rise, and others  $8\frac{1}{2}$  per cent. to the dip. Five cars are delivered to each chamber per day.

The other locomotive handles the cars from 15 chambers, the grade of which varies from 2 to 6 per cent. to the dip. At night this same locomotive tends twelve of the above places.

The maximum grade on which these locomotives have been used is 17 per cent. If the grade exceeded this, there

was danger in operating the locomotive due to the fact that if the power was shut off, the motorman was likely to set the brakes too hard and skid the wheels, causing a runaway.

#### ELECTRIC HOISTS

Electric hoists are of various sizes and makes, ranging from 25 to 200 h.p. capacity. When operated by direct current,

a railway type of motor is used as the load is intermittent and the series motor is particularly adapted for the duty it has to perform. When the station capacity is reasonably large, hoists up to 80 h.p. are usually equipped with one motor; while, for larger capacities, two motors are usually employed, with series and parallel controller, owing to the small current required when starting the load and making up trips. After the trip is started and up to speed, the motors are thrown in multiple and the resistance gradually cut out.

In changing from the series to the parallel position, however, the circuit is not broken entirely, but one motor momentarily carries the entire load to prevent too great a strain on the rope due to the sudden change in speed which would otherwise occur. Figs. 6 and 7 show typical single- and double-motor hoist equipments. The rope speed is usually from 450 to 500 ft. per min., but in hoists used for sinking slopes when few cars are to be handled per day, it is desirable to use a lower rope speed, thereby reducing the h.p. of the motor required.

According to a statement in *Fuel* of Feb. 5 and 7, the recent coal famine has made it evident that railroads in the Northwest cannot depend upon private capital to develop coal properties from which to supply the railroads with fuel. Prospecting parties have shown that the Harriman and St. Paul systems penetrate rich coal fields, and probably these roads will go into the coal-mining industry.

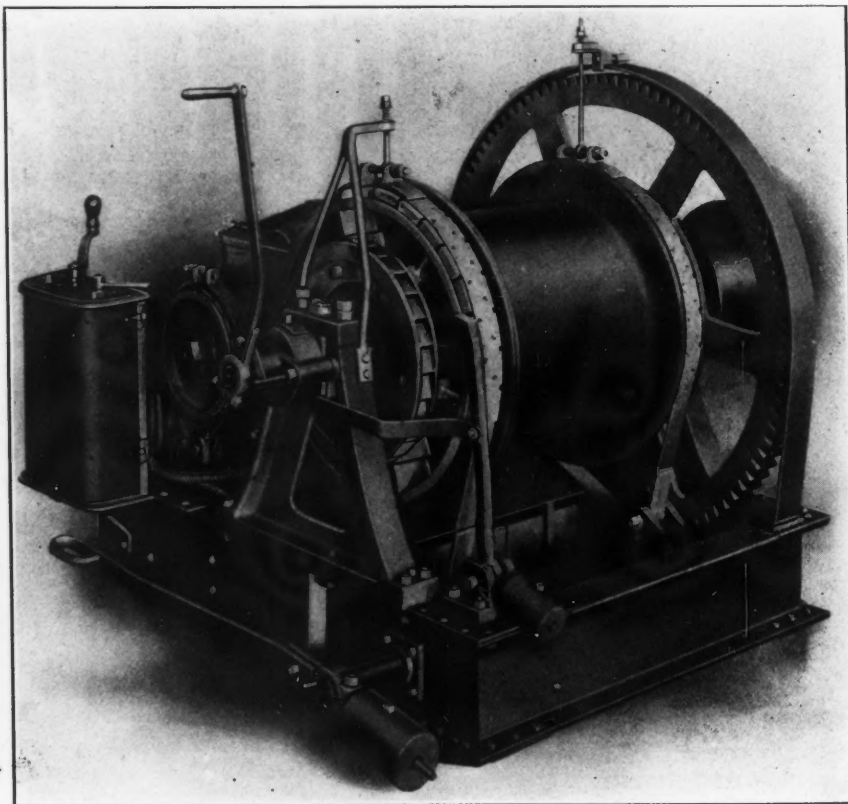


FIG. 3. SINGLE-MOTOR HOIST

### Allis-Chalmers Electric Hoist

The Allis-Chalmers Company has recently put upon the market a line of standard electric hoists designed to work under approximately the same conditions as its well known small steam-driven hoist. The single-drum electric hoists are of 15, 25, 35, 50 and 75 h.p. capacity, and double-drum hoists are made in 30, 50, 75, 100, 125, and 150 h.p. sizes.

The drum, or drums, and motor are mounted upon a bed plate of box section, with broad bearing surface on the foundation. The bearings are carried on pedestals cast in one piece with the bed plate. The bed plate and pedestals are of cast iron, and of ample proportions to withstand the shocks and strains incident to rough usage. The bearings of each hoist are all of the same length and diameter, lined with babbitt metal.

The drum runs loose upon the shaft and is made in one piece, of cast iron. The

movable end of the band is actuated by a simple arrangement of toggle lever, motion to which is imparted by a collar sliding on the drum shaft and controlled by the operator's hand lever. When the clutch is thrown in, the band is tightened around the drum shell by the toggle motion, and the pull of the rope on the drum tends to still further tighten the grip of the band on the shell. Both band-friction clutch and band brake are hand operated, the operating levers being provided with quadrants and locking pawls. Both drum and intermediate shafts are made extra large in diameter.

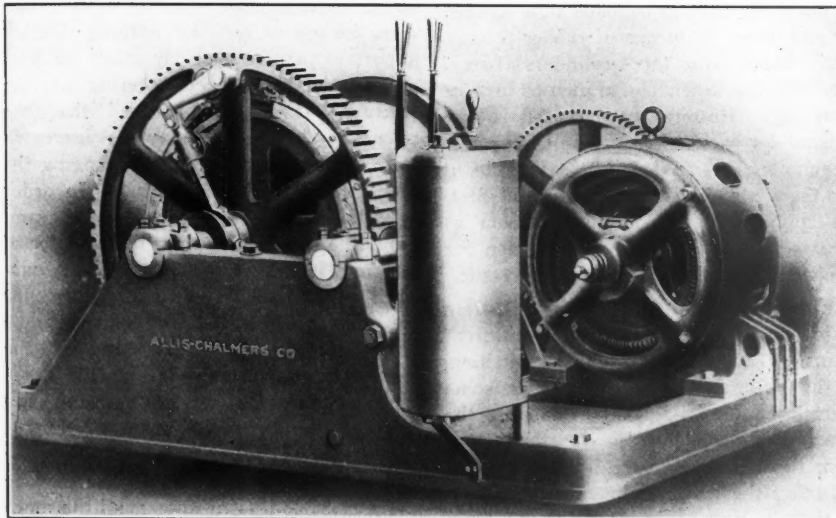
The gears are cast of a special mixture of iron with heavy rims, arms and hubs. The pinions are of cast steel. The teeth of both wheels and pinions are cut. When desired, the pinion on the motor shaft will be made of rawhide. For driving, either direct or alternating-current motors wound for the usual voltages are used,

anthracite region to establish such a fund, and, if successful, it will, no doubt, be followed by many others throughout the region. That such a fund is sorely needed goes without debate, but hitherto there has always been difficulty about the sources of revenue.

Efforts have been made from time to time to secure some legislation to tax coal to provide a revenue, but this failed. The Erie company has arranged to pay into the treasury an amount equal to the contributions of all the employees, or in other words to subscribe one-half of the revenue needed. The plan has been well received and the principal feature is that every employee shall pay into the fund, whenever a call is made, a sum equal to one day's earnings, and at the same time the company shall pay in a sum equal to all that paid by the men. Whenever this money is exhausted by the payment of relief funds another call is to be made, so that no more money will be raised than will be actually needed. Every employee is eligible to membership, but no one will be entitled to benefits unless he has contributed to the last call made.

The relief proposed is as follows: In case of death following an accident, \$75 shall be paid for funeral expenses, and \$3 per week shall be allowed the widow for the period of one year, provided that she remains unmarried during that time, and \$1 per week shall be paid for each child under the age of 14 years for the period of one year. In case of injury following an accident while at work, the rate of relief will be as follows:

Persons who are paid 15c. an hour shall receive \$1 a day during the period that relief is allowed, and those earning less than 15c. an hour shall be allowed 50c. a day. There are other interesting features. The Erie company was the first to organize the first-aid societies which have been so successful in the anthracite region.



ALLIS-CHALMERS SMALL ELECTRIC HOIST

spider hubs are fitted with bronze bushings, which can be readily replaced in case of wear. The drum spiders have strongly ribbed arms, and the drum shell is reinforced by deep circular ribs. The hole in the shell through which the rope passes for fastening has a long radius curve, thus avoiding any sharp bend in the rope and doing away with rope breakage at this point. The face of the drum is straight, and the flanges are of ample depth.

The brake is of the steel-band type, with wide face, and is provided with turnbuckle adjustment for taking up the wear on the brake blocks. One end of the brake band is anchored by eye bars around the operating shaft, and the other end has a turnbuckle attachment to the lever on the operating shaft controlled by the operator's hand lever.

The main gear, keyed on the drum shaft, forms the driving member of the clutch, which is of the band-friction type. The fixed end of the band is anchored to the driving gear and has suitable adjust-

and if alternating current, either 25-cycle or 60-cycle machines. The controllers used are of the drum type, similar to those in common use in street-car service. On all single-drum hoists the motor is not reversed, but on double-drum hoists the handle or lever of the controller not only controls the speed but also reserves the motor, and is locked in the off position. The controller is attached to the frame of the hoist.

### Coal Miners' Relief Fund

For many years operators and miners in the anthracite region have been discussing the organization of a miners' relief fund. The first step was taken this week by the Erie company, which controls the collieries of the Pennsylvania Coal Company and the Hillside Coal and Iron Company, the statement of the plans and methods of operation having been made public. This is the first real effort in the

### Canadian Pig Iron

The following table, prepared by the American Iron and Steel Association, gives the total production of pig iron, including spiegeleisen and ferromanganese, in Canada, from 1894, in gross tons:

1894.....	44,791	1901.....	244,976
1895.....	37,829	1902.....	319,557
1896.....	60,030	1903.....	265,418
1897.....	53,796	1904.....	270,942
1898.....	68,755	1905.....	468,003
1899.....	94,070	1906.....	541,957
1900.....	86,090		

During 1906 Canada had 13 furnaces in blast. In the first half of 1905 it had 13 furnaces in blast, and during the last half of the year 12 furnaces. It will be observed that in the two years from 1904 to 1906 the production of pig iron in Canada more than doubled. The average output per furnace for the year 1906 was 41,689 tons.

## COLLIERY NOTES

### Detail's in the Operation and Development of Anthracite and Bituminous Mines

This page of Colliery Notes has been published weekly in the JOURNAL for nearly a year, and from the expressions of opinion that we have received, we feel that it has fulfilled the purpose intended. We realize that many of the ideas advanced herein have not met, and could not meet, with the unqualified approval of every reader, and consequently we have welcomed comment and criticism when there has been a difference of opinion. We hope that our readers will continue to favor us with their criticisms. Much of the information which has been presented in this department has been collected first-hand at the mines. We feel that the department would increase in importance if the mine foremen, superintendents, engineers, and managers would send us brief notes describing any new idea or successful methods which come under their observation. As a new feature, we shall publish as colliery notes, brief answers to practical questions in coal mining, when such are suitable for this page.

It would be well if all safety lamps were so constructed that they could not be put together, ready for use, unless all the gauzes were in. The fault here lies in the fact that such lamps generally have bonnets or shields, and if a gauze should be left out after cleaning, the defect may not be noticed, and the lamp taken into the mine, at the risk of causing a serious explosion.

In fighting a mine fire, each man should be provided with a lemon or two (not one of the kind now being handed around, but instead, the real fruit) and when he feels he is being affected by the gas, should cut a slice off each end of the lemon, and suck the juice; in this way, he can proceed with the lemon held over his mouth, as breathing through the sour moist pulp seems to purify the air inhaled.

Carbon dioxide gas in a mine is one of the most difficult gases to remove from the workings. It is formed principally by the combustion of illuminants, the respiration of men and horses and by the rotting of mine timbers. This gas is about one-half again as heavy as air, and therefore tends to accumulate in the low places or dip workings of a mine. The fortunate conditions connected with the presence of this gas are its peculiar taste and its inability to support combustion. These evidences largely eliminate its dangerous qualities, as the men are sufficiently warned to escape in time.

Among the many advantages resulting from splitting the air current, may be mentioned the fact that by this method a

greater quantity of air can be propelled by a given power. When splitting the air is resorted to the rubbing surface is increased, and as a consequence, the pressure, which varies directly as the rubbing surface, is also slightly increased; on the other hand, splitting the current will reduce the velocity with the same pressure, and since the pressure varies in proportion to the square of the velocity, the reduction in this latter element more than balances the effects of the increased surfaces of contact.

In providing for the safety of men, some of the larger mines of Austria have prepared a so called safety chamber underground, which is a strongly constructed retreat having a single entrance with a door that can be made tight against air and water by means of rubber fittings. Each chamber has three cylinders of oxygen, sufficient to enable 30 men to breathe three days. Respiratory apparatus is here at hand for parties leaving the chamber to reconnoiter or signal. In the safety chamber there are foods, medicines, and first-aid appliances. The standard room as here built will accommodate 24 men for a reasonable time while awaiting rescue.

In the anthracite field where it is often customary to work several different seams, or where the coal bed is pitching, so that it must be worked in lifts, some operators follow the plan of tapping the water in the upper vein to the lower seam through large bore holes, and thus collecting the water in one general sump, so that it may be handled by the main pumps. This method saves the cost of installing several underground pumping plants, besides reducing the cost of maintenance; however, such a system frequently overburdens the pumps besides requiring the consumption of an enormous amount of steam to lift the water to a greater height.

One ton of anthracite or good bituminous coal is equal to about one and one-half cords of dry mixed wood, chiefly white oak. It requires about two cords of soft wood, such as yellow and white pine, hemlock, etc., to equal one ton of anthracite coal. Some of the western bituminous coals are so inferior as a fuel, that a ton of the coal is hardly equal to a cord of average wood. Dry white oak weighs 3500 lb. per cord, or one and a half tons, while a cord of dry white and yellow pine or hemlock only weighs about nine-tenths ton. Perfectly green wood just cut weighs one-fifth to one-quarter more than partially dry wood. Green wood as a fuel results in a great loss of heat.

One of the problems that has puzzled many mining men is the continued upheaval of the bottom of some of the gangways in the mines of many districts. At one anthracite mine, for several months past, the mine officials have been confronted by the problem of having the floor in one of the haulways continually being forced or squeezed up, the rise often amounting to several inches during the night. It has generally been thought that the upheaval of bottom in such cases is due to the pressure of the overlying strata on the surrounding pillars, or to the action of water; careful investigation has led to the belief that in many instances this bulging or raising of the entry floor is due to the great pressure of the gases contained in the strata underlying the coal seam.

In the use of concrete nothing is more important than to properly select the proportions of the elements entering into the mixture. It has been proved that the strength of concrete may be increased fully 100 per cent. by simply changing the proportions of sand and stone. In order to obtain satisfactory results the sand should be so screened that the diameter of the largest grains will not exceed one-tenth of the diameter of the largest stone; the stone should also be required to be of one size. The larger the stone used the coarser the sand must be; on the other hand, when small stones are used the sand must be fine and a larger proportion of cement must be mixed. Investigation shows that the denser the concrete the less permeable it is to water, and the more durable it is. Practical experiments indicate that generally the proportion of cement to sand and stone should be as 1 to 2 to 6.

In underground surveying, the work is rendered more difficult by the darkness and the dirt present. The liability to error being thus increased, the practice of having each measurement checked is advisable. In carrying out this plan, the rear-chainman, back-sight, or transitman, as the case may be, holds the zero mark of the tape, or some even foot, at the station or instrument head; the fore-chainman or fore-sightman, catches the measurement; this reading is recorded by the front-chainman, after which the tape is again stretched and the measurement caught at the transit or point where the instrument is set up. The recorded measurements are not compared until the day's work is completed, or at least until both parties have written the figures. This system not only eliminates the frequent errors of measurement that occur, and the consequent re-running and re-calculating that ensue, but requires at a maximum not more than from 25 to 35 min. per day.



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## Mine Inspection in Pennsylvania

A bill making any person holding a certificate as mine foreman eligible as a candidate for the office of mine inspector is about to be introduced at Harrisburg by a representative of the miners of the anthracite region. The proposed legislation, so directly affecting the interests both of operators and miners, is bound to become a topic of serious discussion. Before entering into the merits of the question it is necessary to explain the present method of appointing the mine inspectors, and the limitations in the exercise of their duties.

Formerly the mine inspectors were appointed by the Governor from a list of eligibles, but under the present law the office is elective. The judges of the county courts appoint examining boards, composed of three reputable coal miners in actual practice, and two reputable mining engineers. These boards conduct examinations of candidates for the eligible list. For admittance to this examination, the law requires five years' actual experience in the mines, and previous employment in mines which are subject to noxious and explosive gases. The nature of these examinations is thoroughly practical. The applicants who answer successfully 90 per cent. of the questions are given certificates of competency, and then become eligible for nomination for the post of mine inspector in the regular political way. The law requires that the examinations be held each year, at least six months before the date of the general election in November.

Certificates of eligibility for employment as mine foreman are issued in a similar way, but although the law requires that mine foremen also shall have had five years' practical experience in the mines, including experience in gaseous mines, the examination for such qualification is much less severe than for the office of mine inspector. Obviously, the enactment of the proposed law would further let down the bars which safeguard the important office of mine inspector by making it more generally elective than it is at present.

It was a great mistake ever to make this office elective. Even under the present conditions, the inspectors are hampered by political influences, which prevent them from doing their duty thoroughly, and in the way they would like to, if let

alone. In so far as the operators interfere in that way, they are severely culpable, and shortsightedly act against their own best interests, as well as those of the miners whom they employ. However, it is the miners who are most directly concerned, because while the operators are risking only their property, the miners are risking their lives.

The present movement originated among the miners themselves. Nothing could be more mistaken. Instead of cheapening the office of mine inspector, and rendering it more subject to political influence than it is even now, their own best interests demand that they advocate an increase in the dignity and power of the office. If there be any office which ought to be removed entirely from the political field, and put under strict civil service rules, it is that of mine inspector, upon whose ability, intelligence and faithfulness the safety of life and limb of many thousands of workers depends.

We do not believe that the majority of the miners of the anthracite region desire the change in the law which is now advocated. They are being misled by self-seekers. They should unite in demanding the withdrawal of the present project, and in its place they should demand a law which will improve the ability of the mine inspectors to care for their own interests. Their own honest leaders will give them the same advice.

## How Metals are Sold

We have received inquiries as to the manner and terms of selling the important metals, other than iron and steel. We have many times printed articles on these subjects, but as new persons are constantly coming into the business, who are unfamiliar with it, there is ample reason for republishing information that is well known to the majority.

Gold is, as is well known, the standard of value, its price being fixed at the British Mint at 77s. 10.5d. per oz. troy of 0.925 fineness; and at the United States Mint at \$20.6718 per oz. troy. These mints receive unlimited quantities at those prices. However, there is nothing to prevent a private banker from bidding higher, if he chooses. Of course, no one will pay much above the coinage rate, because gold can always be obtained from the mints on the basis of 77s. 10.5d. and \$20.6718 per oz.

respectively, but gold coin loses something by abrasion and is subject to further loss in shipment, wherefore there is a margin for bidding on gold bullion. In December, 1903, the price for gold bullion was 78s. 0.5d., the highest of recent years. Shipments of bullion to London by the gold-mining companies are received by their banks. On the day of arrival, bids are asked from the Bank of England and from foreign banks which may want the gold for export. The highest bidder gets it. The market for gold is intimately associated with the banking transactions whereby international balances are settled. In the purchase of ores, and for all ordinary purposes, gold has only the fixed coinage value.

The silver market is also intimately connected with banking transactions, large exports being made from London to the far East in settlement of balances. The silver market of the world, more than any other metal market, is determined by London. The silver brokers of London meet daily at 2 p.m. and fix a price for that day. They are bound to sell at the price thus fixed any quantity required, but are not bound to take any quantity that may be offered. If the quantity offered is more than can be disposed of, it necessarily goes over to the day following and then has an effect in fixing the price for that day. The London quotation is for standard silver, i.e., 0.925 fine.

The New York price for silver fluctuates generally in correspondence with the London price, being lower than the London price by an amount representing commissions, expressage, insurance, interest and other charges between the two markets, and also is affected by fluctuations in the rate of exchange. Occasionally the New York price foreshadows the London price for the following day, wherefore the difference between the two markets is not absolutely constant. The New York price is established by the firm of Handy & Harman, which handles the great bulk of the silver bullion business of the United States, most of the large refiners selling their product through it. Silver is commonly sold in ingots a little upward of 1000 oz. in weight, 0.999 fine, for cash, immediate delivery. The quotation above referred to is frequently called the "official price," and is commonly adopted in business and by the press and is the quotation which is published in the JOURNAL. Occasionally there are quotations for "com-

mercial bars," which are a little higher than the "official price." These represent the retail business that is done with jewelers, manufacturers of silverware, etc., a business into which the large refiners do not enter. The large transactions in silver are rather complicated, and as stated above, are closely involved with banking. This is illustrated by the transactions of the U. S. Mint in 1906, when it purchased 6,158,725 oz. of silver. Before inviting tenders publicly, last August, the Treasury Department, anticipating that such invitation might have an effect upon the market, bought about 2,500,000 oz. on the London market for future delivery. These purchases were afterward exchanged for metal in this country, which was delivered at the several mints as required. The remainder was purchased directly in this country. The American purchases cost, in lots of about 100,000 oz., from  $\frac{3}{8}$  to  $\frac{1}{2}$ c. more than the quotations for the same day. However, the prices paid by the Government included delivery, and also interest which sellers have to reckon on account of delay in securing Government settlements.

Because of the fact that about 70 per cent. of the world's output of copper is produced in North America, the New York market is the leading and governing one in this metal, although it is always strongly influenced by the London market, inasmuch as a large part of the American production is sold for export. Practically all of the copper produced in North America is sold by seven concerns, but of these two are extremely small factors. On the other hand, the great bulk of the domestic consumption is by a few manufacturing concerns. Under these circumstances, the transactions are generally in large lots on a contract basis. There is no business to speak of done on any metal exchange, and little or no speculative business done in any way. Small requirements for copper are supplied by brokers, who purchase from the large selling agencies, and do a retail business, so to speak, which is quite distinct from the great wholesale business.

The quotations which are reported in the JOURNAL represent the bulk of the transactions as made with consumers, basis, New York, cash. The quotations are based on transactions which represent a very large proportion of the total copper sold. No distinction is made among copper sold as "spot," "prompt," or

"future," but all the sales are taken as made for consumption and averaged as nearly as possible. The small lots sold at premiums figure almost disappearingly small when averaged in the great bulk of the transactions. It is aimed to represent the average actually received by the producers for their whole output, as is shown at the end of the year by their official reports. It is a common practice, nowadays, for copper to be sold on the basis of 30 days, delivered, which means that the seller pays the freight to the point of consumption and waits for the money 30 days after delivery, or else discounts the bill for cash. This is commonly ignored in many casual and inaccurate reports of the price of copper.

The spelter market is quoted in the same manner as the copper market. In the quotations for copper and spelter, two prices are commonly given, in order to represent the range of the market, but the full range is seldom shown precisely, because the mean of the figures given is intended to represent the average, which would not always be practicable by giving the extreme ranges.

Upward of 90 per cent. of the lead produced from domestic ores is refined and sold by three interests, chief among which is the American Smelting and Refining Company. The market for pig lead is largely controlled by the latter company, and at present the price is controlled by it, inasmuch as the selling price fixed by it is adopted by the other large producers. The price established by the American Smelting and Refining Company is for nearby shipments of desilverized lead in 50-ton lots, or larger. The bulk of all the lead produced goes into consumption on that basis, the large consumers making contracts for their supply and paying for it at the average of the settling prices for the month. A small amount of lead has been sold during the last year out of warehouse by independent dealers at a premium, giving rise to quotations higher than those of the trust, but the total volume of this business is insignificant in comparison with the great production of lead which is marketed on the terms stated above.

### Readers Who Will Not Read

The mail is continually bringing us letters requesting information which the writers could and should have found in

the columns of the JOURNAL. The requests frequently refer to matters which have been discussed in detail in issues less than a month old. Many will inquire about the source and scope of statistics pertaining to their own particular field of interest, when the qualifying statement sought had been placed as near the original figures as mechanical limitation would permit.

This failure to read is everywhere in evidence. Capitalists employ experts to investigate enterprises involving thousands of dollars and then calmly refuse to read the report presented, preferring to base a decision upon a few hurried verbal statements. Newspapers of sedate and hallowed traditions fairly shout at one when they have anything really important to say, and the magazines are quite as vociferous in their clamor for attention.

What is the matter with the reading public nowadays? Is the rush and turmoil of this busy age destroying the good old habit of reading, once considered the mark of an inquiring and informed mind, or are the sensational papers spoiling us all? Must everyone be coaxed, or bribed, or bullied into reading what he knows he ought to read? It is as true today as it was in Bacon's time that "Reading maketh a full man," and never has familiarity with the printed page been of greater importance to the professional worker. The technical periodicals have never offered so fine an array of practical material nor presented it more attractively than those of the present year. Yet the readers will not read.

The specialist will read—scanning every line. Those who can afford to hire specialists do not suffer. But the ordinary reader seldom knows how much directly valuable material he misses. The trouble, it seems to us, is largely the failure to recognize the technical paper as a tool of the trade.

### America Through Foreign Eyes

Observations, criticisms and comments on foreign conditions and practice are always of interest, frequently of remarkable value. Such are Mr. Bryce's work on "The American Commonwealth" and the great works of M. Leroy Beaulieu on Russia. The superlative accuracy of these and others of their class emphasizes the peculiar inability of many travelers and

writers to observe and learn the facts about the foreign countries they visit. These remarks are inspired by a paper on the treatment of zinc-lead ores, which we read recently in one of the leading French mining and metallurgical journals. The author, who is an engineer, had evidently visited America. Yet he puts on record such misinformation as the following:

"The zinc smelteries of the United States are supplied by the immense deposits of zinc ore of Joplin, Peoria, etc., in Missouri, Kansas, Illinois, Indiana, Pennsylvania, etc., and the coal fields of Pennsylvania." Further on we are told that in the manufacture of zinc oxide by the Wetherill process, the zinc oxide passing out of the furnaces is condensed in towers down which water is showered.

Many of the author's statements and conclusions as to his general subject are discriminating and sound, but how he could derive such false knowledge as that which we have cited as examples is beyond our comprehension. We wonder if American observation of things in France and Germany is equally defective. We think not. On the other hand the failure of many foreigners to learn our geography, spelling of proper names, and general conditions is a source of never ending mystification.

### Iron-mine Records

The report of individual mine shipments of iron ore from the Lake Superior region is now complete for 1906, and shows some remarkable achievements in the handling of great quantities of material. The old ranges in Michigan are less conspicuous in this respect; but many of the mines did well, considering that they are nearly all underground workings, of considerable depth.

Thus on the Marquette range, the Cleveland-Cliffs group, which includes several openings, shipped 1,339,944 tons. One other mine passed half a million, the Lake Superior, with 635,671 tons. On the Menominee, the greatest shipper was the Chapin with 943,425 tons, while three others neared half a million each—the Penn, 496,582; the Pewabic, 493,891; and the old Aragon, 431,000 tons. On the Gogebic, the Norrie group, with several shafts, sent out 1,244,468 tons, the Newport coming second with 549,745 tons. On the Vermillion range, in Minnesota, also

a district of deep mines, the big shipper was the Pioneer, with 766,853 tons.

It was on the Mesabi range, however, that the great records were made last year, when eight mines passed a million tons each. The leader was the Mountain Iron, which shipped 2,536,249 tons. The other seven, in order, were the Morris, 1,809,743; the Hull-Rust, 1,690,311; the Fayal, 1,634,853; the Burt, 1,377,076; the Mahoning, 1,274,232; the Adams, 1,238,350; and the Stevenson, 1,014,500 tons.

It must be remembered that these records are made in seven months of actual working, the mines being practically closed down through the winter. At the Mountain Iron, for instance, the monthly average reached 362,321 tons, or about 12,000 tons a day.

ROBERT N. BELL, State inspector of mines of Idaho, is exemplary for his promptness in publishing his annual reports of the mining industry of Idaho. His report for 1906 is now at hand. Other State officials would do well to imitate his policy. Information quickly available is far more valuable than ancient history, a fact which many officials lose sight of in the desire to correct figures to the last decimal, which often are incapable of absolutely correct presentation anyway. Mr. Bell's reports are admirable not only for their promptness, but also for the interest and value of the information which they give. We hope that the people of Idaho will continue to reelect him so long as he wants the post, and that the legislature of the State will promptly provide him with an adequate appropriation, which at present he has not got.

WITH A SINGULAR fatuity, the Government is going to appeal the zinc-ore case, the acting Secretary of the Treasury having given directions to that effect under date of Feb. 16. There may possibly be some question, yet, as to the dutiability of sulphide ore, but as to the status of the silicates and carbonates there can be but one decision, namely that which has already been rendered by the Board of General Appraisers. Of course, the buyers of zinc ore will go right on with their importations, as heretofore, but it would be a pity, and unfair, if in the face of the decision recently rendered the Government should go ahead levying duties and holding up the money of importers under protest.

## Canadian Mining Institute

The ninth annual meeting, as announced, will be held in Toronto, Ont., March 6, 7 and 8. The opening session will be held in the banquet hall of the King Edward Hotel, on Wednesday, March 6, at 10:30 a.m., and will be devoted to business detail. Sessions for the reading of papers will be held as follows: Wednesday, March 6, 3 p.m., and 8 p.m.; Thursday, March 7, 10:30 a.m., 3 p.m., and 8 p.m.; Friday, March 8, 10:30 a.m. The annual dinner will be held at the King Edward Hotel on Friday, March 8 at 8:15 p.m.

The following papers are announced for this session: Presidential address, George R. Smith, Thetford Mines, P. Q.; "The Iron Ores of Canada," Prof. C. H. Leith, Madison, Wisconsin; "Magnetic Separation by the Gröndal Process," F. A. J. Fitzgerald and P. McN. Bennie, Niagara Falls, N. Y.; "The Iron Ore Deposits of Temagami District, Ontario," Alfred E. Barlow, Ottawa; "Supplies and Reserves of Iron Ores," John Birkinbine, Philadelphia, Penn.; "The Geology of the Cobalt District," C. R. Van Hise, Madison, Wisconsin; "Smelting of Cobalt Ores," Hiram W. Hixon, Victoria Mines, Ont.; "The Cobalt Ores Deposits," M. T. Culbert, Cobalt, Ont.; "The Cobalt Mining District," Dr. Robert Bell, Ottawa; "Notes on Some Additions to the Map of Cobalt," W. G. Miller, Toronto, Ont.; "New Discoveries in Northern Quebec," J. Obalski, Quebec; "Microscopic Examination of Nickeliferous Pyrrhotite," Dr. William Campbell, Columbia University, New York; "The New Tilbury Oil Fields, Ontario," Eugene Coste, Toronto; "The Minerals of Alberta," D. B. Dowling, Ottawa; "Further Observations on the Copper Deposits of British Columbia, the Yukon and Alaskan Coast," W. M. Brewer, Victoria, B. C.; "The Marble Bay Copper Deposit, Texada Island, B. C.," O. E. Leroy, Ottawa; "The Geology of the Franklin District Ore Deposits, B. C.," R. W. Brock, Kingston, Ont.; "Some Notes on the Economic Geology of the Skeena River," W. W. Leach, Ottawa; "Notes on Recent Developments in Quartz Mining in the Yukon," D. D. Cairns, Ottawa; "Recent Mining Conditions in the Yukon," R. G. McConnell, Ottawa; "Canadian Graphite," H. H. Brumell, Buckingham, Que.; "Carbon Minerals of New Brunswick," Dr. R. W. Ells, Ottawa; "Undeveloped Coal Areas of Nova Scotia," Dr. J. E. Woodman, Halifax, N. S.; "Mineral Resources of the Province of Quebec," Fritz Cirkel, Montreal; "Undeveloped Mineral Resources of the Dominion," Dr. Frank D. Adams, Montreal; "History of the Bruce Mines, Ont.," H. J. Carnegie Williams, Bruce Mines, Ont.; "Ownership of Mineral Deposits," Frederick Hobart, New York; "Mining Royalties," J. M. Clark, Toronto; "Some New Points in the Geology of Copper Ores," Prof. J. F. Kemp, Columbia

University, New York; "Magmatic Waters," Hiram W. Hixon, Victoria Mines, Ont.; "The Use of Graphic Formulas in Metallurgical Calculations," D. H. Brown, Copper Cliff, Ont.; "Copper Deposits at Yerington, Nevada," E. P. Jennings, Salt Lake City, Utah; "The Status of Mining in Canada," J. C. Gwillim, Kingston, Ont.; "Reflections on Mines and Mining in Canada," N. Daru, Geological Survey, of India; "Fifty Years of Mining and Metallurgy in Eastern Canada," Major R. G. Leckie, Sudbury, Ont.; "Sir William Logan and Our Geological Survey," Dr. Robert Bell, Ottawa; "Diamond Mining in South Africa," Dr. J. Bonsall Porter, Montreal; "Electric Furnaces," Dr. A. E. Stansfield, Montreal. Other papers, the titles of which are not yet received, are promised by Frederick Keefer, Greenwood, B. C.; S. S. Sorenson, Monterey, Cal.; and W. F. C. Parsons, Londonderry, Nova Scotia.

## Osceola Consolidated Mining Company

The Osceola Consolidated Mining Company owns one of the best known properties in the Lake Superior copper district. Its report is for the year 1906. The capital stock is \$2,500,000, of which 3850 shares are in the treasury, leaving 96,150 shares, of \$25 par value, outstanding. The statement shows, as of Dec. 31, 1906, cash, accounts receivable and copper, \$1,994,985; supplies and fuel at mines, \$204,750; wood lands, \$37,309; Mineral Range Railroad stock, \$145,800; Lake Superior Smelting Company stock, \$60,000; total assets, \$2,442,844. Bills and accounts payable were \$528,780; dividend declared, \$576,900; total liabilities, \$1,105,680, leaving a surplus balance of \$1,337,164. Dividends declared during the year were \$12 per share, or \$1,153,800 in all.

The total rock stamped during the year was 1,016,240 tons, from which was saved 24,227,281 lb. of mineral. The refined copper obtained was 18,588,451 lb., or 18.3 lb. per ton of rock stamped. The total cost of mining and stamping was \$1.60 per ton; cost of stamping, 13.83c. per ton.

The earnings and expenses for the year were as follows:

	Amount.	Per Lb. Cop- per. Cents.
Copper sold.....	\$3,511,273	18.89
Interest, etc.....	136,538	0.73
<b>Total receipts.....</b>	<b>\$3,646,811</b>	<b>19.62</b>
Running expenses at mine	\$1,623,511	8.73
Smelting, transportation, etc.....	244,629	1.32
Construction expenses....	155,482	0.84
<b>Total expenses.....</b>	<b>\$2,023,622</b>	<b>10.89</b>
<b>Net earnings.....</b>	<b>\$1,623,189</b>	<b>8.73</b>

After paying \$1,153,800 in dividends, there was a surplus of \$469,389 for the year.

Improvements in progress at the mines include more systematic discarding of waste rock, and the substitution of me-

chanical haulage for hand tramping. The use of the compound stamp and re-crushing rolls have reduced the cost of treating rock.

The directors' report says: "The cost of operations has been kept down, notwithstanding an increase of 10 per cent. in labor and higher prices for all supplies. The compound stamps and re-crushing rolls have more than fulfilled all that was expected of them as to efficiency, and, in addition, the losses in the tailings from the mill have also been lessened. The percentage of copper in the rock is slightly less than for last year. This was caused through treating a poorer grade of rock, which was justified by the high price of copper.

"The fire at No. 1 shaft North Kearsarge was doubly unfortunate as it rendered useless the expensive repairs just completed, and necessitated duplicating the cost of these repairs. As these fires are liable to occur in all incline shafts through friction of the rollers used to support the hoisting rope, there is furnished a fresh argument, if one were needed, for the use of concrete stringers, for with these there would be no wood to burn in the shaft.

"An improvement long contemplated was the furnishing Lake Superior water to the Osceola mine location. This has been made possible, through an arrangement with the Tamarack Mining Company, from its Lake Superior pumping plant. The location now has efficient fire protection which was at once followed by a general reduction in all insurance rates. No heavy construction outlay seems called for during 1907."

## Mining Enterprise in Turkey

It is announced from Constantinople in *Echo des Mines*, Jan. 17, that since the promulgation of the new Turkish mining laws greater interest has been evinced by foreigners in the mineral wealth of the empire. Recently an English company purchased from a Turkish subject, extensive lead and silver mines in the province of Usknob. The seller was paid £4000 in cash and £100,000 in privileged shares of the Kraiowa Proprietary Mining Company, to be established shortly with a capital of £400,000. An Anglo-French syndicate, supported by the embassies, is endeavoring to obtain a grant of the Kesvhan collieries. The Porte at present opposes the idea for so called political and strategical motives. The collieries are near the Black sea and Russo-Bulgarian frontier. The company, however, thinks that diplomacy will be able to remove the scruples of the Porte.

F. M. Guye, in the *Northwest Mining Journal*, reports the discovery of a large body of magnetite near Snoqualmie pass, in the Cascade range.

# CORRESPONDENCE

Discussions by Our Readers of Various Topics of Interest

## Blacksmith's Forge as an Assay Furnace

A short time ago I had occasion to make some fire assays on a quartz copper-bearing ore to see if it carried any gold or silver. We had an old, home-made, single-muffle furnace, but the firebox was so small and the draft and coal so poor, that it would not get up enough heat after six hours of firing.

I therefore took a large crucible and, putting in the ore, flux, etc., placed it in the fire of an ordinary blacksmith's forge. After 10 minutes the fusion was complete and in 5 minutes more the crucible was poured. The slag was very clean and glassy and the button soft, considering the copper in the ore.

After running several crucibles, two and often three at a time, we cupeled them in an old crucible, with a hole  $\frac{1}{2}$  inch in diameter in the bottom. The crucible was placed on its side on top of the fire and half-burnt coal piled loosely over it. The hole in the bottom was to let the air circulate through as in an ordinary muffle.

Two cupels were run at a time, while the bellows were pumped to give just the heat desired. This kind of furnace is available to every prospector who has a forge for sharpening his drills. The heat can be raised and lowered at will, and a very high heat can be generated when desired.

With a pocket button balance costing from \$15 to \$20, a few crucibles, some litharge, bone ash, soda, flour and salt for a cover, a little acid and a couple of test tubes, rough assays can be made almost anywhere.

A cupel mold is handy, but not absolutely essential. Cupels can be molded by hand when necessary. A pocket button balance will weigh within  $\frac{1}{10}$  of a mg., and by using two assay tons in a charge, or combining two buttons if the crucibles are not large enough, you can come within one dollar of the gold per ton.

No prospector can make much of a hole in the ground without a place to sharpen his tools, so that an engineer can generally get a fairly good idea of the run of the ore on the spot, and this may save him the trouble of packing samples of lean ore to civilization to get it analyzed.

The pocket balance, crucibles, etc., can be packed in a small box, say a 25-lb. powder box as the largest, and even in a 10-lb. powder box if properly packed, and only a few crucibles are taken. These can

be used over again until they break. A mold into which to pour the crucibles can be made out of a piece of sheet iron, which is bent into a cone and riveted.

W. R. WADE.

Silver City, New Mexico.

## Increase of Moisture in Coke Shipped in Sealed Cars

In your issue of the 16th inst. "Steel," writing on the above subject, asks certain questions, which I take pleasure in answering in the order named:

In the test described the coke was sampled on the yard as it was drawn from the ovens, and the moisture determined in the laboratory of Dr. Henry Froehling, analytical chemist. As a further test 100 pounds of the same coke was placed on the top of a battery of boilers, and after the third day it was carefully weighed for the loss, which was less than one per cent. Upon reaching destination at Louisville, Kentucky, samples were taken from the cars before unloading, and analyzed by a chemist of Dennis Long & Co., who found 12 per cent. of moisture.

The usual laboratory methods were employed by expert chemists in both cases.

The coke was watered in the ovens and allowed to dry before drawing. The temperature of the coke when drawn, and of the ovens from which it was drawn, exceeded 212 deg., and toward the last the brick in sides and crown of ovens showed a dull red heat. No water was thrown on the coke outside of the oven, and there was no excess of water used in the oven.

Different cokes have different capacities for water, depending largely upon the cells and structure, but I should say that a lump of coke might contain 8 or 10 per cent. of moisture, and still look dry on the outside. In this particular case a test for absolute capacity was made by Dr. Froehling in his laboratory.

I have no particular theory, but merely a suggestion made in search of information.

WM. N. PAGE.

Ansted, W. Va., Feb. 19, 1907.

## State Geological Survey of Wisconsin

In the Feb. 9 number of the JOURNAL you state that Wisconsin is considering the establishment of a State Geological Survey. I wish to call your attention to a list of the publications of the present State Geological Survey, which, by the

way, is the second survey which the State has had.

This survey has been in operation for some time and is still very much alive, which is indicated by the fact that there is a strong probability that the legislature will increase its appropriation by \$20,000 per year for the extension of its work. This bill is probably what led to the error in your editorial.

W. O. HOTCHKISS.

Madison, Wis., Feb. 19, 1907.

## Rapid Method for the Determination of Iron in Slag

The following method for the estimation of iron in slag will give results in 10 minutes:

To 0.5 gram chilled slag in a casserole add 10 c.c. hydrochloric acid. Boil a minute or two to expel  $H_2S$ , stirring well to break up lumps of silica; remove from heat; add about 5 grams zinc dust; stir; add 20 c.c. sulphuric acid (1 to 5), stir well, and filter quickly through a folded filter. Dilute to 300 c.c. with cold water; add 5 c.c. syrupy phosphoric acid and titrate with  $KMnO_4$ . GEO. B. HOUGH.

Chicago, Ill.

## The Production of Mica in India

The total production of mica in India during the year 1905 amounted to 25,641 cwt., of the value of \$421,975. In the same year the exports of Indian mica rose to 133,159 cwt., as against only 18,250 in 1904. The total value of the exports, \$710,040 against \$415,915, did not rise in 1906 in the same ratio, owing to the fact that in Bengal the mica now being mined is of very inferior quality. Present production is chiefly confined to Bengal and Madras, but 2760 cwt. were produced in the Ajmere district of Rajputana during the year. Mica of fair quality has also been reported to occur in the Kishengarh State of Rajputana, but does not appear to have been mined as yet. The prevailing prices of mica in Calcutta ranged during 1906 from \$1.38 per pound for one shipment of clear ruby down to 13c. per pound for shipments of stained ruby.

It is reported in *Coal and Iron* (Jan. 23, 1907) that Cumberland coal miners from England are going to Vancouver, B.C., in large numbers to work in the mines there, the mine owners having advanced their passage money.

## Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Dr. R. W. Raymond sailed for Jamaica, Feb. 16. He will be absent until about the middle of April.

Benjamin B. Lawrence has been chosen vice-president of the British Columbia Copper Company.

Ellsworth Daggett, mining engineer, of Salt Lake City, Utah, has been visiting in New York this week.

Hudson H. Nicholson, of Chicago, passed through Denver recently on his way to Nevada on professional business.

Col. W. C. Greene has resigned from the presidency of the Greene Consolidated Copper Company, being succeeded by W. D. Thornton.

J. B. Ferguson of the Western Oil and Coal Consolidated Company, of Canada, has gone to England in the interests of the company.

Washington B. Vanderlip has left Nevada, where he has been making mine examinations, for Butte, Mont., on professional business.

T. I. Crane, of Pilling & Crane, Philadelphia, has sailed for Cuba on business connected with iron-ore deposits owned by the firm on the island.

H. Vincent Wallace left Nogales, Arizona, last week for Guanajuato, Mexico, on professional business. From that place he expects to go to Durango.

Henry Harris, who has been assistant superintendent at the works of the Hall Mining and Smelting Company, at Nelson, B. C., has resigned that position.

L. W. Trumbull, of Laramie, Wyoming, has returned from the Missouri zinc district, where he has been examining a mining property on behalf of Pittsburg clients.

Edward S. Wiard, of Wiard & Brown, mining engineers, of Denver, Colo., is at present in Mexico, on business connected with the American Smelters Securities Company.

Edward A. Nis has completed his professional work at Greenwater, Cal., and is on his way to San Juancito, Honduras, to take the position of mine superintendent for the New York & Honduras Rosario Mining Company.

H. Z. Bixler has tendered his resignation as chief engineer of the Republic Iron and Steel Company, to take effect March 1. Since his promotion to that position he has had charge of the building of the rail mill, two new furnaces, and other work in the vicinity of Youngstown, Ohio.

Samuel W. Traylor, of New York, consulting engineer for the Tri-Bullion Smelting and Development Company, left this week for a trip to the mines at Mag-

dalena, N. M., with the object of perfecting plans in connection with the operations of the company. The company intends to build large smelting works.

Dr. Howard T. Barnes has been appointed to the chair of physics in the faculty of applied science, at McGill University, Montreal, recently vacated by the resignation of Dr. Ernest Rutherford. Dr. Barnes graduated at McGill in 1893; he became assistant professor in physics in 1902, and associate professor in 1906.

Edgar A. Collins, who has been in charge of the Combination Mines Company's property, at Goldfield, Nev., as superintendent, since the purchase of the property, in 1903, has resigned, to take effect on March 1, when the active control of the property is taken over by the Goldfield Consolidated Mines Company. Mr. Collins has accepted the superintendency of the Montana Tonopah Manufacturing Company, at Tonopah, Nev., and will enter upon his new duties very shortly.

## Obituary

T. Burrell Bewick, mining engineer, of London, died recently at the age of 50. He was the son of T. J. Bewick, the founder of the firm of Bewick, Moreing & Co. He retired from that firm a few years ago.

John Ryan, who has been for some time in charge of the mining interests in Mexico owned by his father, Patrick Ryan, of Salt Lake, Utah, died at Guadalajara, recently, after a brief illness. He was 27 years old.

## Industrial

Rapid work in blast-furnace construction was accomplished by the Carnegie Steel Company in rebuilding stack No. 3 of the Duquesne group of furnaces, which was recently blown in after just 53 days of idleness. During that time the furnace was completely rebuilt. When the furnace was blown out it had been in continuous operation from the time that it was built four years ago.

In addition to building a new blast furnace at Lorain the National Tube Company will reconstruct furnace No. 2, giving the company two new furnaces out of the appropriation allowed it by the United States Steel Corporation. Work on the new furnace, which will be known as No. 5, is well under way. The National Tube Company has also started work on its new galvanizing plant in Lorain, Ohio.

The business hitherto carried on by John A. Caldwell, New York, in fuel-saving devices, has been merged into the Sarco Fuel Saving and Engineering Company. This company has been incorporated under the laws of New York, with a capital of \$100,000, to take over the American interests of Sanders, Rehders & Co.,

Ltd., of London and Manchester, England, and to manufacture on this side their various apparatus. Offices will be in the West Street building, New York. Mr. Sanders, chairman of the above-named firm, is the president, and Mr. Caldwell general manager.

## Societies and Technical Schools

*Minnesota School of Mines Society*—H. V. Winchell, geologist for the Great Northern Railway Company, delivered an address before this society Feb. 14, his subject being: "The Geological Department of the Amalgamated Copper Company."

*Engineers' Club of Philadelphia*—At the regular meeting, Feb. 16, a paper was read by Howard W. DuBois, on "Hydraulic Gold Mining in British North America." The paper was fully illustrated by lantern slides, and its presentation was followed by the exhibition of a large number of colored slides showing the scenery and characteristics of the country.

## Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

Ingersoll-Rand Company, 11 Broadway, New York. Catalog No. 46. Rand Rock Drills. Pp. 84, illustrated; paper, 6x9 in.; 1907.

The Risdon Iron Works, San Francisco, Cal. Catalog No. 17. Gold Dredging Machinery. Pp. 59, illustrated; paper, 7x10 in.; 1906.

Allis-Chalmers Company, Milwaukee, Wis. Bulletin No. 1407. The Bennetts Pouring Spoon. Pp. 4, illustrated; paper; 8x10½ in.; January, 1907.

## Construction News

*Quinnimont, West Virginia*—Coal-mining machinery will be needed by the Export Coal Company, which is preparing to open a mine. J. E. Beury, Charleston, W. Va., is president.

*Colfax, Washington*—The Gold Bug Mining Company is preparing to put in a hoist and drilling plant. L. F. Smith is president, his address being Colfax, Whitman county, Washington.

*Cartersville, Georgia*—Arrangements are being made to work manganese mines near this place. Machinery for mining and concentrating will be needed. J. C. Mallonie, Box 305, Savannah, Ga., is manager.

*Nicholasville, Kentucky*—Parties representing the Pittsburg Barytes Company have purchased property and propose to put up plant for mining barytes and preparing it for market. W. J. Wyman, Honaker, Va., is manager.

## Special Correspondence

San Francisco Feb. 20

Although the supervisors of Sutter county, and the executive committee of the Anti-Debris Association have decided to bring suits against the dredging companies at Oroville, Butte county, the supervisors of Yuba county have taken no steps in that direction. The dredge operators have appointed a permanent committee to represent their interests in future controversies, consisting of J. H. Leggett, Karl Krug, Chas. Helman, G. J. Carr and J. J. Hamlyn. An engineer of the Anti-Debris Association and a representative of the Sutter county supervisors have been in the Oroville field recently, and it is expected that after they have carefully examined the conditions a conference will be held with the dredge operators. It is probable that the differences will be settled without bringing them into court.

There will be no appeal by the Home Mining Company against the decision of the court in favor of the Champion Mining Company of Nevada City. The Champion has acquired the Home Company's holdings, paying a small amount therefor. The Champion Company now owns three miles of mining ground at Nevada City, including some 15 or 16 quartz claims. The Champion was awarded \$25,000 damages by the recent decision and the Home people thought best to give up and sell out, instead of carrying on further litigation.

M. J. Cooney, formerly of South Africa, is prospecting for diamonds about two miles north of Oroville, Butte county. He has had a few men at work for some time and has been engaged in the operation for over 18 months. Several diamonds were found where the ground was hydraulicked years ago for gold. Had the overburden of 20 to 60 ft. of gravel boulders not been washed off there would have been no visible indication of diamondiferous material as the bedrock would of course still be hidden. Finding the ground favorable in appearance he sunk 50 ft. and came on to "blue" which he asserts is identical in appearance with that of the South Africa mines. He has found numerous "chips" or small diamonds and says there is a record of two diamonds one of which weighs 1½ carats and the other ½ carat, from this locality. Mr. Cooney has found menasconite, olivenes, zircons, spinels, garnets, etc. With few exceptions the crystals sieved from this locality are small. The piece of ground taken up is some 50 acres in extent, and is the washed-off bedrock of an old hydraulic mine. Some 1400 cu.yd. have been taken out ready for washing. This is entirely a private enterprise, and merely a prospecting one, though the indications are favorable.

Activity in the new copper camp of

Hartoum, near Needles, San Bernardino county, is said to be increasing with many new strikes reported. On the Amors mine, where a ledge more than 15 ft. wide with rich surface outcroppings is in evidence, a shaft is to be sunk. Several leases are to be made soon.

In the Blue Ledge district in Siskiyou county, on the Oregon border, some 500 men are now at work in the mines or on wagon roads. The district is quite large and lies 40 miles from Yreka and an equal distance from Medford, Oregon. The Siskiyou county supervisors are building a trail, to be widened into a road, from Oak Bar to Hutton, the principal settlement in the district. The ores are of copper, carrying some gold and silver, and there are six mines which development has proven to be of value, and there are also numbers of prospects.

The Mountain Copper Company has changed its plan for building a railroad from the Hornet mine to the Boulder Creek station on the Iron Mountain leading to the smelter at Keswick. The entire branch will be built for locomotive traction. Originally it was designed to build an electric road from the mine down the mountain to a point 400 ft. above the terminus of the spur to be built up Boulder creek. Ore was to be dumped down a chute from the road to the Iron Mountain. It has now been decided to build the railroad direct from Boulder creek to the Hornet and operate it throughout by steam. The Hornet has a larger body of copper ore than has the Iron Mountain mine, but it is of lower grade. It is to smelt this low-grade ore that the smelter at Keswick is being rehabilitated.

Salt Lake City Feb. 22

At a meeting of the directors of the American Flag Mining Company operating at Park City, G. H. Rathman, of Sioux City, Ia., was elected president to succeed the late T. F. Singiser. J. H. Keene, of Chicago, was added to the directorate.

Dividends have been ordered by five Utah mining companies for payment this month, as follows: Grand Central, \$15,000; Victoria, \$10,000; Beck Tunnel Consolidated, \$40,000; Utah, \$3000; Century, \$3000. Plans are well advanced looking toward a consolidation of the Star Consolidated and Black Jack mines in the Tintic district. It is proposed to organize a new company with 1,000,000 shares; 800,000 shares to be divided equally among the shareholders of each company, with the balance to go into the treasury. It is understood that Jesse Knight, of Provo, will be elected president of the consolidated company.

There are two Bingham consolidations being arranged. One between the Bingham Central and Bingham Standard Copper companies, which will give the merger company about 500 acres of mineralized

territory, near the Boston Consolidated, Utah Consolidated, and Bingham-New Haven mines. The Copper Glance and Illinois mining companies also propose to join issues, and a new company formed to be known as the Bingham Amalgamated Copper Company. Samuel Newhouse will be president of the new concern, of which the Standard and Bingham Central properties will form the basis.

A syndicate of Salt Lake mining men have organized the Red Metal Mining Company, which will develop a property recently acquired by the promoters in the Walker River Indian reservation country, in Nevada. The officers are: Lemuel U. Colbath, president; W. J. Craig, vice-president and manager; who, with W. R. Wightman, William Pischel, and Dr. John T. White, are directors. Alex. Colbath, of Salt Lake, is secretary.

A strong syndicate of Salt Lake mining men and capitalists has completed the organization of the Yerington Consolidated Copper Company, with the Copper Deposit and Copper King groups of claims in the Yerington, Nevada, district, as the basis. The capital stock is 1,000,000 shares of the par value of \$5 each. The officers are: Frank J. Hagenbarth, president; Windsor V. Rice, vice-president; Walter C. Orem, treasurer and manager; J. H. Turner, secretary; who, with E. A. Wall, John Dern and William Keyting are directors.

Official announcement has been made of an agreement having been reached between the American Smelting and Refining Company, and the 400 odd farmers who appeared as plaintiffs in the smelter smoke cases, tried in the Federal court, and which resulted in a decree of court prohibiting the treatment of any one or combination of ores containing an excess of 6 per cent. sulphur. Accordingly, the court will be asked for a stipulation modifying the decree of the court to meet the condition upon which the late contention has been settled. The smelter people have shown to the satisfaction of the farmers that the fumes can be arrested through the interposition of a system of bag houses and cooling chambers. The company, however, will compensate the farmers who were plaintiffs in the smoke cases to an amount aggregating \$60,000, whenever they conclude the signing of smoke easements to their lands. With the foregoing program carried out the lead smelter at Murray will continue in operation. It is understood that officials of the United States Smelting Company are endeavoring to come to a similar understanding with the farmers.

Considerable interest is being taken in the development of the antimony deposits of Garfield county, and several shipments of ore have been made to California. The mines are situated about 60 miles south of Marysville, the southern terminus of the Rio Grande Western Railroad, in Utah.

Denver Feb. 23

The new mill of the Camp Bird mine near Ouray, which was completed a short time ago, is evidently doing some model work. During the month of December, which was the first month that it was in full operation, nearly 7000 tons of ore were treated, the value of the bullion and concentrates amounting to \$271,568, nearly 80 per cent. of which is reported to have been clear profit. A large amount of high-grade ore was milled, which had accumulated during the construction of the plant, and the average amount of profit in the future cannot come up to the above figure.

A strong effort is being made by interested parties to secure an appropriation for a geological survey for Colorado.

The Denver & Rio Grande system may before long be run by electric power. Investigations are being made in regard to the feasibility of the project. The probability is that the experiment will be made between Denver and Pueblo first.

From present appearances San Juan and Ouray counties will before long become large producers of copper ores. The former county is credited with over 4,000,000 lb. of copper last year and the development in that line has only just commenced. The Red Mountain district promises especially well and an active season is probable in that vicinity.

The trial which is at present in progress in Idaho of the alleged murderers of Governor Steunenberg is being watched with a good deal of interest in this State. Last Sunday a large meeting was held at Miners' Union Hall at Victor, in the Cripple Creek district, in sympathy with the three prominent members who are accused of participation. No disturbance took place. The minority opinion of Justice McKenna, of the United States Supreme Court, in regard to the alleged illegal extradition of Moyer, Haywood and Pettibone, was read and a resolution denouncing the action of the governors of Colorado and Idaho was adopted.

An important meeting of the tunnel board for the construction of the new drainage project in the Cripple Creek district was held in Colorado Springs, Feb. 21, and a committee, composed of President Bernard, Frank G. Peck and F. F. Costello, was appointed to purchase the necessary machinery and commence operations at once. A cash assessment of \$40,000 was levied on the subscribers. Up to date the total amount of subscriptions for this great enterprise is \$400,000, which is expected to complete the bore to the contact.

Scranton Feb. 25

The Conciliation Board, this week, ordered the strikers at the Morea colliery, of the Dodson Coal Company to return to work before their grievances were considered. The men, without filing any complaint, quit work and prevented the

company from securing other employees. The matter came before the board upon the complaint of the company that their employees, including firemen and others necessary to protect the property, had quit without giving notice. The board went on record as stating that the action of the men was in direct violation of the terms of the award of the commission and calling upon them to return to work and to file their grievances within five days after doing so. The representatives upon the board mentioned that they did not think that the men would obey the order.

The board also went on record in declaring that it had the right to adjust and make rates of compensation for collieries which were opened after the date of the award of the commission, this action being taken in connection with the grievances of the employees at the Mary D. colliery of the Wentz Coal Company.

The report of Mine Inspector P. J. Moore, for the first anthracite district for the past year shows a decrease of 50 per cent. in the fatalities. The synopsis of the reports of the entire region, for the year, shows that there were 87 less fatal accidents than in the previous year. Falls of coal are given as the cause of most of these accidents. The decrease in the number of accidents is attributed to greater care in safeguarding the miners; the establishment of first-aid societies and the demand by the employers upon the men to observing more strictly the mining laws.

Toronto, Ont. Feb. 25

The official returns of the Timiskaming & Northern Ontario Railway of the shipments of Cobalt ore for the week ending Feb. 16 were as follows: Trethewey, 179,648 lb.; Nipissing, 101,585; Nova Scotia, 30,000; O'Brien, 64,000; Total, 375,233 lb.

A large number of Cobalt companies have recently ordered machinery. In all 56 plants have been put in or are under order since last spring. Recent orders for plants have been placed by the Victoria Cobalt, the Hunter Cobalt, the Buffalo, the Nancy Helen, the Provincial mines, the Kerr Lake (Jacobs) and others.

The North American Refining and Smelting Company has decided to build its plant at Thorold, on the Welland canal, where a suitable site has been secured. The plant, which will have a capacity of from 25 to 40 tons daily, will cost \$250,000.

At the annual meeting of the International Portland Cement Company at Hull, P. Q., Feb. 19, the president, Sir Sandford Fleming, presented a report showing that the orders received last year called for twice as much cement as could be supplied. During 12 months the net earnings were \$261,953 or over 26 per cent on the capital. A resolution in favor of the enlargement of the plant was adopted.

London Feb. 16

The report of the Exploration Company for the year 1906 exhibits an unfortunate recurrence of the necessity for writing down the value of the assets which has characterized the history of the company before. Four or five years ago the company went through an acute crisis of this sort, which was duly recorded in your columns at the time. The only way to get rid of the incubus of depreciating investments, and to put the concern on its legs again was to split the company into two parts, one of which should acquire the assets of doubtful value, and the other the satisfactory investments. This was accordingly done just three years ago, and the new Exploration Company then launched. The first year's profits were £30,000, and the second £67,000, so things were beginning to look much brighter. The report for the third year of its new life, 1906, has thrown quite a damper on its progress, for though a profit of £97,973 was realized, yet it has been found necessary to write down the profit and loss account by £98,726 on account of the serious depreciation of the company's South African holdings. The total profits of the three years amount to about £195,000, and the losses to £98,726. Out of the net profit dividends at the rate of 5 per cent. on the capital, £750,000, were paid during the second and third years, absorbing £75,000, and leaving £22,000 as balance to be carried forward to the year 1907. The directors are naturally hopeful that the South African holdings will improve again. The most promising part of the Exploration Company holdings are the Mexican properties such as El Oro, Somera, etc., and the American copper properties that it has recently acquired interests in. Let us hope that the company will easily recover from this second setback.

Le Roi No. 2, Ltd., has done remarkably well during the past year, as disclosed in the official report for the year ended Sept. 30 last. A profit of £41,600 was made, after all expenses were paid, and £16,000 allowed for exploration work and depreciation. The year commenced with £20,700 on hand, so that there was £62,300 available for distribution on September 30. Out of this £31,500 has been distributed as dividend and £30,800 carried forward. The mine is still producing well, and the recently discovered lode is promising. It is deemed prudent, however, to look for other properties, as the mine, though containing much ore, is not one of permanent promise. An option has been acquired on the Vancouver mine, at Slocan and the company has taken an interest in the Cloncurry Syndicate, which is the parent of the Queensland Exploration Company. The development of copper properties in North Queensland is arousing interest here, of which more on a subsequent occasion.



### General Mining News

#### Lake Superior Iron Ore Shipments--

The rail shipments of iron ore from the Lake Superior region, now completely reported, exceeded all the estimates, having been 1,008,544 tons in 1906, against 876,552 in 1905, and 596,175, in 1904. The total shipments, by ranges, were as follows for two years' past, in long tons:

Range:	1905.	1906.	Changes.
Marquette.....	4,210,522	4,057,187	D. 153,335
Menominee.....	4,495,451	5,109,088	I. 613,637
Gogebic.....	3,705,207	3,641,985	D. 63,222
Vermillion.....	1,677,186	1,792,355	I. 115,169
Mesabi.....	20,153,699	23,792,782	I. 3,639,083
Baraboo.....	111,391	128,742	I. 17,351
Total.....	34,353,456	38,522,139	I. 4,168,683

The total increase was 12.1 per cent. The figures do not include the ore from the Michipicoten range in Canada, which was 121,555 tons last year. The proportions of the total furnished by the different ranges in 1906 were: Marquette, 10.5 per cent.; Menominee, 13.3; Gogebic, 9.5; Vermillion, 4.6; Mesabi, 61.8; Baraboo, 0.3 per cent.

### ARIZONA

#### YAVAPAI COUNTY

*Humboldt & Verde Valley Railway*—James H. Purdy, the promoter of this company, states that the necessary capital is assured, and that preliminary work will be commenced soon. The proposed line extends from Humboldt to the Verde Valley, and passes through a rich mineral country.

*Logan Copper Company*—This company has temporarily abandoned work on account of the increased flow of water. As soon as the necessary machinery can be installed it will resume work.

*New England-Arizona Gold and Copper Company*—This company will resume operations soon. It has been shut down for over a month for the purpose of installing a steam hoist and other machinery.

*Triangle Mines Company*—This company has resumed operations at its mines at McCabe, after a shut-down of about two months.

### ARKANSAS

The preliminary report of Martin Rafter, State mine inspector, shows that 1,971,144 short tons of coal were mined in 1905, and 1,875,569 tons in 1906; a decrease of 95,575 tons. There were 4411 men employed, of whom 3027 were miners. The average time worked was 154 days. The average coal mined per employee was 447 tons for the year. The average daily tonnage per miner was 4.02 tons. The number of men killed during the year was 11, being 2.49 per 1000 employees; or 0.016 per 1000 days' work.

### CALIFORNIA

#### EL DORADO COUNTY

*El Dorado Water and Deep Gravel Company*—This company has been for

some time doing underground work in the Excelsior drift mine, and some 6000 ft. of drifts have been run. The work has proven the value of the property, which was formerly a hydraulic mine, and it is now to be rehabilitated. A new 10-stamp mill to be run by water power, has just been completed. The main tunnel is in 3000 ft., where a fine body of gravel is found. A. Baring-Gould is superintendent.

### INYO COUNTY

*Ubehebe District*—The properties in this district recently bought by John Salsbury, are to be shortly transferred to Eastern men. The Mairs property of seven claims is under bond to Haywards & Pugh, of Goldfield.

*White Mountain Mining Company*—This company, which recently acquired the Roberts property at Pine Mountain, near Laws, has let a contract for a 600-ft. tunnel to tap the third ledge. They have a team haul of 16 miles to Laws, but will begin shipping ore as soon as the Bishop-Goldfield road is free from snow. It is learned that the price of the property was \$90,000.

### MARIPOSA COUNTY

*Mount Gaines*—This mine at Hornitos was at one time a large producer. It is being reopened by Los Angeles men.

### NEVADA COUNTY

*Antimony*—Robert Johnson has found on his ranch, seven miles south of Grass Valley, a deposit of antimony ore.

*Greenman*—A bad cave at the top of the shaft of this mine, Canada Hill, Nevada City, admitted the water from Little Deer creek, and the mine is again flooded. It is only a short time since the mine was unwatered and shaft sinking was about to begin.

### ORANGE COUNTY

*Santa Ana Tin Mining Company*—This company, at Trabuco cañon, is about to build a smelter which is to be operated by some new process.

*Silverado Cañon*—Los Angeles men have filed on and recorded 35 mining claims in this district.

### COLORADO

#### LAKE COUNTY—LEADVILLE

*Ibex*—Over 200 lessees are at work on the Little Jonny, employing 450 men, and with few exceptions all are shipping ore. The property is being worked from No. 1 to No. 4 shafts, and rich ore is frequently encountered in places where it was thought no ore existed; during the week four different sets of lessees opened pockets of such ore. Some interest is being taken in the lease worked at the 1300-ft. level of No. 4 shaft, which is in a fissure country. When the lessees started to work they drifted to the south 150 ft. following at first a small streak of ore that

ran high in gold; this widened out to 5 ft., but so low grade that it could not be shipped. An upraise was started about the middle of the drift and carried up for 40 ft., when a streak of ore on the hanging wall was opened about 4 in. wide and at first carried values amounting to 5 oz. gold, 37 oz. silver and 5 per cent. copper; since then the values in gold have increased and the silver and copper values are the same. Alongside of this streak are three others about the same width that run \$40 per ton, and the balance of the vein about 3½ ft., is still low grade.

*Yak Tunnel*—The big bore is being gradually driven ahead into the South Evans country to connect with the Ollie Reed. Arrangements are on foot to have the tunnel driven to the New Monarch group of claims, and, when perfected, three shifts will be put on and the tunnel driven as quickly as possible.

*New Monarch*—The ground in the Cleveland shaft is changing with the opening of a body of ore, and the progress made is more satisfactory. The ore now covers the whole of the shaft; in character it is lead sulphide and will run in the neighborhood of \$20 per ton. From its general appearance and the trend it is a different shoot from that found in the Winnie; no work will be done on it until the shaft is sunk the extra lift, then it will be thoroughly developed.

*Breece Hill*—This section of the district is shipping more ore at present than it has done for a number of years, and the ore is all of good grade. Several months ago the parties who had a lease on the Elk, adjoining the Little Jonny to the south, quit, as they were unable to make it pay. Two months ago Leadville men took hold of it, installed a good plant of machinery and started work from the lower level. Last week a large body of ore was found and shipments are going out at the rate of 30 tons daily.

### MARYLAND

#### ALLEGANY COUNTY

*Maryland Coal Company*—This company's report for the year 1906 shows 209,350 tons coal mined; 188,709 tons from the company's mines in Maryland and 20,641 tons from those in West Virginia. The total is a decrease of 35,344 tons from 1905. The net profits for 1906 were \$155,630, from which dividends amounting to \$150,776 were paid, leaving \$4854 to surplus account.

### MASSACHUSETTS

#### NORFOLK COUNTY

For years there has been talk of the presence of gold in the rock ridge in the southeast part of the town of Wrentham, near the Rhode Island line. Stringers of quartz are found in the granite, which carry some iron pyrites, and assays have

shown the existence of traces of gold with the pyrite. A syndicate composed of people from Providence and Pawtucket, R. I., has taken options on some land on the ridge and is erecting a plant, consisting of crushers, rolls and cyanide tanks, to work the rock. No exploration work seems to have been done, beyond sampling the outcropping quartz stringers.

#### MICHIGAN

##### MARQUETTE RANGE—IRON

*Rolling Mill*—This mine, under operation by the Jones & Laughlin Company, is being opened rapidly. Four drifts are being extended from the bottom of the shaft, which is 643 ft. deep. The drifts are going east, west, south and north, respectively, and all have encountered ore. Each is upward of 300 ft. long, and will be continued to a length of 400 ft. before the season of navigation opens. Two drifts are already opened into the main orebody. The shaft will be sunk to greater depth and additional levels opened later in the season. The new hoisting plant is working satisfactorily, and the new air compressor will be ready to go into commission in two weeks. A spur 1000 ft. long is being extended to the property by the Lake Superior & Ishpeming Railroad.

*Jackson*—The Cleveland-Cliffs Iron Company is making good progress with the improvements it has under way at this property, where two open pits are to be operated during the coming summer. The water is nearly all out of the old pit west of the tram-road, and rapid progress is being made in the construction of the shaft-house and trestle. A crew will be put to work as soon as the water is out, cleaning out the bottom, laying rails, etc., so that mining operations can be started as soon as the shaft-house is completed. The trestle will be 700 ft. long, extending to a spur being put in by the Lake Superior & Ishpeming Railroad at the South Jackson location. The ore will be raised from the pit in skips, dumped into cars at the shaft-house, and trammed by power to the pocket at the spur.

#### MONTANA

##### BUTTE DISTRICT

*North Butte*—The ore production of North Butte was 5000 tons less during January than in December, but only first class was mined and the gross proceeds and net profits were greater than in any one month since the company was organized.

*Coalition*—Two bodies of ore have been discovered recently in the Minnie Healey mine, owned by this company—one by way of a crosscut from Boston & Montana property at a depth of 1400 ft., and the other by Red Metal, the operating company, at another point, 1300 ft. deep.

*Anaconda*—The company has struck a body of high-grade ore in one of the lower levels of the Mountain Consolidated mine and is developing it. The company is now

operating all of its mines, having resumed full blast in the Neversweat, Feb. 10. Its railroad car service is now good.

*Boston & Montana*—The company is now mining its customary quantity of ore, but is operating only three of its five blast furnaces at the plant. Cause, coke shortage.

*Butte Lode Extension*—This is a new company, organized to operate the St. Angus group of four claims 12 miles northeast of Butte. Its officers are: President, John MacGinniss; vice-president, Charles S. Warren; secretary, John M. Murphy; treasurer, C. J. Kelly. These men and Joseph Russell are the directors. The company has opened a body of copper ore at 90, 120 and 150 ft. in the St. Angus and will add 150 ft. to the shaft and crosscut the veins, two, at the bottom. The veins have an east and west course, and the property is located in the section in which Walter Harvey Weed, of the Geological Survey, predicted that a continuation of the veins of Butte would be found.

#### NEVADA

With the view of remedying some of the evils arising from the Southern Pacific's monopoly of the railroad systems in Nevada, the State senate has under consideration a railroad-rate bill which has been introduced by Senator Payne, of Esmeralda. The bill limits freight rates to 3c. per ton-mile in all cases, a minimum charge of 35c. per ton on short hauls being allowed. Passenger rates are limited to 3c. per mile.

##### ESMERALDA COUNTY—GOLDFIELD

*Frances-Mohawk*—The shaft is now approaching the water zone at a depth of 290 ft. The ledge at that point continues to assay from \$15 to \$25 per ton, but the ore is beginning to carry heavier sulphides.

*Rochester*—The shaft in this property has recently penetrated country rock which carries stringers of quartz. Some of this quartz is highly auriferous.

*Florence*—The Goldfield Leasing syndicate has erected a new hoist on its lease. The shaft has been sunk to 170 ft. and will be sunk deeper.

##### NYE COUNTY—TONOPAH

*Ore Shipments*—Shipments over the Tonopah Railroad for the week ending Feb. 14 were: Tonopah Company, 1381; Montana Tonopah, 436; Tonopah Midway, 213; West End, 44; Tonopah Belmont, 250; Tonopah Extension, 300; total, 2624 tons. Additional shipments were 30 tons from Lone Pine and 2600 tons from Goldfield, making a total of 5254 tons.

#### PENNSYLVANIA

##### ANTHRACITE COAL

*Anchor Coal Company*—This company is sinking several slopes at the Anchor colliery, Heckerscherville valley, to deter-

mine whether the method adopted to quench the mine fire is successful. For the past four months the company has been boring holes and filling them with silt, believing that the crevices are thus made practically air-tight, and smother the fire.

#### SOUTH DAKOTA

##### LAWRENCE COUNTY

*Henry Roos*—The most important strike for some time was made on this ground when a 30-ft. vein of copper rock, showing up well in the pan, was crosscut in the tunnel. The second wall has not yet been encountered and it is impossible to tell how much wider the vein may be. The vein matter consists of red slate, streaked with white quartz and carrying a quantity of iron pyrites. The vein runs with the formation.

##### PENNINGTON COUNTY

*Coats Tin Property*—A deal has just been closed whereby this property, consisting of over 100 acres, was sold to Frank B. Cook, of Philadelphia, for \$5000. This claim was considered one of the most valuable of the tin properties. The new owners will put a force of men at work early in the spring.

*Mica*—A mica factory which will give employment to from 60 to 75 people will be installed in Keystone. It will handle about 5 tons of mica a day. Several other properties will also furnish material. The mica will be trimmed, sorted and prepared for shipment.

#### UTAH

##### MORGAN COUNTY

*Carbonate Gem*—This company is installing new mine equipment, and will begin regular shipments of lead-silver ore soon. H. A. Van Patten, of Ogden, is manager.

*Carbonate Hill*—This property has developed into quite a large producer of lead-silver ore. The principal ownership is vested in John A. Creighton and John M. Daugherty, of Omaha, Neb. Col. M. A. Daugherty, of Salt Lake, is manager.

##### SALT LAKE COUNTY

*New England Gold and Copper*—This Bingham company has begun the enlargement of its mill, and the installation of new slimes equipment through which it is expected that a closer saving in the tailings will result. The present extraction is about 87 per cent.

*Bingham New Haven*—The management of this Bingham mine is having new ore bins built to meet present needs, as a consequence of the striking of a large orebody in the lower tunnel. This orebody has not been cross-cut for the reason that it has been necessary first to provide means for taking care of the ore. No definite plans regarding the construction of a smelter have been announced.

Foreign Mining News

CANADA

ONTARIO—COBALT DISTRICT

**Amalgamated Cobalt Mines**—A large amount of preparatory development work has been done on the location, which is centrally situated near the Trethewey and other leading mines. A shaft has been sunk between two veins, and is now 100 ft. down. When the 150-ft. level is reached crosscutting will be done to tap both veins. A 60-h.p. boiler, four-drill compressor and a steam hoist have been put in and 16 men are at work. A. L. Fowler, superintendent, is in charge. The company is also sinking a shaft on a calcite vein to the north of the Silver Leaf property.

**Cobalt Chief**—This property in the Portage bay extension, Cobalt, was formerly known as the Moore & Hare claim and has lately changed hands. Active operations have been pushed under the direction of Superintendent J. T. Fee. A shaft is being sunk at the junction of the main vein and another vein crossing it, and is down 30 ft., with promising results. A shaft-house and powder-house have been erected and a Rand-Jenckes steam plant installed.

ONTARIO—MANITOU LAKE

**Laurentian**—A visit of inspection to this mine, Manitou lake, and other valuable properties in the district recently acquired by the Hugo von Hagen Exploration Company, of New York, was recently made by Dr. Hugo von Hagen, president of the company, J. T. Kirby, of New York, and Anthony Blum. The object was to make arrangements for development.

MEXICO

COAHUILA

**Mexican Coal and Coke Company**—On Monday evening, Feb. 18, a violent explosion occurred in this company's shaft No. 7, at Las Esperanzas, killing 50 men. In addition 11 men were saved, all badly injured. Edwin Ludlow, the general manager, had gone to South McAlester, Ind. Ter., just before the accident.

AFRICA

TRANSVAAL

Gold production in January was 537,638 oz. fine, or \$11,112,977; an increase of 89,000 oz. as compared with January, 1906. During the month there was an increase of 2336 Kafir laborers employed. The total number at the close of the month was 83,567 Kafirs and 53,828 Chinese.

RHODESIA

Gold production reported in January was 47,048 oz. bullion, an increase of 3695 oz. over January, 1906. The bullion reported this year was equal to 41,873 oz. fine gold, or \$865,515 in value.

NEW CALEDONIA

Exports of minerals from the colony are reported by the *Bulletin du Commerce*, of Noumea, as below, in metric tons, for the full year:

	1905.	1906.	Changes.
Nickel ore.....	125,289	130,689	I. 5,400
Cobalt ore.....	7,919	2,487	D. 5,432
Copper ore.....	.....	207	I. 207
Chrome ore.....	51,374	57,367	I. 5,993

There were increases in all items, except cobalt ore, which shows a heavy decline.

Coal Trade Review

NEW YORK, Feb. 27

No change in the coal markets in the West is reported, except that there is some improvement in transportation conditions. This is not great, but operators are ready to welcome even the slightest change for the better.

In the East the markets are generally quiet, the cold spell showing signs of passing over too soon to have any permanent effect on the demand for domestic coal. Steam and gas coals are in steady demand, and there is no over-supply. In fact, there is almost a scarcity of anthracite steam sizes in the seaboard cities.

COAL-TRAFFIC NOTES

Shipments of coal and coke originating on the Pennsylvania Railroad Company's lines east of Pittsburg for the year to Feb. 16 were as follows, in short tons:

	1906.	1907.	Changes.
Anthracite.....	684,690	660,884	D. 23,806
Bituminous.....	4,846,080	4,794,401	D. 51,679
Coke.....	1,670,982	1,765,145	I. 94,163
Total.....	7,201,752	7,220,430	I. 18,678

The gain so far this year has been entirely in coke.

The coal and coke traffic of the Norfolk & Western Railroad for the full year is reported as follows, in short tons:

	Coal.	Coke.	Total.
To Line points.....	8,383,664	2,109,453	10,493,102
To Tidewater.....	2,903,130	162,331	3,065,461
Total.....	11,286,799	2,271,764	13,558,563
Total, 1905.....	10,206,916	2,406,459	12,613,375

The total increase last year was 945,188 tons, or 7.5 per cent. Of the total tonnage in 1906, there was 22.6 per cent. carried to tidewater, and 77.4 per cent. delivered to points on the line of the road.

Receipts of coal at Chicago for the full year, with shipments to other markets, are reported as follows:

	Received.	Shipm'ts.	Balance.
Anthracite.....	1,526,282	542,554	983,728
Bituminous.....	10,626,518	2,772,294	7,854,224
Coke.....	342,919	258,316	84,603
Total.....	12,495,719	3,573,164	8,922,555
Total, 1905.....	11,201,343	3,063,671	8,137,672

The balance represents, approximately, the consumption of the city. The bituminous receipts were from the following sources: Pennsylvania, 925,237 tons; Ohio, 856,833; West Virginia, 914,420; Indiana, 2,961,926; Illinois, 4,968,102 tons.

The coal tonnage of the Baltimore &

Ohio Railroad for the full year was as follows, in short tons:

	1905.	1906.	Changes.
Anthracite.....	1,050,108	974,524	D. 75,584
Bituminous.....	22,315,469	25,046,832	I. 2,731,363
Coke.....	4,910,568	5,884,243	I. 973,675
Total.....	28,276,145	31,905,599	I. 3,629,454

The total increase in 1906 over the previous year was 12.8 per cent.

New York

Feb. 27

ANTHRACITE

There is very little to report concerning the situation in the anthracite market; demand continues strong and producers report that they are able to take care of their orders for prepared sizes; but that the demand for small steam sizes is far in excess of the supply. The local retail dealers are busy, but their profits have been materially cut down on account of the heavy hauling and the injury to horses on account of the recent storms. Prices remain unchanged at \$4.75 for broken, \$5 for egg, stove and chestnut. Small steam sizes are quoted nominally at \$3 for pea, \$2.25@2.50 for buckwheat, \$1.50 for rice, \$1.40 for barley; all f.o.b. New York harbor shipping points.

BITUMINOUS

The Atlantic seaboard soft-coal trade is moving quietly, cleaning up the balance of coal on old contracts. There is some demand from out-of-the-way points to get cargoes on the way as soon as ice conditions will permit. Contract prices have not yet been named. The embargo of the Pennsylvania Railroad on all shipments of soft coal is being felt in the shortage of coal for the moment at New York harbor ports. This condition has been shown by a stiffening of prices, which are today \$2.75 f.o.b. New York harbor shipping ports, for fair grades of steam coal.

Trade in the far East is nearly all old contract business; the loading and discharging clause on bills of lading is preventing shipments at this time, there having been several cases where vessels took so long to load on account of the badly frozen condition of coal in the cars that by the time the vessel was loaded the time allowance had been used up and the vessel was on demurrage. The loading and discharging clause has been the cause of severe criticism recently on account of the failure of vessels to arrive at the date promised. It has been suggested that allowance should be made for loading and unloading when a vessel fails to arrive as per schedule.

Trade along the Sound has been using a fair amount of coal. New York harbor trade is short of coal at the present time on account of the embargo, but this is not serious. All-rail trade shows a little demand, with prices strong. Transportation from mines to tide is fairly good; car supply is dependent upon main-line roads, the Baltimore & Ohio furnishing from 10 to 25 and the Pennsylvania from

50 to 60 per cent. of the demand. Coast-wise vessels are in sufficient supply for all demands. Philadelphia quotes freight rates to Boston, Salem and Portland at \$1@1.10 and discharge, loading and discharging clause included.

### Birmingham Feb. 25

Alabama coal operations are improving slowly, as the railroads begin to furnish more cars. In Cullman county a railroad 10 miles long is under construction to reach undeveloped coalfields. Development will also be pushed in Tuskaaloosa county and in the lower part of Jefferson county. In Walker county there is considerable investigation being done. The Birmingham Iron Company has experts at work drilling for veins of coal in the southwestern part of Jefferson county on the line of the new Atlanta, Birmingham & Atlantic Railroad.

Coke is still in demand and a high price is obtained. A hearing on the new mining law is given by the legislative committee this week in Birmingham.

### Chicago Feb. 25

The wholesale coal market continues weak and there has been much coal on tracks in the last week that was sold at a sacrifice. Efforts are being made to restrict shipments from the mines of Illinois and Indiana, but it will take a week to clear the accumulation on tracks.

Anthracite business from now until April 1 will be in small lots. Chestnut is scarce, most orders being filled by all-rail consignments. Other sizes are in fairly good supply at the dock yards.

The demand in Illinois and Indiana coals is mostly for run-of-mine. Lump and egg sell for \$1.75@2.65, run-of-mine for \$1.75@2.25 and screenings for \$1.25@1.50.

Of coals from east of Indiana smokeless run-of-mine is strongest, the cause being short supplies. Smokeless run-of-mine sells slightly above the circular quotation, \$3.45@3.55 being obtained. Hocking has a superabundance of coal on tracks, making the price \$3.25@3.45. Pittsburg No. 8 is weakish at \$2.90 for ¾-in. Youghiogheny is weak at \$3.05@3.20, there being too much on tracks. Cannel coal continues in good demand at \$5.40@5.75 per ton.

### Cleveland Feb. 26

The prospects are for a strong movement of coal to the upper lake regions for the coming season of navigation. Already some of the big producers have made sales at about the same prices as ruled last year. The one factor in the situation which seemed uncertain was a possibility that the railroads in this territory would increase the rate from the mines to the lake ports, having had an understanding with the Western railroads that a similar rate advance would be made from the Illinois fields to Chicago.

This seemed to form the basis for an advance in rates of about 16 2/3 per cent. The railroads held back, fearing the effect upon public sentiment. Another possible factor has been the fear the river combine of mines would desert its river territory, and come into the lake trade. The importance of such a change is modified by the knowledge the company would not have over 500,000 tons to ship by lake, out of a possible total of more than 15,000,000.

Prices in local territory have not changed. Mine-run steam coal has held at \$1.15@1.20 at mines for Ohio, and \$1.10@1.15 for Pennsylvania. Ohio slack has been selling at \$1.10@1.15; Pennsylvania around \$1.

The coke market is strong for immediate delivery; for delivery during the last half of the year it is a little easier. The 72-hour foundry coke is \$4 for immediate delivery. Furnace coke is \$3.60@3.75 for immediate shipment, and \$3.25 for second-half.

### Pittsburg Feb. 26

Coal—Some large annual contracts have been closed this week and most of them were on a basis of \$1.15 a ton for mine-run, f.o.b. mine. Sales for prompt shipment are at \$1.20. There is no shortage of railroad cars and nearly all the mines are in full operation. The Monongahela River Consolidated Coal and Coke Company yesterday closed several important contracts aggregating about \$1,000,000. The largest was placed by the Southern Pacific Railroad and Steamship Company and calls for 250,000 tons to be delivered at its wharves in New Orleans. The annual contract from the St. Louis Gas Company was also placed and calls for from 175,000 to 200,000 tons. Cold weather has checked the rise in the rivers and the big tows that were ready to go out have been held up.

Connellsville Coke—The coke market remains about the same as a week ago. Prices are firm, strictly Connellsville furnace coke, prompt shipment, being quoted at \$3.50@3.60 and for all year at \$3.10@3.25. Prompt foundry is quoted at \$3.90@4.10 and for deliveries extending through the year at \$3.75. The *Courier* gives the production for the week in the Connellsville region at 268,628 tons, and in the Lower Connellsville region at 141,275 tons. The shipments totaled 15,047 cars distributed as follows: To Pittsburg, 5184 cars; to points west of Connellsville, 8898 cars; to points east of Connellsville, 965 cars.

## Foreign Coal Trade

Feb. 27

Coal production in Belgium for the year was 21,844,200 metric tons in 1905, and 23,610,740 tons in 1906; an increase of 1,766,540 tons last year.

Imports of fuel into France for the year were, in metric tons:

	1905.	1906.	Changes.
Coal.....	10,507,064	14,354,320	I. 3,847,256
Coke.....	1,632,841	2,257,860	I. 625,019
Briquets.....	398,397	547,250	I. 148,853
<b>Total.....</b>	<b>12,538,302</b>	<b>17,159,430</b>	<b>I. 4,621,128</b>

The larger imports were from Great Britain and Belgium.

Exports of fuel from France for the year, including steamer coal, were as follows:

	1905.	1906.	Changes.
Coal.....	1,657,123	1,372,870	D. 284,253
Coke.....	242,053	178,380	D. 63,673
Briquets.....	89,234	130,510	I. 41,276
<b>Total.....</b>	<b>1,988,410</b>	<b>1,681,760</b>	<b>D. 306,650</b>

Steamer fuel included 133,252 tons and 32,686 tons briquets in 1905, against 121,800 tons coal and 96,090 tons briquets last year.

The preliminary report for the Nord and the Pas-du-Calais, the two more important coal-mining districts in France, is as follows, in metric tons:

	1905.	1906.	Changes.
Nord.....	6,729,840	6,243,086	D. 486,754
Pas-du-Calais.....	17,543,215	15,828,688	D. 1,714,527
<b>Total coal.....</b>	<b>24,273,055</b>	<b>22,071,774</b>	<b>D. 2,201,281</b>
<b>Coke made.....</b>	<b>1,772,793</b>	<b>1,678,823</b>	<b>D. 93,970</b>
<b>Briquets made.....</b>	<b>972,129</b>	<b>956,333</b>	<b>D. 15,796</b>

The heaviest producer in the Nord last year was the Anzin company, with 3,102,465 tons; in the Pas-du-Calais the Lens, with 3,030,258 tons.

## Iron Trade Review

NEW YORK, Feb. 27

There is little change to report this week. So far as pig iron is concerned, the market remains quiet. Some buyers talk of a tendency to make concessions on future business, but makers are generally firm in their views, and are not inclined to recede from present quotations.

In finished material there is some new business coming in, especially in structural material. The pressure for deliveries on contracts continues, and mills are fully occupied. Most of them are anticipating new orders in plenty next month, when the approach of spring usually brings out new trade. In the meantime they have quite enough to do to keep up with the specifications received.

Baltimore Feb. 26

Imports of spiegeleisen at this port for the week were 1199 tons; of ferro-manganese, 870 tons. Imports of iron ore were 11,150 tons, from Cuba.

Included in the exports were 2922 tons steel rails and 104 tons splice-bars, to Buenos Aires.

Birmingham Feb. 25

A few small lots of spot iron were sold in the Birmingham district during the past week at \$23 per ton, No. 2 foundry. A few sales of iron for delivery during the latter part of the year were booked during the past week \$18.50 per ton, No. 2 foundry.

dry, being the minimum price reported. No iron has been sold this year under \$18 per ton. Charcoal iron sold during the past few days at \$27 per ton, with a lively inquiry for more of the product. The railroad car situation is a little improved. The advance of 25c. in freight rates will go into effect March 2, from this territory to the Ohio river. Above the Ohio river the 20c. per ton advance has been on for 30 days already.

The 50-ton charcoal furnace of the Eagle Iron Company at Attalla, Ala., has been blown in and orders are in hand for the product for some time. Raw material is on hand for a couple of months' operation, at least.

**Chicago** Feb. 25

The market for pig iron continues uncertain. There seems neither strengthening nor weakening of prices, and sales are still of the quick-delivery sort chiefly. Southern dealers are asserting that the price of \$18.50 has been, and will be, firmly maintained as a minimum for No. 2 iron. Northern iron, being relatively stronger, is unaffected in price and the short-order condition affects it but slightly, Northern furnaces being well sold up. The minimum on Northern is \$23.50 as last week. On the Birmingham price of \$18.50 for second-half deliveries the local price becomes \$22.60. For quick deliveries there is a premium of \$1@3.

The beginning of the week is marked by inquiries tending to show the intention of many melters to make contracts much more freely than in the last two or three weeks.

**Cleveland** Feb. 26

**Iron Ore**—The movement of iron ore from the lake docks to the furnace stock piles has been heavy. A few sales are being made off the stock piles at Lake Erie ports, the price being unchanged from those prevailing for this year's delivery.

**Pig Iron**—The market for the immediate future is strong. For the present there is such a good demand for all grades of material that prices are holding steady. On foundry iron, for immediate shipment, the price is unchanged at \$25@26 in the valleys. For second-quarter delivery the price is \$23@24 in the valleys. For second-half delivery iron is selling at about \$22 in the valleys for No. 2. Southern prices are about steady. Bessemer and basic are about \$20 at furnace for second quarter and for second half.

**Finished Material**—The market is strong along all lines. There is a good demand for material on specifications against old contracts, as well as a better demand for material on new contracts. The market is especially strong for plates and shapes.

**Pittsburg** Feb. 26

Specifications in all lines of finished material are still in excess of shipments

and the steel market remains strong. The recent rumors that some railroads are likely to cancel many large orders owing to inability to secure funds have been practically dissipated and it is now regarded as certain that all contracts placed will be filled. The mills have enough business on the books to keep them going steadily until the fourth quarter, and there are large tonnages in sight on which negotiations are pending. New business is light, for the reason that deliveries cannot be guaranteed. The Pittsburg Steel Company, the leading independent, last week began the erection of eight open-hearth steel furnaces and will continue to add to its capacity. Demand for wire products is in excess of production. The National Tube Company has put the Youngstown department in operation after an idleness of over a year. This company has ordered an advance of two points, or \$4 a ton, in 2 3/4- to 5-in. boiler tubes. The large plate mills are badly congested and cannot promise deliveries on contracts inside of four months; 1.70c. is the absolute minimum. Eastern mills that can make deliveries have no difficulty in getting 2c. for prompt shipment. There is no decline in the big demand for sheets. On blue annealed sheets an independent concern is quoting No. 16 gage at 2.40c., or \$7 a ton above the "official" price.

**Pig Iron**—The market is still quiet, with no sales for last half. Both foundry and bessemer iron for prompt delivery have declined, sales of carload lots of No. 2 foundry having been made at \$24, Valley furnaces; a sale of 3000 tons of bessemer was made at \$22 for second-quarter delivery. For prompt, \$22.50 can be done. A sale of 2000 tons of basic for prompt delivery is reported today at \$22. Gray forge has dropped about \$1 a ton; sales at \$21, Valley, or \$21.85, Pittsburg, for prompt shipment.

**Steel**—There is a better supply of billets this week, but prices remain firm at \$29@29.50 for bessemer and \$32 for open-hearth. Plates remain at 1.70c. and merchant-steel bars at 1.60c.

**Sheets**—The mills all are from three to four months behind in deliveries. Black sheets remain at 2.60c. and galvanized at 3.75c. for No. 28 gage.

**Ferro-Manganese**—There is no change in the market and prompt ferro continues to be quoted at \$73 to \$74, and for late delivery \$70 is quoted.

**Cartagena, Spain** Jan. 26

**Iron and Manganiferous Ores**—Messrs. Barrington & Holt report for the week: Shipments were one cargo, 3900 tons dry ore, and one cargo, 3900 tons manganiferous ore, to Great Britain; one cargo, 5300 tons dry ore, to Rotterdam; one cargo, 5200 tons dry ore to Philadelphia; a total of 18,300 tons. Both output and shipping continue heavy.

Quotations are, f.o.b. shipping port: Or-

dinary 50 per cent. ore, 9s. 9d.@10s. 3d.; special low phosphorus ore, 10s. 9d.; specular ore, 55 per cent. iron, 12s. 6d. Manganiferous ore, 35 per cent. iron and 12 per cent. manganese, is 14s. 6d., same terms; no higher grades offered.

**Iron Pyrites**—Pyrites, 40 per cent. iron and 43 sulphur, are 11s. 9d. per ton, f.o.b. Cartagena.

**Metal Market**

NEW YORK, Feb. 27

**Gold and Silver Exports and Imports.**

At all United States Ports in January and year.

Metal.	Exports.	Imports.	Excess.
<b>Gold:</b>			
Jan. 1907...	\$2,443,441	\$ 3,204,457	Imp. \$ 761,016
" 1906 ..	5,741,665	2,605,709	Exp. 3,135,956
Year 1907..	2,443,441	3,204,457	Imp. 761,016
" 1906 ..	5,741,665	2,605,709	Exp. 3,135,956
<b>Silver:</b>			
Jan. 1907...	4,766,874	3,620,888	Exp. 1,145,986
" 1906 ..	7,516,668	4,686,711	" 2,829,957
" 1907 ..	4,766,874	3,620,888	" 1,145,986
" 1906 ..	7,516,668	4,686,711	" 2,829,957

These statements cover the total movement of gold and silver to and from the United States. These figures are furnished by the Bureau of Statistics of the Department of Commerce and Labor.

**Gold and Silver Movement, New York.**

For week ending Feb. 23 and years from Jan. 1.

Period.	Gold.		Silver.	
	Exports.	Imports.	Exports.	Imports.
Week.....	\$ 15,300	\$ 440,195	\$1,105,115	\$ 32,515
1907.....	1,410,355	1,532,243	4,338,655	384,503
1906.....	3,008,379	362,866	13,657,569	235,021
1906.....	29,456,196	714,423	5,681,440	177,153

Exports of gold for the week were to the West Indies; of silver to London and Paris. Imports of gold for the week were from Germany and Mexico; of silver from Mexico and South America.

The joint statement of all the banks in the New York Clearing House for the week ending Feb. 23 shows loans, \$1,083,463,400, a decrease of \$8,600,600; deposits, \$1,045,021,700, a decrease of \$12,524,500, as compared with the preceding week. Reserve accounts show:

	1906.	1907.
Specie.....	\$185,637,200	\$190,145,800
Legal tenders.....	80,063,200	75,419,200
Total.....	\$265,700,400	\$265,565,000
Surplus.....	\$5,125,725	\$4,309,575

The surplus over legal requirements shows a decrease of \$121,475, as compared with the previous week.

Specie holdings of the leading banks of the world on Feb. 23 are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York .....			\$190,145,800
England.....	\$183,381,190		183,381,190
France.....	529,072,740	\$197,047,820	726,120,560
Germany.....	166,953,750	55,651,250	222,605,000
Spain.....	77,040,000	122,095,000	199,135,000
Netherlands.....	27,717,000	28,900,000	56,617,000
Belgium.....	15,933,335	7,966,665	23,900,000
Italy.....	162,295,000	24,040,500	186,335,500
Russia.....	590,255,000	23,675,000	613,930,000
Aust.-Hungary.....	232,150,000	60,655,000	292,805,000
Sweden.....	20,540,000		20,540,000

The banks of England and Sweden report gold only. The New York banks do not separate gold and silver in their reports.

Shipments of silver from London to the East are reported by Pixley & Abell as follows, for the year to Feb. 14:

	1905.	1906.	Changes.
India.....	£ 2,939,500	£1,738,110	D. £ 1,201,390
China.....	.....	.....	.....
Straits.....	.....	76,300	I. ....
Total.....	£ 2,939,500	£1,814,410	D. £ 1,125,090

Imports for the week were £47,000 from New York, and £150,000 from Shanghai; a total of £197,000. Exports were £738,000 in bars and £162,000 in Mexican dollars; £900,000 in all, to India.

Indian exchange is still strong, and the Council bills offered in London were taken at an average of 16.09d. per rupee. There has been some buying of silver for the Indian Government.

The gold and silver movement in France for the full year is reported as below:

	1905.	1906.
Gold:		
Imports.....	Fr. 779,648,000	Fr. 490,473,000
Exports.....	131,494,000	165,087,000
Excess, imports....	Fr. 648,154,000	Fr. 265,386,000
Silver:		
Imports.....	104,909,000	156,619,000
Exports.....	100,469,000	134,718,000
Excess, imports....	Fr. 4,440,000	Fr. 21,901,000

Imports of copper and nickel coins were 157,000 fr. in 1905, and 122,000 fr. in 1906; exports were 308,000 fr. in 1905, and 290,000 fr. last year.

Prices of Foreign Coins

	Bid.	Asked.
Mexican dollars.....	\$0.531	\$0.55
Peruvian soles and Chilean.....	0.484	0.49
Victoria sovereigns.....	4.854	4.87
Twenty francs.....	3.86	3.89
Spanish 25 pesetas.....	4.78	4.80

SILVER AND STERLING EXCHANGE.

February.	Sterling Exchange.	Silver.		February.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
21	4.84½	68¾	31¾	25	4.84½	69	31½
22	.....	.....	31½	26	4.84½	69½	32
23	4.84½	69	31½	27	4.84½	69½	32½

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

Other Metals

Daily Prices of Metals in New York.

February.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.			Cts. per lb.	New York, Cts. per lb.
21	25 @25½	24¾ @25	106½	41¾	6.00	6.80 @6.90	6.65 @6.75
22	.....	.....	107½	.....	.....	.....	.....
23	25 @25½	24¾ @25	.....	42	6.00	6.80 @6.90	6.65 @6.75
24	25 @25½	24¾ @25	107½	42½	6.00	6.80 @6.90	6.65 @6.75
25	25 @25½	24¾ @25	107½	41¾	6.00	6.85 @6.90	6.70 @6.75
26	25 @25½	24¾ @25	107½	42	6.00	6.85 @6.90	6.70 @6.75
27	25 @25½	24¾ @25	108½	42	6.00	6.85 @6.90	6.70 @6.75

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electrolytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions as made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The lead prices are those quoted by the American Smelting and Refining Company for near-by shipments of desilverized lead in 50-ton lots, or larger. The quotation on spelter are for ordinary western brands; special brands command a premium.

**Copper**—Some large sales were reported at the beginning of the week, but after the holiday the market became dull again, and the sales have been very small in amount, domestic and foreign consumers both being chary about contracting their requirements for delivery beyond June. The scarcity of near-by metal is still pronounced and a premium is exacted from belated buyers. Quotations at the close are unchanged at 25@25½ for Lake copper; 24¾@25c. for electrolytic in ingots, cakes and wirebars; while business in casting has been done between 24¼@24¾.

The London standard market, on account of a great deal of speculation, on the bull side, has shown a very much firmer tendency, and closes strong at £108 5s. for spot, £109 7s. 6d. for three month.

Refined and manufactured sorts we quote: English tough, £112@113; best selected, £115@116; strong sheets, £125@126.

Exports of copper from New York for the week were 1213 tons. Our special correspondent reports the exports from Baltimore for the week at 1352 long tons. In addition there was exported from Baltimore 94,982 lb. copper sulphate.

**Copper Sheets**—The base price of copper sheets is 32c. per pound.

**Copper Wire**—The base price of copper wire, No. 0000 to No. 8, is 27¼@27½c. per pound.

**Tin**—Consumers during the past week have taken a more active interest in this metal than for some time, and considerable business resulted. The orders placed from this side had the effect of advancing the London market, which at one time touched £193 15s. for spot. This advance, however, could not be maintained, and prices over there sagged off, the close being cabled as steady at £191 10s. for spot, £190 5s. for three months. Prices in this market, which had advanced to 42¼ for spot, close at 41¾@42c.

**Lead**—The quotation remains unchanged at 6c. New York.

The London market does not show any change either and is reported steady at £19 10s. for Spanish lead, £19 12s. 6d. for English.

**St. Louis Lead Market**—The John Wahl Commission Company telegraphs on Feb. 27 as follows: Lead is unchanged. The price is 6.07½c. for ordinary, and 6.15c. for refined Missouri brands.

**Spanish Lead Market**—Messrs. Barrington & Holt report from Cartagena,

Spain, under date of Feb. 9, that the price for pig lead has been 90.75 reales per quintal, silver being paid at 14 reales per ounce; exchange, 27.39 pesetas to £1. The lead price, on current exchange, is equal to £18 11s. per long ton f.o.b. Cartagena. Exports were 66 tons desilverized and 531 tons argentiferous lead to Marseilles; 602 tons argentiferous to London; 1199 tons in all.

**Spelter**—The demand from consumers having again become very satisfactory, the advance in this metal has made further progress, and quotations at the close are 6.85@6.90, New York; 6.70@6.75c., St. Louis.

From London a very dull market is reported, but the tendency seems to be somewhat steadier, the quotations being cabled as £26 for good ordinaries, £26 5s. for specials.

**Spanish Zinc Ore Market**—Messrs. Barrington & Holt report from Cartagena, Spain, under date of Feb. 9, that exports for the week were 2000 tons blende to Antwerp. The market is dull.

**Zinc Sheets**—The base price is now \$8.50 per 100 lb. (less discount of 8 per cent.) f.o.b. cars at Lasalle and Peru, in 600-lb. case for gages No. 9 to 22, both inclusive; widths from 32 to 60 in., both inclusive; the lengths from 84 to 96 in., both inclusive. The freight rate to New York is 27.5c. per 100 pounds.

**Antimony**—The market is neglected, and the nominal quotations reported remain unchanged at 23¼c. for ordinaries, 23½@24c. for Hallett's, and 24½@25c. for Cookson's.

**Nickel**—For large lots, New York or other parallel delivery, the chief producer quotes 45@50c. per lb., according to size and terms of order. For small quantities prices are 50@65c., same delivery.

**Platinum**—Demand continues strong and prices high. Unmanufactured platinum is quoted at \$38 per oz. for ordinary and \$41 per oz. for hard. For good scrap \$31.50@32 is paid.

**Quicksilver**—Current prices in New York are \$41 per flask of 75 lb. for large quantities, and \$42 for smaller orders. San Francisco prices are \$38@39 per flask, according to quantities, for domestic orders, and \$37@37.50 for export. The London price is £7 per flask, but £6 16s. 3d. is quoted by jobbers.

**Aluminum**—Prices are steady and demand good. Prices for ton lots, or over, are: No. 1, over 99 per cent. pure metal, 36c. per lb.; No. 2, over 90 per cent., 34c. Small lots are 1 to 3c. higher, according to size. Rods, according to size, are 1c. per lb. up, over the price of ingots. Granulated metal is 2c. per lb. over ingots.

**Minor Metals**—For minor metals and their alloys, wholesale prices are, f.o.b. works:

	Per Lb.
Cadmium, 99.5% f. o. b. Hamburg....	1.40@1.46
Chromium, pure (N. Y.).....	80c.
Copper, red oxide.....	50c.
Ferro-Chrome (70).....	11½c.
Ferro-Chrome (7-9% carbon, per lb. Cr.)	10½c.
Ferro-Chrome (1% C. for each 10% Cr.)	11@11½c.
Ferro-Chrome (60-64% Cr., 3-4% C.)...	12@12½c.
Ferro-Chrome (60-70% Cr., 1% C. or less)	38c.
Ferro-Molybdenum (50%).....	1.00
Ferro-Titanium (20%).....	80c.
Ferro-Tungsten (37%).....	30c.
Ferro-Vanadium (25-50%, per lb. vana-	
dium contents).....	\$5.50
Magnesium, pure (N. Y.).....	1.50
Manganese, pure 98@99% N. Y.....	75c.
Manganese-Copper (30@70%) N. Y.....	45c.
Molybdenum (98@99%, N. Y.).....	\$1.75
Phosphorus, foreign red (f. o. b. N. Y.)	90c.
Phosphorus, American yellow (f. o. b.	
Niagara Falls).....	42c.
Tungsten (best) p. und lots.....	1.25
Ferro-Silicon (50%) spot. Ex. ship	
Atlantic ports.....	\$97@100 ton.

Variations in price depend chiefly on size and conditions of orders.

A movement has recently been on foot in Germany to create a metal exchange, either at Berlin or Hamburg, with the object of making its prices the standard for German ore and metal contracts, which now are based on the transactions of the metal exchange at London. The project will probably come to nothing, inasmuch as the headquarters of the largest concerns in the metal trade of Germany are at Frankfurt and Halberstadt, while furthermore the zinc producers of Silesia have declared that they will under no circumstances have anything to do with any Berlin or Hamburg metal exchange.

**Chemicals**

NEW YORK, Feb. 27

**Copper Sulphate**—The market remains steady, with a good demand. Prices are unchanged, at \$7.25 per 100 lb. for car-load lots, or over; \$7.50 per 100 lb. for smaller parcels.

**Nitrate of Soda**—The market is firm and tends to advance in price on account of the small production and deliveries during February. We quote 95 per cent. at \$2.42½ and 96 per cent. at \$2.50 for all positions during the year. For 1908 delivery the prices are \$2.40 for 95 and \$2.47½ for 96 per cent.

**Missouri Ore Market**

JOPLIN, Feb. 23

The highest price reported paid for zinc ore was \$53.50 per ton, the assay-basis price being quoted at \$47 to \$50 per ton of 60 per cent. zinc. The average price, all grades, was \$48.06.

The highest price reported paid for lead was \$87.50, with ores carrying 80 per cent. lead selling at \$84@86. The average is \$84.04 per ton. Lead buyers announce a weaker market at the close, with a further decline probable for next week.

The new purchasing agents for the Mineral Point Zinc Company's works at DePue, Ill., are now taking zinc ore and shipments are being made to the Lanyon-Star works at Bartlesville, Oklahoma. Shipments to William Lanyon's new works

at Deering, Kan., are expected to be started at an early date. Thus, with the old buyers in the field for their customary allotments, it is seen that the demand keeps pace with the larger supply of this year. For the two months the shipment has been increased over the two months of 1906 by 8220 tons of zinc and 821 tons of lead, and the output has shown even a greater increase. The stock in the bins approximates 7600 tons of zinc and 700 tons of lead, practically all sold.

Following are the shipments of zinc and lead from the various camps of the district for the week ending today:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville.....	2,858,460	451,320	\$87,558
Joplin.....	2,415,890	387,890	76,687
Galena-Empire.....	1,167,470	139,940	33,896
Duenweg.....	1,065,430	143,840	31,611
Badger.....	1,058,400	.....	26,460
Alba-Neck City.....	708,990	.....	19,224
Prosperity.....	196,920	289,390	16,880
Spurgeon.....	364,500	84,750	10,945
Granby.....	450,000	72,000	10,450
Oronogo.....	316,430	15,690	8,721
Sherwood.....	266,470	25,040	7,712
Aurora.....	303,530	.....	7,284
Baxter Springs.....	223,560	5,520	5,484
Carthage.....	147,560	.....	3,689
Carl Junction.....	124,740	7,150	3,480
Zincite.....	67,430	12,640	2,182
Springfield.....	50,750	.....	1,218
Reeds.....	34,130	.....	819
<b>Totals.....</b>	<b>11,880,600</b>	<b>1,635,170</b>	<b>\$354,300</b>
Two months.....	93,337,700	12,738,440	\$2,707,454
Zinc value, the week, \$285,588; 2 months, \$2,170,694			
Lead value, the week, 68,712; 2 months, 536,760			

The following table shows the average monthly prices of zinc and lead ores in Joplin, by months; the average for zinc being based on the prices of assay basis ores carrying 60 per cent. zinc:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1906.	1907.	Month.	1906.	1907.
January...	47.38	45.84	January...	75.20	83.58
February...	47.37	47.11	February...	72.83	84.53
March.....	42.68	.....	March.....	73.73	.....
April.....	44.63	.....	April.....	75.13	.....
May.....	40.51	.....	May.....	78.40	.....
June.....	43.83	.....	June.....	80.96	.....
July.....	43.25	.....	July.....	74.31	.....
August.....	43.56	.....	August.....	75.36	.....
September.	42.58	.....	September.	79.64	.....
October....	41.55	.....	October....	79.84	.....
November..	44.13	.....	November..	81.98	.....
December..	43.68	.....	December..	81.89	.....
<b>Year.....</b>	<b>43.24</b>	<b>.....</b>	<b>Year.....</b>	<b>77.40</b>	<b>.....</b>

**Wisconsin Ore Market**

PLATTEVILLE, Feb. 23

The market has been steady this week, with no material change. The camps of the district loaded ore as follows for the week ending Feb. 23:

Camps.	Zinc, Lb.	Lead, Lb.	Sulphur, Lb.
Platteville.....	223,710	.....	.....
Buncombe-Hazel Green..	593,102	.....	.....
Linden.....	299,020	.....	.....
Highland.....	264,000	44,400	.....
Rewey.....	180,000	.....	.....
Galena.....	135,800	60,000	.....
Benton.....	125,840	.....	.....
Mineral Point.....	74,460	.....	.....
Cuba City.....	67,540	.....	.....
Livingston.....	55,000	.....	.....
<b>Total for week.....</b>	<b>2,018,472</b>	<b>104,400</b>	<b>.....</b>
<b>Year to Feb. 23.....</b>	<b>12,060,487</b>	<b>648,470</b>	<b>96,480</b>

The zinc-ore shipments for the week exceeded 2,000,000 lb., being above the average for this year.

**Mining Stocks**

NEW YORK, Feb. 27

The general stock markets are still depressed, and it can hardly be said that liquidation is over. The markets, moreover, are largely professional, the public, apparently, taking little interest.

On the New York curb mining stocks were rather inactive, and the tendency of prices was downward. Arrangements are being made to list some of the copper stocks on the exchange, which will reduce the importance of the outside market.

On the exchange one sale of Homestake, of South Dakota, was recorded, the first for several weeks. A lot of 100 shares changed hands, at \$85 per share.

Boston Feb. 26

Events the past week show that the Calumet & Hecla management is in a particularly aggressive mood and seeks to hold its supremacy in the Lake Michigan mining world. It now controls La Salle, Centennial and Allouez, and will control the Osceola at the latter's annual meeting, March 14. A contest for proxies is now going on, but there is little doubt that Calumet & Hecla will win out against the present Osceola management, as it was in the field early soliciting proxies both here and in Michigan. On Wednesday last the Calumet had transferred to its credit 20,000 shares of Osceola, which it had purchased in the open market. This means that Calumet is investing its surplus money in going mines and mineral lands and aims to control the output in that section of the country. For the present, at least, the corporations will be maintained separately and the Calumet will benefit as developments progress and yield the company income. It stands in the light of a holding company with a majority of the stocks.

Marketwise conditions have been unfavorable, although the week included but four days, Friday and Saturday being holidays. Trinity was again in the front with pretty violent fluctuations, both up and down. From a closing at \$30.87½ a week back it rose to \$38, but in 24 hours' time its price had broken to \$28.50. Today's closing was \$31.62½. A financial statement issued as of Feb. 19, 1907, shows a cash balance in the treasury of \$123,714. Several Lake stocks had moderate flurries after the Calumet's new acquisition.

Calumet & Hecla directors declared another \$20 dividend last week, the same as the previous two payments, and the stock touched \$940, ex-dividend, selling at \$960 today. Last week, it will be remembered, it touched \$1000. Osceola made its best record at \$181, but is now off to \$171. Amalgamated fell \$3.25 to \$110 during the week, closing tonight at \$111.

It is said that an attempt will be made to take control away from the present

Franklin mining management at the annual meeting, April 17.

As a rule, mining shares are from \$1 to \$2 lower than they were a week ago. The curb continues to grow and finds more and more followers.

Colorado Springs Feb. 23

Trading on the local stock exchange has been dull and featureless for the entire week. The lack of interest in the projected tunnel by a number of the large mine-owners has a depressing effect. Prices remain stiff, holders declining to sell, except at an advance. Work has been the most active and sold from 15 up to 19 7/8c. this week.

STOCK QUOTATIONS

Table with columns for NEW YORK Feb. 26 and BOSTON Feb. 26. Lists various stock names and their prices.

N. Y. INDUSTRIAL table listing industrial stocks like Am. Agri. Chem., Am. Smelt. & Ref., etc.

ST. LOUIS Feb. 23 table listing local stock prices with columns for Name of Com., High, and Low.

S. FRANCISCO Feb. 21

Table of stock quotations for S. Francisco, including COMSTOCK STOCKS, TONOPAH STOCKS, and GOLDFIELD STOCKS.

NEVADA Feb. 27

Table of stock quotations for Nevada, including TONOPAH STOCKS, BULLFROG STOCKS, and MANHATTAN STOCKS.

New Dividends

Table listing companies and their new dividends, including American Coal, Am. Smelters Securities, etc.

Assessments

Table listing companies and their assessments, including Butler-Liberal, Clark-Virginia, etc.

Monthly Average Prices of Metals

Table showing monthly average prices of silver in New York and London from 1906 to 1907.

AVERAGE PRICES OF COPPER

Table showing average prices of copper in New York and London, including Electrolytic and Lake grades.

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Table showing average prices of tin in New York from 1906 to 1907.

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Table showing average prices of lead in New York and London from 1906 to 1907.

New York, cents per pound. London, pounds sterling per long ton.

AVERAGE PRICE OF SPELTER

Table showing average prices of spelter in New York, St. Louis, and London from 1906 to 1907.

New York and St. Louis, cents per pound. London in pounds sterling per long ton.





DIVIDENDS.

Metal and Mining Companies—U. S.

Table listing Metal and Mining Companies in the U.S. with columns for Name of Company and Location, Authorized Capital, Shares (Issued, Par Val.), Dividends (Total to Date, Latest), and Amt.

Coal, Iron and Other Industrials—United States.

Table listing Coal, Iron and Other Industrials in the United States with columns for Name of Company and Location, Authorized Capital, Shares (Issued, Par Val.), Dividends (Total to Date, Latest), and Amt.

Canada, Mexico, Central and South America.

Table listing companies in Canada, Mexico, Central and South America with columns for Name of Company and Location, Authorized Capital, Shares (Issued, Par Val.), Dividends (Total to Date, Latest), and Amt.

\*Previous to consolidation \$1,436,260 were divided.

\*Mexican Currency.

## THE MINING INDEX.

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

We will undertake to furnish a copy of any article (if in print) in the original language, for the price quoted. Where no price is quoted the cost is unknown. These papers are not kept in stock, but must be ordered from the publisher; hence there will be some delay for foreign papers.

No accounts can be opened for these small amounts, but remittance must be sent with order. For the convenience of those making small but frequent remittances, coupons are furnished at the following prices: 20 cents each, six for \$1.00, thirty-three for \$5.00 and one hundred for \$15.00. This arrangement will be especially appreciated by foreign readers and men in distant mining camps. Where remittances are made in even dollars we will return the excess over an order in coupons upon request.

### ALUMINUM

2526—ALUMINUM—Aluminio en Vez de Cobre en las Instalaciones Electricas. C. T. de Tolentino. (Revista Minera, Jan. 16, 1907; 1 p.) A short article, comparing the relative advantages of copper and aluminum as conductors of electricity, and giving a summary of the saving to be made by using aluminum on a line 30,000 meters long. 40c.

2527—SOLDERING—The "Shoop" Process of Aluminum Soldering. (Electric Accumulator, Jan., 1907; 1 p.) Discusses this new method of aluminum soldering, which is based upon the fact that aluminum becomes soft at certain temperatures, in which condition it may be joined by hammering to another piece of aluminum heated to the same temperature. Tests upon joints welded in this fashion are tabulated with the article. 40c.

### ANTIMONY

2528—IDAHO—The Antimony Beds in the Cœur d'Alenes. J. J. O'Leary. (Eng. & Mg. J., Feb. 9, 1907.) Describes the development which has taken place upon the six antimony claims of this field, and gives a brief account of a crude method of smelting which was practiced temporarily. 20c.

### CEMENT

2529—CEMENT—Ueber den Einfluss einiger Lösungen auf Portland- und Schlacken-zement. H. Renezeder. (Oest. Wochenschrift für den öffentlichen Baudienst, Jan. 19, 1907; 3½ pp.) A long account of the effect of different solutions and of sea water on the properties and quality of cement. 40c.

2530—ONTARIO—Cement Industry of Ontario. (Report of Ont. Bureau of Mines, Vol. XIV, Part 1; 66 pp.) Describes briefly the marl deposits of Ontario, and discusses in considerable detail the apparatus used in making cement. Also enumerates the principal cement producers of the province.

2531—SPECIFIC GRAVITY of Portland Cement. D. B. Butler. (Paper No. 3625 before the Brit. Instn. of Civil Engrs., Session 1905-1906; 6 pp.) Sums up the results of tests made to determine the correctness of the theory that specific gravity is a criterion of proper calcination. The conclusion is reached that specific gravity is no indication of this whatever, and that it depends solely upon age of the cement.

### CLAY

2532—KAOLIN MINING in Georgia. Otto Veatch. (Eng. & Mg. J., Feb. 9, 1907; 1½ pp.) Gives an account of the kaolin deposits at several places in Georgia, and describes the open-cut method of mining; also the method used in preparing the kaolin for market. 20c.

### COAL AND COKE

2533—BRITISH COLUMBIA—Coal Measures of the Teikwa. (B. C. Mg. Rec., Dec., 1906; 1½ pp.) Describes briefly the geology of these coal deposits and the development which the various companies have done upon their claims. 20c.

2534—BROWN COAL MINING—Die Verwendung von Baggern zur Abraumarbeit auf den Braunkohlenbergwerken der Provinz Sachsen. M. Tornow. (Zeit. f. Berg. Hütten u. Salinenwesen, Band 54, 5 Heft; 26½ pp.) A very complete account of the use of bucket dredges for stripping and working deposits of brown coal in Saxony. Many examples of cost keeping under different mining conditions are given, and the entire subject is

fully discussed from a theoretical as well as practical point of view.

2535—CHINA—Coal Mining in China. N. F. Drake. (Mg. Wid., Feb. 16, 1907; 2 pp.) The primitive methods of coal mining in use in China are discussed briefly, and the occurrence of coal, province by province, in the Empire is summarized. 20c.

2536—COAL of the United States. F. Z. Scheißenberg. (Proceedings, Engrs. Soc'y of W. Penn., Jan., 1907; 23 pp.) The characteristics of the various coal fields of the United States are outlined, and the subject of dust and gas explosions in mines is briefly considered. 40c.

2537—COAL CONSUMPTION—Efficiency in Coal Consumption. M. Brown. (Sci. & Art of Mining, Jan. 26, 1907; 1 p.) First instalment, dealing principally with the various ways in which energy is spent during steam generation. 40c.

2538—COAL FORMATION—Maximum Rate of Deposition of Coal. G. H. Ashley. (Econ. Geology, Jan.-Feb., 1907; 13 pp.) Contains an account of the investigations undertaken by the author with a view to determining the maximum rate of deposition of coal to obtain a basis for estimating the time involved in the process. 60c.

2539—COAL MINE FIRES. R. V. Norris. (Eng. & Mg. J., Feb. 9 and 16, 1907; 4 pp.) Lecture before the students at Columbia University, revised by the author, giving an account of the methods used to extinguish fires in the Big Lick and Warrior Run collieries, and containing comments and precautions to be observed in other standard methods of fighting mine fires. 20c.

2540—COAL MINE SAMPLING, The Value of. M. R. Campbell. (Econ. Geology, Jan.-Feb., 1907; 9½ pp.) Gives a brief resumé of the results of fuel testing at the St. Louis exposition, and discusses the results obtained with reference to the manner in which the sample was taken. Gives also proposed methods of mine sampling to eliminate the personal equation as much as possible. 60c.

2541—COAL MINING—A Single-room System. H. S. Gay. (Mines & Min., Feb., 1907; 3 pp.) Paper read before the Coal Mining Institute, Dec. 19, 1906, giving the results obtained by the author in applying the longwall system of mining to moderately thick coal seams, with special reference to the hydraulic props which were used. 20c.

2542—COAL MINING—Early Coal Mining in the Lackawanna Valley. W. H. Richmond. (Mines & Min., Feb., 1907; 1 p.) Gives a history of the development of the mining industry and transportation in the Lackawanna valley coal district. 20c.

2543—COAL MINING—The Technics of Coal Mining. Geo. H. Winstanley. (Mg. Engineering, Feb., 1906; 2½ pp.) Continuation of article previously indexed, containing in this instalment a consideration of the various types of faults which are met with in coal mining, together with a few examples in tracing out the new location of the seam, which has been lost by faulting. 40c.

2544—COAL TESTING—Testing and Purchasing Coal for Steam Plants. A. O. Doane. (Eng. News, Feb. 7, 1907; 1 p.) Discusses the importance of knowing the composition and calorific power of coal for heating purposes, and discusses various means of making tests necessary for the above determination. 20c.

2545—COAL TESTING—The Testing of Coal. A. Bement. (Jl. Western Soc'y of Engrs., Dec., 1906; 39 pp.) Reprint of the above paper which was read before the Western Soc'y of Engrs., Oct. 3, 1906, together

with discussion of the same by various members of the Society. 40c.

2546—COKE—Increase of Moisture in Coke Shipped in Sealed Cars. T. F. Farrell and W. N. Page. (Eng. & Mg. J., Feb. 9 and 16, 1907.) Contains various theories as to the reasons for the presence of moisture in fresh coke which was transported only in sealed cars, the prevalent opinion being that chemical action resulted in the absorption from the air. 20c.

2547—COKE OVEN MATERIALS. J. M. McKinley. (Mines & Min., Feb., 1907; 1 p.) Paper read before the Coal Mining Inst., Dec. 19, 1906. The effect of the physical conditions of the coke oven upon the coke produced is discussed and special account is taken of the brick used for lining, crown brick and the shape of the oven. 20c.

2548—COKE OVENS—Eine neue Kabelwinde für Kochofentüren, System F. G. L. Meyer-Bochum. (Glückauf, Jan. 19, 1907; 1 p.) Describes and illustrates a new device for raising and lowering doors on coke ovens, making use of a counterbalance to obtain the necessary power. 40c.

2549—COLLIERY EXPLOSION—The Stuart Colliery Disaster. F. W. Parsons. (Eng. & Mg. J., Feb. 16, 1907; 1 p.) Discusses the explosion at this colliery with regard to the effect which the character of the coal and the method of operation may have had upon the cause of the disaster. 20c.

2550—GERMAN COAL SYNDICATES—Das Verhältniss der Grossisten untereinander, ferner zum Bergbau, Detailhandel und Konsum. (Deutsche Kohlen-Zeitung, Jan. 26, 1907; 1 p.) Discusses a few considerations which have bearing upon the organization of syndicates for controlling the coal industry of Germany.

2551—ILLINOIS—Coal Mining in Eastern Illinois. F. W. Parsons. (Eng. & Mg. J., Feb. 16, 1907; 2½ pp.) The general practice of coal mining in eastern Illinois is described by reference to the methods employed by the Dering Coal Co., whose equipment and plan of working are outlined. 20c.

2552—ILLINOIS COALS—The Economic Value of Illinois Coals. L. P. Breckenridge. (Clay Rec., Jan. 30, 1907; 6 pp.) A very valuable contribution upon the coals of Illinois, comparing their occurrence with other coal fields of the United States, and giving the results of many analyses and boiler tests made upon them. 20c.

2553—KENTUCKY COAL MINE. R. B. Coiton. (Yale Sci. Monthly, Jan., 1907; 4 pp.) A very brief account of the conditions at Pine Ridge, and a short description of the methods in use for breaking down and hoisting the coal. 40c.

2554—LIFE-SAVING APPARATUS—Das Verwendungsgebiet der Schlauch- und Sauerstoffatmungsapparate bei der Grubenbrandgewältigung. F. Hagemann. (Glückauf, Jan. 12, 1907; 1500 w.) Discussion of the application of respirators and hose to rescue work after explosions in mines, dealing with the necessity of having such apparatus easily accessible in the workings, and describing also actual mines where the devices were used to aid in removing accumulations of gas. 40c.

2555—LIFE-SAVING APPARATUS—Les appareils de sauvetage. (Comptes Rendus mensuels des Réunions de la Société de l'Industrie minière, Feb., 1907; 10 pp.) A summary of the principal types of apparatus in use in gaseous mines in England for rescue work, dealing especially with compressed air, pneumatic and various kinds of portable devices.

2556—LIGNITE of Northeastern Wyo-

ming. S. Kennedy. (Mines & Min., Feb., 1907; 3 pp.) Shows how the use of lignite as fuel on locomotives has caused remarkable development of this industry in Wyoming, and describes the principal features of the Sheridan coalfield and its mines. 20c.

2557—MICHIGAN—Coal Mining in Michigan. G. E. Edwards. (Mg. Wid., Feb. 9, 1907; 1 p.) Describes briefly the coal measures of Michigan, and the developments that have taken place during 1906. 20c.

2558—MINE GASES—The Action of Coal-mine Gases. Richard Lee. (Eng. & Mg. Jl., Feb. 9, 1907; ½ p.) Brief review of the characteristics of carbon monoxide, fire-damp and after-damp, with tests for detecting the presence of each. 20c.

2559—MINING STATISTICS. E. W. Parker. (Mines & Minerals, Feb., 1907; 1 p.) Paper read before the Coal Mining Institute, Dec. 19, 1906, discussing some of the principles which must be kept in mind in the collection of statistics, with notes on the great increase in coal tonnage during recent years. 20c.

2560—PEAT DEPOSITS of New Jersey. H. B. Kummel. (Econ. Geology, Jan.-Feb., 1907; 10 pp.) Describes briefly the occurrence of peat in this State, and sums up the results of analyses, calorimeter and coking tests on the peat. 60c.

2561—SAFETY LAMPS—Gallford's Patent Reflector. (Sci. & Art of Mining, Feb. 9, 1907; 2 pp.) Describes with considerable detail this invention, which consists essentially of an arrangement whereby the light from a safety lamp may be reflected to any part of the working as becomes necessary. 40c.

2562—TIMBERING—Beton im Kohlenbergbau. (Tonindustrie Zeitung, Feb. 2, 1907; 1 p.) Describes a method of using concrete in some French coal mines as supports for timbering, to the end that more of the coal may be won with greater safety. 40c.

2563—TRANSVAAL—The Coals of the Transvaal. F. A. D. H. Mosely. (Jl. Transvaal Inst. Mech. Engrs., Jan., 1907; 3 pp.) Describes briefly the occurrence of coal in a few districts of the Transvaal, and gives the results of ultimate analyses and determinations of calorific powers upon samples from the producing mines. Continuation of article previously indexed. 60c.

2564—VENTILATION in Flat Coal Seams. A. H. Stow. (Eng. & Mg. Jl., Jan. 26, 1907; 4 pp.) A technical consideration of various methods of ventilation in this type of coal seam, giving many practical examples of brattice construction and maintenance. 20c.

2565—VIRGINIA—The Richmond Coal Basin. E. K. Judd. (Eng. & Mg. Jl., Feb. 9, 1907; 1 p.) A description of the coal occurrences of this Virginia district, and an account of the sinking of shafts on the property by an air-hammer drill. 20c.

#### COPPER

2566—ANALYSIS of Industrial Copper. Messrs. Holland and Berliaux. (Mg. Jl., Feb. 9, 1907; ½ p.) Translation from *Bulletin de la Société Nationale pour l'Encouragement de l'Industrie*, July, 1906, giving in detail procedures for determining the principal impurities which occur in industrial copper, and giving very brief comments upon some of the steps in the manipulation. 40c.

2567—ARIZONA—Copper Mining at Bisbee, Arizona. R. B. Brinsmade. (Mines & Min., Feb., 1907; 4½ pp.) Gives a history of the discovery of this district, the development that has taken place, and describes the formation, methods of mining and the equipment of some of the principal mines of the district. 20c.

2568—ARIZONA—The Production of Copper in Arizona during 1906. James Douglas. (Eng. & Mg. Jl., Jan. 26, 1907; 1 p.) Gives a summary of the principal operations that have taken place in the various copper districts of this State, and discusses the output of some of the principal producers. 20c.

2569—BLAST FURNACE VS. REVERBERATORY. H. L. Charles. (Mg. & Sci. Press, Jan. 26, 1907; 2 pp.) A discussion of the various features of blast-furnace practice in comparison with reverberatory furnaces for smelting copper ores. 20c.

2570—CALIFORNIA—Notes on the Foot-hill Copper Belt of the Sierra Nevada. A. Knopf. (Bull. of the University of California, Dept. of Geol., Vol. IV, No. 17; 13 pp.) The principal copper camps of this region of the Sierra Nevada are enumerated and brief mention is made of the occurrence of ore and the character of the country rock in each district. 20c.

2571—CHILE—Copper Mines of Collahuasi, Chile. J. Muro. (Bull., Internat'l Bureau of Amer. Republics, Dec., 1906.) Gives a brief description of the occurrence and character of the ore which is produced from this district. 20c.

2572—COPPER MATTES—The Constitution of Mattes Produced in Copper Smelting. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 2½ pp.) Discussion of the above paper by Allan Gibb and R. C. Philip, which was previously mentioned in the Index.

2573—COPPER REFINING—Relative Elimination of Iron, Sulphur and Arsenic in Bessemerizing Copper Mattes. E. P. Mathewson. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 7½ pp.) Paper to be read at the April, 1907, meeting of the A. I. M. E., giving in tabular form the results of analyses of samples taken from copper converters during the refining of the matte, and while the blast was on.

2574—ELECTROLYSIS OF COPPER—Lieber das Acetatkupfer (das sogen. allotrope Kupfer). Carl Benedicks. (Metallurgie, Jan. 22, 1907; 11 pp.) Continuation of article previously indexed, this instalment dealing with the effect of different current densities upon the quality of the copper produced; it also gives an account of experiments undertaken to determine the electric conductivity of the "acetate copper." 40c.

2575—IDAHO—Operations at White Knob Mine. Robt. N. Bell. (Eng. & Mg. Jl., Jan. 26, 1907.) The character and occurrence of the ores at this mine are described briefly. 20c.

2576—IDAHO—The Snowstorm Copper Mine. Robt. N. Bell. (Eng. & Mg. Jl., Feb. 9, 1907.) A very brief description of the ore-bodies at this corner mine. 20c.

2577—NEVADA—Mining Conditions at Ely, Nevada. E. W. Ralph. (Mg. & Sci. Press, Jan. 26, 1907; 2 pp.) Briefly outlines the geological features of this camp in Nevada, which promises copper production in the future. 20c.

2578—SECONDARY ENRICHMENT of Copper-Iron Sulphides. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 3 pp.) Discussion of the paper by T. T. Read of the above title, which was previously mentioned in the Index.

2579—SPAIN—Les Gisements de Cuivre de la Region de Ferrol, Province de Corogne (Espagne). (L'Echo des Mines, Jan. 31, 1907.) Describes the location and mode of occurrence of copper ore in this Spanish province, with notes on future prospects.

2580—TESTING of Copper by the Consumer. (Brass World, Jan., 1907; 4 pp.) Discusses the advantages resulting from testing copper by the consumer, and describes the principal methods of testing in use, giving directions for carrying them out. 20c.

#### GOLD AND SILVER

2581—AFRICA—Gold Mining in West Africa. W. Fischer Wilkinson. (Eng. & Mg. Jl., Jan. 26, 1907; 1 p.) The mines of the Gold Coast and Ashanti districts are briefly enumerated and described, and some space is devoted to the blanket occurrence, and working costs. 20c.

2582—AMALGAMATION—L'Etat actuel e la Soudure électrique. E. Guarni. (Revue univ. des Mines, Dec., 1906; 2500 w.) A second contribution by the author to the art of silver amalgamation. This article discusses the theory and chemistry of the Pato process, giving the reactions which take place, ending with a brief summary of the present state of knowledge of the chemistry of amalgamation. \$1.

2583—ARIZONA—The Weaver Mining District, Arizona. W. A. Root. (Mg. Wid., Feb. 16, 1907; 1 p.) The equipment of some of the principal mines in this district is briefly described, with a few notes on the cyanide and milling practice of the camp. 20c.

2584—ARSENICAL ORES—Notes on the Treatment of Arsenical Ores. C. F. Lee. (Northwest Mg. Jl., Jan., 1907; 1 p.) Discusses briefly the occurrence of arsenical ores in the Cascade range of Washington, and considers the relative advantages of water concentration, cyaniding and roasting as regards the best method of extracting the arsenic. 20c.

2585—ASSAYING—Etude Pratique des Minerais aurifères principalement dans les Colonies et Pays Isolés. N. Dégoutin. Bull. de la Soc. de l'Industrie minière, Tome V, IV livraison, 1906; 145 pp.) Continuation of lengthy paper previously indexed, the present chapter containing a very thorough discussion of the assaying of gold ores in all its branches, dealing in great detail with sacrifice, crucible fusion, cupellation, etc.

2586—BLACK SAND. J. M. Nicol. (Mg. & Sci. Press, Jan. 19, 1907; 2½ pp.) Gives the ideas of the author as to the best methods for working up black sands for the gold contained, and outlines briefly some of the precautions which must be observed throughout the process. 20c.

2587—BLACK SANDS of the Pacific Slope, in 1905. D. T. Day and R. H. Richards. (Advance Chapter from Mineral Resources of the U. S., Calendar Year 1905; 84 pp.) Contains the long expected report of the investigation of the black sands of the

Pacific coast, and gives the methods used in collecting samples, concentrating, assaying, determining their mineralogical character, and tabulates the results of tests on all the samples submitted.

2588—BRITISH COLUMBIA—Operations of the Berry Creek Mining Company in 1906. (B. C. Mg. Rec., Dec., 1906; 4½ pp.) Describes the present condition of this mining company with regard to its equipment and operations during 1906. This property is interesting because of the occurrence of platinum and similar metals among the black sands which occur sparingly on the property. 40c.

2589—CALIFORNIA—Geology of the Exposed Treasure Lode, Mojave, California. C. DeKalb. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 10 pp.) Paper to be read at the April, 1907, meeting of the A. I. M. E., giving an account of the geology of this Californian lode, and describing the relations of the rocks to each other; also the periods of faulting which have occurred.

2590—COBALT—The Mines of Cobalt. Reginald Meeks. (Eng. & Mg. Jl., Jan. 26, 1907; 2½ pp.) Several of the principal mining companies of this camp are described in detail as to their equipment, and the underground development which they have so far carried through. 20c.

2591—COBALT—The Nipissing and Foster Cobalt Mines. R. Meeks. (Eng. & Mg. Jl., Feb. 9, 1907; 2½ pp.) An account of the two larger mines of this Ontario district, showing how primitive methods are being abandoned, and describing briefly the method of hydraulic prospecting which is used here. 20c.

2592—COBALT DISTRICT, Ontario. H. W. Hardinge. (Mg. Wid., Feb. 9, 1907; ½ p.) An account of a visit by the author to this mining district, describing briefly the geology of the region and the occurrence of the ore, and showing that little actual development has been done, making it essential for investors to insist upon definite reports upon properties before investing. 20c.

2593—COLOMBIA—A Mining Enterprise in Colombia. F. C. Nicholas. (Mg. Wid., Feb. 9, 1907; 2 pp.) The general conditions which have developed placer properties in this South American republic are discussed, and the conclusion is reached that all mining which is to be carried on in this region must be done with the aid of considerable capital. 20c.

2594—CYANIDATION—Cyanide Sand Handling Systems of the Witwatersrand. A. F. Crank. (Jl. Transvaal Inst. Mech. Engrs., Jan., 1907; 21 pp.) Describes the evolution of the methods and machinery used in handling sands on the Rand, and outlines the present equipment of the principal plants of the district. 60c.

2595—CYANIDATION of Raw Pyritic Concentrates. F. C. Smith. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 5 pp.) Gives the results of a series of tests upon concentrating a pyrite ore and cyaniding the concentrates, ending in the decision to treat the concentrates raw after grinding through 100-mesh screen.

2596—CYANIDATION—The Butters Cyanide Plant, Virginia City, Nev. C. T. Rice. (Eng. & Mg. Jl., Feb. 9, 1907; 4½ p.) A very complete account of the labor-saving devices which are in use in this Nevada mill, giving an especial account of the methods of filtering the solution and precipitating the gold. 20c.

2597—CYANIDATION—The Butters Filter. M. R. Lamb. (Mg. & Sci. Press, Feb. 2, 1907; 2 pp.) Describes the operation and construction of this filter, which claims to be very efficient in extracting precious metal from slimes not amenable to treatment by any other method, as well as from sands which are now treated by percolation, but which will be ground much finer and treated by agitation and filtration. 20c.

2598—CYANIDATION—The Butters Slimes Filter at the Cyanide Plant of the Combination Mines Company, Goldfield, Nevada. M. R. Lamb. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 10 pp.) A description of the construction of this filter, showing its economy in erection, and giving the cycle of operations through which it is run during working. Paper to be read at the April, 1907, meeting of the A. I. M. E.

2599—CYANIDATION—The Moore and Butters Filters. F. L. Bosquil. (Mg. & Sci. Press, Feb. 2, 1907.) Discussion of the relative advantages of stationary and movable frames for filter presses, showing that the operating cost of the Butters-Cassel is less than that of the Moore filter. 20c.

2600—CYANIDE PRACTICE on Boulder Co. Ores. F. Leonard. (Western Chemist and Metallurgist, Jan., 1907; 4½ pp.) Describes a mill run made upon ores from Boulders Co., Colo., giving the methods of handling the pulp, and the details of cyaniding. 60c.

2601—DREDGING—A Powerful Dredge

Equipped with a Cable Storage Drum. (Eng. News, Feb. 7, 1907; 1½ pp.) Describes the equipment and method of operating the exceptionally large dredge which is used in Michigan on government contract work. 20c.

2602—DREDGING and Horticulture. D'Arcy Weatherbe. (Mg. & Sci. Press, Feb. 2, 1907; 1 p.) Describes the utilization of the tailings pile at Folsom, California, where the company has erected a rock-crushing plant to crush their tailings for use in concrete, and where the land which has been covered with stack piles has been reclaimed and utilized for alfalfa and fig-tree cultivation. 20c.

2603—GOLD AND PYRITE—Some Associations of Gold with Pyrite and Tellurides. W. J. Sharwood. (Mg. & Sci. Press, Jan. 26, 1907; 3 pp.) Gives the result of a series of micrographical studies of thin rock sections, with special reference to the relation of gold to pyrite and tellurides. 20c.

2604—HYDRAULIC MINING—Recent Practice in Hydraulic Fill Dam Construction. (Proceedings Amer. Soc'y Civil Engrs., Jan., 1907; 3½ pp.) Discussion by W. L. Butcher and T. G. Dabney of the above paper which was previously mentioned in the Index.

2605—IDAHO—South Mountain, Idaho. Robt. N. Bell. (Eng. & Mg. J., Feb. 9, 1907; 1 p.) The geology of the silver-lead district of South Mountain, Idaho, is described in an interesting manner, and the mixture of minerals which occurs here is commented upon. 20c.

2606—MILLING—Design and Working of Gold Milling Equipment, with Special Reference to the Witwatersrand. G. A. Denny. (Paper No. 3023 before the British Instn. of Civil Engrs., 1906; 61 pp., 2 plates and numerous figures.) A very complete consideration of the principles which underlie the design of mills and the methods of treatment to be adopted for various classes of ore.

2607—MILLING—Regulating Mill Returns in the Transvaal. A. Selwyn-Brown. (Eng. & Mg. J., Feb. 9, 1907; 1 p.) Brief account of the way in which the fluctuating character of the ore of the Transvaal has forced the managers to adopt a process of "sweetening" poor ore in order to obtain a sufficiently high average assay value. 20c.

2608—MILLING—Single-stamp Mills. J. W. Pinder. (Mg. & Sci. Press, Feb. 2, 1907; 1 p.) Discusses the possible substitution of single stamps for batteries in milling practice, and argues that classification of pulp immediately after stamping is a necessity for efficient recovery of values. 20c.

2609—MILLING—Test of Lane Mill Run Side by Side with Fly-stamp Battery. J. A. Stewart. (L. A. Mg. Rev., Jan. 26, 1907.) An interesting account of simultaneous tests of the Lane system of crushing and stamp crushing, giving screen analyses of concentrates and tailings, showing a superior fine grinding power for the Lane mill. 20c.

2610—RAND METALLURGICAL PROGRESS and Recent Innovations. G. A. and H. S. Denny. (Jl. So. Afr. Assn. of Engrs., Dec., 1906; 1½ pp.) Note by D. Simpson of his experience with the Denny method of working at the New Goch gold mine. \$1.

2611—SOUTH AFRICA—Review of Mining in South Africa in 1906. O. Letcher. (Mg. Wid., Jan. 26, 1907; 1 p.) Brief review of developments in the mining industry of South and Central Africa during the past year. 40c.

2612—SOUTH AMERICA—Mining in South America in 1906. M. A. Denegri and K. C. Farish. (Mg. Wid., Jan. 26, 1907; 2 pp.) Review of mining conditions in Peru and Colombia during 1906. 40c.

2613—TRANSVAAL—Ancient Workings in the Northern Transvaal. J. M. Calderwood. (So. Afr. Mines, Dec. 29, 1906; 1 p.) Gives a brief description of the method of working these abandoned prospects of the Northern Transvaal, and predicting the renewing of mining operations as soon as the completion of railways allows reduction of transportation charges. 40c.

2614—TUBE MILLS—Grinding in Tube Mills at the Waihi Gold Mine, Waihi, New Zealand. E. G. Banks. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 4 pp.) A summary of tests which extended over a long period of time, with a view to determining the suitability of tube mills to supplement stamps, and ending in the decision to install the tube mills.

2615—VIRGINIA GOLD MINE. E. K. Judd. (Eng. & Mg. J., Feb. 16, 1907; ½ p.) Outlines the present state of development and methods of operation in this one active Virginia mine in the Virginia copper district. 20c.

2616—WESTERN AUSTRALIA—Individual Records of Kalgoorlie Producers. R. Stokes. (Mg. Wid., Feb. 2, 1907; 1½ p.) Present state of development of several of the principal mines of the Kalgoorlie district is briefly described, including character of ore

treated, methods of treatment and percentages of extraction. 20c.

2617—WESTERN AUSTRALIA—Metasomatic Processes in the Gold Deposits of Western Australia. W. Lindgren. (Mg. J., Feb. 2 and 9, 1907; ½ p.) Study of the ore deposits and country rocks of Western Australia, with reference to the probable process by which the orebodies were formed. 60c.

### IRON AND STEEL

2618—ALABAMA—New Sources of Ore Supply in Alabama. T. P. Grasty. (Mfgs. Record, Feb. 7, 1907; 1½ pp.) Description of the natural resources of Alabama in iron ore, and a discussion of the conditions which have hitherto made it impossible to develop these resources in the manner which they deserve. 20c.

2619—AUSTRIA—Die Eisen- und Stahlgewinnung in Innerösterreich, speziell am steirischen Erzberge im Mittelalter. A. Müllner. (Oest. Zeit. f. Berg- u. Hüttenw., Feb. 2, 1907; 4½ pp.) An interesting account of the metallurgy of iron and steel in Austria, dealing in this instalment with the primitive devices which were used in early times for smelting the ores. 40c.

2620—BLAST FURNACE PRACTICE at Blaenavon. G. F. Martin. (Iron & Coal Tr. Rev., Jan. 18, 1907; 1½ pp.) Paper read before the So. Wales Inst. of Engineers. Describes the equipment for smelting at this plant and pays especial attention to the regulation of the hot blast and the smelting of calcined sulphides. Interesting tables showing the efficiency of furnaces under different conditions of blast are given. 40c.

2621—BLAST FURNACES—Le Charge-ment des Hauts Fourneaux, d'après les Méthodes Américaines. C. Dantin. (Génie Civil, Jan. 19, 1907; 3 pp.) An illustrated description of the best American systems for charging blast furnaces automatically; also an account of the installation of an automatic charging system at Aumetz, Lorraine. 40c.

2622—CAR WHEELS—The Manufacture of Cast Iron Car Wheels. (Iron Trade Rev., Feb. 7, 1907; 6 pp.) A very detailed review of the development of the circular floor, straight line and continuous systems, as applied to the manufacture of cast-iron wheels, together with description of various new and important labor-saving devices which are now used in this industry. 20c.

2623—CARBON ESTIMATION—The Estimation of Carbon in Iron and Steel by Oxidizing the Borings, with the Use of a Single Bunsen Burner. J. A. Auopperle. (Iron Age, Jan. 24, 1907.) Gives the procedure for a method of determining carbon in steel by the direct ignition of the borings with a Bunsen burner, the claim being made that this method of determination will occupy only ten minutes from the time the one-gram sample is laid out. 20c.

2624—COLORADO FUEL AND IRON COMPANY—The Blast Furnaces at the Minnequa Steel Works. Lawrence Lewis. (Eng. & Mg. J., Jan. 26, 1907; 3½ pp.) Continuation of a series of articles on the operations of this company, this article dealing with the blast furnaces and the power plant for operating the mechanism connected with them. 20c.

2625—ELECTRIC FURNACE—Ueber die Fortschritte in der Elektrostaahl-Darstellung. (Stahl u. Eisen, Jan. 16, 1907; 7 pp.) Conclusion of article previously indexed, this instalment dealing with the induction process of electric steel production, discussing the theory of the reduction and describing briefly various procedures. 40c.

2626—ELECTRIC SMELTING—Implantacion de la Electrosiderurgia en Espana. El Horno Kjellin de Araya. (Revista Minera, Jan. 16, 1907; 1 p. and 1 plate.) Brief account of the introduction of electric furnace smelting into Spain, describing the operation and working of the steel plant at Araya. 40c.

2627—ELECTROMETALLURGY OF IRON—Die Fortschritte der Elektro-metallurgie des Eisens. A. Neuburger. (Zeit. f. ange. Chemie, Jan. 18, 1907; 11 pp.) A long contribution on the more important aspects of recent progress in the electrometallurgy of iron, reviewing the results obtained by the chief investigators of this subject. 40c.

2628—FOUNDRY IRON—Die Verwendung des Flammofens in der Giesserei, insbesondere zur Schmelzung von schmiedbarem Guss. Ing. Gelenkkrichen. (Stahl u. Eisen, Jan. 16, 1907; 4 pp.) Conclusion of article previously indexed, this instalment considering the effect of the carbon content upon the iron and discussing the question of temperature, and how it enters into foundry practice. 40c.

2629—GOGEBIC RANGE—Some Gogebic Mines as Seen in 1906. (Iron Tr. Rev., Jan. 31, 1907; 4½ pp.) Gives a comparison of the output of various districts of the Gogebic range, and describes the awakened activities and the new developments at the principal mines of this region. 20c.

2630—HEAT TREATMENT of Steels Containing Fifty Hundredths and Eight Hundredths Per Cent. of Carbon. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 1½ pp.) Discussion by Albert Sauveur of the above paper by C. E. Corson, which was previously read before the Institute.

2631—MARTIN PROCESS—Beitrag zur Metallurgie des Martinprozesses. T. Naske. (Stahl u. Eisen, Jan. 30, 1907; 5 pp.) An investigation of the theory of the process of making Martin steel, and an attempt to trace the chemical reactions which take place. This instalment deals especially with the various condition which determine whether manganese in the steel bath will be oxidized or reduced. 40c.

2632—MECHANICAL EQUIPMENT FOR STEEL WORKS—Maschinelle Einrichtungen für das Eisenhüttenwesen. F. Frölich. (Zeit. des Vereines deutscher Ingenieure, Jan. 12 and 19, 1907; 9 pp.) Continuation of lengthy serial previously indexed; dealing in these instalments with cranes and charging appliances for various furnaces. Many drawings and detailed descriptions are given. 60c.

2633—NICKEL STEEL—Aciers Nickel-Silicium. L. Guillet. (Revue de Metallurgie, Dec. 1, 1906; 19½ pp.) Gives results of a long series of tests upon the properties of nickel steel and silicon steel; descriptions of micrographical tests, mechanical properties, etc., are given; also a list of conclusions drawn from a study of results. \$1.

2634—NITROGEN IN STEEL—Undersökning Utförd vid Motala Verkstad Öfver Kväve Järn och Stal. H. Braune. (Jernkontorets Annaler, 1906; 16 pp.) The author shows that the bad qualities of certain classes of steel are caused by the presence of nitrogen. 80c.

2635—ONTARIO—Boston Township Iron Range. W. G. Miller. (Report of Ontario Bureau of Mines, Vol. XIV, Part 1; 7 pp.) Describes the physical and geological features of this iron range, with a brief account of the rock outcrops.

2636—ONTARIO—Iron Ranges of Michipicoten West. J. M. Bell. (Report of Ontario Bureau of Mines, Vol. XIV, Part 1, 1905; 77 pp.) Outlines the physiography of these iron ranges, and gives full account of the general stratigraphy of the district.

2637—PENNSYLVANIA—The Iron Mines at Cornwall, Pennsylvania. W. E. Ford. (Yale Sci. Monthly, Jan., 1907; 7 pp.) Gives a brief description of the occurrence of iron ore in this Pennsylvania district, and describes the present condition of open-pit mining there, as carried on by the steam shovel. 40c.

2638—RAIL SPECIFICATIONS—Comparison of American and Foreign Rail Specifications, with a Proposed Standard Specification to Cover American Rails Rolled for Export. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 20 pp.) A discussion of the paper by A. L. Colby, which was previously mentioned in the Index.

2639—ROLLING IRON AND STEEL, Improvements In. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 4 pp.) Discussion by members of the Institute of the above paper by J. E. York, which was previously mentioned in the Index.

2640—RUSSIAN STEEL MAKING—Das Hüttenwerk der Metallurgischen Gesellschaft zu Taganrog. L. Fortunato. (Oest. Zeit. f. Berg- und Hüttenw., Jan. 12, 19, 26 and Feb. 2, 1907; 9 pp.) Continuation of article previously indexed. Enumerates the charging lifts, converters, furnaces, etc., and gives tables of capacities, operating details, and also some account of the daily working of the plant. \$1.

2641—SHEET IRON—La Fabrication des Plaques de Blindage aux Forges nationales de la Chaussade. A. Bizot. (Génie Civil, Jan. 26, 1907; 4 pp.) A very complete description of the equipment of the national works at Guerigne, France, for the manufacture of thin sheet iron and steel. 40c.

2642—SMELTING IRON ORE—Concentration et agglomeration des minerais de fer. L. Campredon. (La Metallurgie, Jan. 30, 1907; ½ p.) Gives a description of a few modifications of the Gerdal process for fritting iron-ore concentrates in preparation for smelting, paying special attention to the concentration and handling of the cars on which the briquets are charged into the chamber where the fritting takes place. 40c.

2643—STEEL PLANT—New Plant of the Detroit Steel Casting Co. (Iron Tr. Rev., Feb. 14, 1907; 5½ pp.) Interesting account of the equipment of the new plant of this company, which manufactures open-hearth and converter-steel castings. 20c.

2644—STEEL WORKS—The Krupp Works. (Engineer, Lond., Feb. 8, 1907; 3 pp.) Brief but interesting description of these famous steel works, with several photographic views of the shops. To be continued. 40c.

2645—STRESSES IN STEEL—The Resist-

ance of Iron and Steel to Reversals of Direct Stress. T. E. Stanton and L. Baird. (Paper No. 3630, before the British Instn. of Civil Engrs., Session 1905-1906; 60 pp., 2 plates.) Outlines the arrangement of the testing machine, describes the test pieces used and tabulates and discusses the results obtained. These tests were carried out upon a very large series of different iron and steels and form a very valuable contribution to the knowledge of the strength of materials.

2646 — **TEMPERING** — Untersuchungen über die Festigkeitseigenschaften und Zusammensetzung des Tempergusses. F. Wüst. (Metallurgie, Jan. 22, 1907; 8 pp.) Description of various tests to determine the mechanical and physical properties of temper iron, and to determine its composition. The results of breaking some 30 different specimens are given in tabular form, and the results discussed. 40c.

2647 — **TEXAS** — Iron Ore Development in East Texas. W. C. Cloyd. (Manufacturers' Record, Feb. 14, 1907; 1 p.) An outline of the different reasons which have prevented iron-ore development in Texas, and a description of the present status of the iron industry in this State. 20c.

2648 — **THERMIT PROCESS** — Method and Cost of Welding Rails by the Thermit Process. (Engineering-Contracting, Feb. 13, 1907; 1 p.) The methods of making the molds which are used in this process of repairing rails are described, and the cost of welding given, together with a list of precautions which must be observed to get best results. 20c.

#### LEAD

2649 — **CARBONATE OF LEAD** — Deposit of Lead Carbonate at Viola Mine, Idaho. R. N. Bell. (Eng. & Mg. Jl., Jan. 26, 1907.) A very brief description of the occurrence of lead ore at this mine in Idaho, giving some assays of the ore. 20c.

2650 — **CARMICHAEL-BRADFORD PROCESS**. W. M. Hutchings. (Eng. & Mg. Jl., Jan. 26, 1907.) Gives some of the views of the author as to the reactions which take place between CaSO and PbS in the Carmichael-Bradford and the Huntington-Hieberlein processes. 20c.

2651 — **IDAHO** — Development in the Cœur d'Alenes. (Lead and Zinc News, Jan. 14, 1907; 2½ pp.) Describes briefly the copper belts and the lead and silver districts in this mining region, showing how present mining developments are rapidly increasing. 20c.

2652 — **IDAHO** — The Gilmore Mine, Idaho. Robt. N. Bell. (Eng. & Mg. Jl., Jan. 26, 1907.) Brief summary of the equipment of this lead mine, giving the shipments for 1906. 20c.

2653 — **LEAD REFINING** — Tredinnick's Process for Desilverizing Lead. L. S. Austin. (Mg. & Sci. Press, Jan. 16, 1907; 1½ pp.) Describes an improvement on the Luce-Rozan method of refining base bullion, whereby the melting pots and steam cranes required to raise the bullion are done away, and a train of crystallizing kettles substituted. The method of operating this new plant is described in brief. 20c.

2654 — **LIME ROASTING** — Laboratory Experiments in Lime-Roasting a Galena Concentrate with Reference to the Savelberg Process. H. O. Hofman, R. P. Reynolds and A. E. Wells. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 15½ pp.) Paper to be read before the April, 1907, meeting of the A. I. M. E. An account of several laboratory tests upon several different mixtures of galena concentrates and lime, with a view to eliminating the sulphur by blowing.

#### NICKEL

2655 — **MALLEABLE NICKEL** — The Manufacture of Malleable Nickel. E. S. Sperry. (Brass World, Jan., 1907; 7 pp.) Very interesting account of attempts to produce malleable nickel by use of manganese and magnesium as components of the alloy to be produced, and a brief description of the method of treating malleable nickel as now practiced. 20c.

#### PETROLEUM

2656 — **CALIFORNIA** — Review of Conditions in the California Oil Fields during 1906. (Pac. Mg. & Oil Reporter, Jan. 5, 1907; 1 p.) Gives a brief account of the recent development in these fields, and discusses the permanency of the wells, the productive capacity of the fields, and the additional equipment of some of the chief producers. 20c.

2657 — **GULF COASTAL OIL FIELDS IN 1906**. (Mg. Wid., Jan. 26, 1907; 1 p.) Discusses the condition of the oil industry in the fields of Texas and Louisiana, and gives the production figures for some of the wells in these districts. 40c.

2658 — **ONTARIO** — Petroleum and Natural Gas. E. T. Corkill. (Report of the Ont. Bureau of Mines, Vol. XIV, Part 1; 28 pp.) Describes the location of petroleum- and nat-

ural-gas fields, discusses the various theories now in force as to the origin of natural gas and petroleum, and describes all the geological formations which are associated with oil-bearing horizons.

2659 — **PETROLEUM INDUSTRY** — A Review of American Developments during 1906. (Petroleum Rev., Jan. 19, 1907; 2 pp.) Discusses the developments and production of oil in American fields and cites some of the new discoveries and failures during prospecting operations. To be concluded. 40c.

2660 — **RUSSIAN PETROLEUM INDUSTRY** during 1906. (Pet. Rev., Jan. 19, 1907; 1½ pp.) Reviews the conditions of the Russian petroleum industry during 1906, commenting briefly upon the conditions which have had bad influences upon the production of these oilfields. Prospects for the year 1907 are briefly discussed. To be continued. 40c.

2661 — **STANDARD OIL COMPANY**, The Methods of Report of Interstate Commerce Commission. (Eng. News, Feb. 7, 1907; 1 p.) Contains many very interesting extracts from the Report of the Interstate Commerce Commission, showing how the Standard Oil Co. maintained and developed its monopoly. 20c.

#### SALT

2662 — **POTASSIUM SALTS** — L'industrie des sels de potasse. E. Bœufve. (Travailleur Afrigain, Jan. 15, 1907; 1 p.) A short account of the salt deposits at Stassfurt, Germany, giving a review of the present condition of the industry there. 40c.

#### SULPHUR AND PYRITES

2663 — **ROASTING OF PYRITES** — Le Grillage des Pyrites au Moyen de Fours mécaniques. L. Pierron. (Revue de Chimie Industrielle, Jan. 15, 1907; 10 pp.) Very thorough article dealing with the mechanical roasting of pyrites. All the principal types of roasting furnaces are described and commented upon, and the features entering into the question of adopting roasters and their best arrangement are discussed. 40c.

2664 — **WYOMING** — Sulphur Mining and Refining in Wyoming. L. W. Trumbull. (Mines & Min., Feb., 1907; 1½ pp.) The sulphur-bearing area of Wyoming is described briefly, an account of the genesis of the deposits is given, and the apparatus and method used in handling the material and preparing it for market are described in detail. 20c.

#### ZINC

2665 — **MISSOURI** — Sheet Ground Mining in the Webb City District. O. Ruhl. (Mg. Reporter, Feb. 7, 1907; 2 pp.) The method of mining these horizontal deposits of zinc ore is described briefly, and a short account of the milling practice in this district is given. 20c.

#### ECONOMIC GEOLOGY—GENERAL

2666 — **AZURITE** — Il giacimento di azzurrite del Castello di Bouvel presso Mara (Sardagna) con alcune osservazioni sulle formazioni del carbonati di rame naturali. (Rassegna Mineraria, Jan. 21, 1907; 2 pp.) A short discussion upon the deposit of azurite in Sardinia, Italy, with notes on the location and character of the mineral. 40c.

2667 — **DIKES**. J. F. Kemp. (Mg. & Sci. Press, Jan. 19, 1907; 3½ pp.) Summary of the present condition of knowledge as to the occurrence and structure of dikes throughout various sections of the country. 20c.

2668 — **FAULTS** — How Should Faults be Named and Classified? T. A. Jaggar, Jr. (Econ. Geology, Jan.-Feb., 1907; 4 pp.) Discusses briefly various forms of faulting, and points out several defects in the present method of describing and identifying these faults. 60c.

2669 — **FOSSILS** — North American Index Fossilis. A. W. Grabau and H. W. Shimer. (School of Mines Quart., Jan., 1907; 72 pp.) Continuation of a lengthy monograph, which has been previously indexed. 60c.

2670 — **GENESIS OF ORE DEPOSITS** — The Need of Field Work in the Study of Ore Genesis. A. P. Coleman. (Eng. & Mg. Jl., Feb. 9, 1907.) A discussion of an article on the genesis of ore deposits by Messrs. Campbell and Knight, reviewing their results, and showing how necessary it is to distinguish between the actual original source of the ore and the theory of its source as indicated by the particular method of investigation pursued. 20c.

2671 — **MEXICO** — Geological Aspects of Mexico. R. T. Hill. (Mg. Wid., Feb. 2, 1907; 1 p.) Continuation of article previously indexed, this instalment giving a general description of the surface features of the southern Sierras, their foothills, and the surrounding country from which they rise. 20c.

2672 — **ONTARIO** — Explorations in Abitibi. J. G. McMillan. (Report of the Ontario Bu-

reau of Mines, Vol. XIV, Part 1, 1905; 28 pp.) Gives at great length an account of explorations in this region, and describes the agricultural resources of the district.

2673 — **ORE DEPOSITS** at the Contacts of Intrusive Rocks and Limestones; and their Significance as Regards the General Formation of Veins. J. F. Kemp. (Econ. Geology, Jan.-Feb., 1907; 13 pp.) Paper read before the Mexican meeting of the International Geological Congress, Sept. 10, 1906, discussing the influence of moving underground waters in the formation of ore deposits when they come in contact with limestones and igneous rocks. 60c.

2674 — **ORE DEPOSITS** — Experiments on the Action of Various Solutions on Pyrite and Marcasite. H. N. Stokes. (Econ. Geol., Jan.-Feb., 1907; 9½ pp.) An account of an uncompleted set of experiments with the hope of throwing some light on the understanding of the formation and decomposition of sulphides by circulating alkaline waters. 60c.

2675 — **QUEBEC** — Report on the Chibougamau Mining Region in the Northern Part of the Province of Quebec. A. P. Low. (Geological Survey of Canada, No. 923; 61 pp. and map.) In this report there is a very long discussion of the physical and geological features of the district, but the report upon the economic minerals is treated in a very sparing manner. The principal conclusion of the report is that active work in the district must await the completion of projected railways.

2676 — **UNDERGROUND WATER** — Ueber die Bewegung von Grundwasser. F. Wünnemann. (Journal für Gasbeleuchtung und Wasserversorgung, Jan. 26, 1907; 9½ pp.) A very detailed consideration of all the factors which relate to the amount, distribution and movement of underground water, explaining the various methods used in obtaining results, and giving good descriptions of various types of apparatus employed.

2677 — **WYOMING** — Geologic Atlas of the United States. Cloud Peak-Fort McKinney Folio. (U. S. Geological Survey, 1906.) Illustrated description of the area, accompanied by topographic maps, areal-geology maps, economic-geology map, structure-section sheets, columnar-section sheet.

#### MINING—GENERAL

2678 — **ALASKA** — Prince William Sound Copper District, Alaska. L. L. Bales, A. W. Tibbitt, W. N. Robeson and T. W. Blakney. (N. W. Mg. Jl., Jan., 1907; 3 pp. and 1 map.) Enumerates the various properties in this Alaskan district, and describes briefly some of the physical features of the region. 20c.

2679 — **AUSTRALIA** — Mining in Australia in 1906. John Plummer. (Mg. Wid., Jan. 26, 1907; 2 pp.) A review of the mining industry in Australia, dealing principally with the conditions which prevail in the gold, silver, lead and copper districts, and discussing only briefly tin and coal mining. 40c.

2680 — **BELGIUM** — L'industria minerale del Belgio nel 1905. L. Dejardin. (Rassegna Mineraria, Feb. 1, 1907; 1½ pp.) Reviews briefly the progress of mining and metallurgy in Belgium during 1905, and gives some tables of production. 40c.

2681 — **BRITISH COLUMBIA**. E. Jacobs. (Eng. & Mg. Jl., Jan. 26, 1907; 1 p.) The principal mineral products of British Columbia are described individually and the chief features attending their production during 1906 are briefly discussed. 20c.

2682 — **BRITISH COLUMBIA** — Annual Review of Mining in British Columbia. E. Jacobs. (B. C. Mg. Rec., Dec., 1906; 8½ pp.) Discusses the production of the various metals that are mined in British Columbia, with comments on the various causes which have led to increase and decrease in production. 40c.

2683 — **BRITISH COLUMBIA** in 1906. A. Wheeler. (Can. Mg. Rev., Feb., 1907; 5 pp.) Reviews of the progress in mining and the output of the chief mining districts of British Columbia. 40c.

2684 — **BRITISH COLUMBIA** — Mining on Vancouver Island in 1906. (B. C. Mg. Rec., Dec., 1906; 4 pp.) Describes the progress in mining on this island by districts, and enumerates the producers within each district. 40c.

2685 — **CALIFORNIA** Mines and Minerals. Compiled by C. G. Yale. (California State Mining Bureau Bulletin No. 44; 52 pp.) Contains the usual statistics of mineral production in this State, classified by kind and by counties; gives also mining maps of the various counties of the State. 20c.

2686 — **CANADA** — Mining in Canada in 1906. "British Columbia," by A. Wheeler; "Ontario," by F. C. Loring. (Mg. Wid., Jan. 26, 1907; 1½ pp.) In British Columbia the chief events of 1906 are briefly discussed and developments and shipments of some of the principal mines are given. In Ontario the conditions of the Cobalt mining district are

outlined, and several of the newer discoveries in this province are briefly mentioned. 40c.

2687—DIAMOND-DRILLING PRACTICE. O. H. Reinholt. (L. A. Mg. Rev., Feb. 2, 1907; 1 p.) Describes some of the difficulties of diamond drilling which are not usually appreciated, and gives some principles of cost estimation, with especial reference to the high labor charges of the West. 20c.

2688—EXPLOSION—Die Dynamitexplosion in dem Bohrturme bei Zappendorf am 4. Mai, 1906. (Zeit. f. Berg-, Hütten- u. Salinenwesen, Band 54, Heft 5; 4½ pp.) An account of an explosion of dynamite in a drill-hole at Zappendorf, Germany, discussing the various causes which could have been responsible for the accident.

2689—JAPANESE MINING LAW—Loi Minière du Japon. (Bull. de la Soc. de l'Industrie minière, Tome V, IV livraison, 1906; 20 pp.) A complete transcription of the mining laws of Japan, giving general acts, rights of miners, surface customs, mining police, and penalties for infractions.

2690—LAW OF THE APEX—Do the Geological Relations of Ore Deposits Justify the Retention of the Law of the Apex? C. H. Shamel. (Econ. Geology, Jan.-Feb., 1907; 15 pp.) Reviews the reasons which caused the adoption of the present Federal apex mining law, and discusses various changes in belief as to the character of ore deposits in virtue of which changes in the law are being agitated at the present time. 60c.

2691—LIME AND MARL DEPOSITS—Wie wird bei Anlage eines Kalksandsteinwerkes die Herstellung guter Kalksandsteine gewährleistet? W. Drakebush. (Tonindustrie Zeitung, Jan. 10, 1907; 1 p.) A discussion of the factors which must be investigated and established in order to insure the profitable exploiting of a lime and marl deposit. 40c.

2692—MEXICO—Mining in Mexico in 1906. (Mg. Wid., Jan. 26, 1907; 12 pp.) A review of the mining industry in Mexico in 1906, divided as follows: "Copper Mines of Cananea," by G. A. Newett; "Chihuahua," by W. D. Pearce; "Northern Mexico," J. A. Robertson; "Jalisco, Sinaloa and Tepic," by A. C. Brady; "Veracruz and Mapimí," by H. Williams; "Mining Investments in Mexico," by T. C. Graham; "Electricity as a Mining Power in Mexico," by C. V. Allen. 40c.

2693—MINE MODELS—Concrete Mine Models. W. R. Crane. (Mines & Min., Feb., 1907; 2½ pp.) Very interesting account of the use of concrete mine models to illustrate the various methods of mining and timbering now in use. 20c.

2694—MINE SURVEYING. A. R. Long. (Mines & Minerals, Feb., 1907; 1½ pp.) Reprint from Proceedings of the Engineering Assn. of the South, describing an improved method of keeping mine-survey notes, with specimen pages from the note book. A few methods of picking up the survey are also given. 20c.

2695—MINING INDUSTRY—Review of Mining in the United States in 1906. (Mg. Wid., Jan. 26, 1906; 30 pp.) A review, by various authors, of the mining progress which has been made in the various States and Territories of the Union. 40c.

2696—MINING LAW—Weak Points of the Federal Law in Relation to Mineral Lands. G. W. Ritter. (Eng. & Mg. Jl., Jan. 26, 1907; 1 p.) The present unsatisfactory condition of the Federal mining law is described, with special reference to the Flagstaff case, and suggestions for preventing abuses in the future are made. 20c.

2697—MINING METHODS—Old Mexican Methods. B. Macdonald. (Mg. & Sci. Press, Jan. 26, 1907; 3 pp.) Interesting illustrated account of the old mining and milling practice of the Guanajuato district. 20c.

2698—MINING PROGRESS—World's Mining Progress Since Early Times. C. C. Schnatterback. (Mg. Wid., Jan. 26, 1907; 27 pp.) A review of the world's mining progress in all branches of mineral production, but dealing especially with gold and silver in the United States, and giving only brief summaries of the mining situation in South and Central America. 40c.

2699—MINING TERMS—Spanish-American Mining Terms. H. E. West. (Mg. & Sci. Press, Feb. 2, 1907; 1½ pp.) Interesting article giving the equivalents or translations of various Spanish terms relating to mining, prospecting, etc., with which the general reader is not familiar. 20c.

2700—NEW MEXICO Mining in 1906. R. V. Smith. (Ores & Metals, Feb. 3, 1907; 2½ pp.) Discusses the progress of mining development in New Mexico during 1906, giving an account of the preparatory work which in the future will give New Mexico an important place among metal producers. 20c.

2701—NEW SOUTH WALES—Industrial Conditions at Broken Hill. R. Stokes. (Mg. Wid., Feb. 16, 1907; 2 pp.) Outlines the progress in the mining industry in this

Australian district, with special reference to the character of the ore deposits. 20c.

2702—ONTARIO—Mines of Eastern Ontario. E. T. Corkill. (Report of the Ontario Bureau of Mines, Vol. XIV, Part 1; 12 pp.) Brief account of the location, equipment and development of all the producing mines of eastern Ontario, classified by nature of mineral produced.

2703—ONTARIO—Mines of Western Ontario. W. E. H. Carter. (Report of the Bureau of Mines of Ont., Vol. XIV, Part 1; 33 pp.) Brief account of the situation, equipment and development of all the producing mines of western Ontario, classified by nature of mineral produced.

2704—ORE HANDLING—The Transportation and Shipment of Ore. (Engineering, Jan. 25 and Feb. 8, 1907; 3 pp.) A detailed description of the facilities for handling of ore at the Alquife mines in Spain, where the existing railway and port necessitated the extension of the railway seaward in the form of a pier. 60c.

2705—SAMPLING—Metallics in Sampling Work. F. A. Thompson. (Western Chemist & Metallurgist, Jan., 1907; 3 pp.) An interesting account of the difficulties met with in attempting to get a correct assay of an ore containing metallic particles, giving the methods used in sampling the ore, and the final procedure which was agreed upon mutually by the sampling mill and the seller of the ore. 60c.

2706—SHAFT SINKING—Einiges über das Zementierverfahren beim Abteufen und Ausbau von Schächten in wasserreichem Gebirge. J. Divis. (Oest. Zeit. f. Berg- u. Hüttenw., Jan. 19 and 26, 1907; 7 pp.) A review and summary of various successful applications of this tubbing process for sinking shafts in water-bearing strata. Describes the method of sinking, handling the cement, and overcoming the various difficulties as they presented themselves. 60c.

2707—SHAFT SINKING—Nouvelle Méthode de Creusement des Puits de Mine par la Congélation. (Revue univ. des Mines, Dec., 1906; 300 w.) Describes and illustrates a new method of applying the freezing process to shaft sinking, whereby it is not necessary to keep a freezing mixture at work when the shaft is completed, but allows a concentration of cold upon a given zone. 60c.

2708—SHAFT SINKING with the Aid of Pumps through Heavily-watered Strata. S. Dean. (Mg. Engineering, Feb., 1907; 1 p.) Continuation of article previously indexed, dealing with the application of pulsometers and bucket-lifts to removing water from the shaft, and showing the advantages in favor of the lift. 40c.

2709—SOUTH AMERICA in 1906. J. P. Hutchins. (Eng. & Mg. Jl., Jan. 26, 1907; ½ p.) Reviews the conditions of South American mining in 1906, discussing briefly the gold, silver and platinum production, and showing that the past year was not one of very general success and the promises for 1907 are not very attractive. 20c.

2710—SURVEYING—Adaptation of the Stadia to Small Scale, Reconnaissance Surveys. R. H. Chapman. (Mg. & Sci. Press, Jan. 19, 1907; 1 p.) Gives a new method for running reconnaissance surveys by a stadia in a flat country, where wheel traverses and aneroid barometer could not be used. 20c.

2711—TAPPING WATER IN MINES. (Eng. & Mg. Jl., Jan. 26, 1907.) Describes two experiences of the author in tapping water from old workings under rather unique conditions. 20c.

2712—TECHNICAL EDUCATION—The Technical School and the University. W. H. Burr. (School of Mines Quar., Jan., 1907; 8 pp.) Outlines the evolution of technical education, showing that technical schools are an integral part of academic education. 60c.

2713—TIMBER Used in Metal Mines. R. S. Kellogg. (Circular 49, Forest Service, Dept. of Agriculture, Dec. 20, 1906.) Gives various tables showing the kinds and quality of timber used in mines. The tables are classified as to iron, coal and metal mines, and the timber, as to whether it is sawed or round. 20c.

2714—WASHINGTON—Mining in Eastern Washington in 1906. M. H. Joseph. (Eng. & Mg. Jl., Jan. 26, 1907; 1 p.) The condition of the mining industry in this State is described, county by county. 20c.

#### ORE DRESSING

2715—CONCENTRATION. Fritz Cirkel. (Can. Mg. Rev., Feb., 1907; 4 pp.) Address before the Mining Soc'y of McGill University, outlining the progress of ore concentration, with a long discussion of its importance to the mining engineer and geologist. 40c.

2716—FLOTATION PROCESS—Theories Concerning the Flotation Process. G. Haglund. (Eng. & Mg. Jl., Feb. 16, 1907; ½ p.) Discussion of the theory of this process of

ore concentration, pointing to the conclusion that it is always advisable to have a carbonate present in the ore, although carbon dioxide gas is not essential for the success of the process. 20c.

2717—SLIME RECOVERY—A Siphon Device for Removing Floating Material. E. S. Wiard. (Mg. & Sci. Press, Feb. 2, 1907; 1 p.) Describes the design and operation of a unique device built by the author in a mill in northern Idaho to remove particles of floating galena from the surface of the water in a long tank which distributed pulp to tables and vanners. 20c.

#### METALLURGY—GENERAL

2718—ALLOYS of Aluminum and Copper. (Engineering, Jan. 25 and Feb. 1, 1907; 6 pp.) An abstract from the 8th Report of the Alloys Research Committee and read before the British Institution of Mechanical Engineers, dealing with various methods of preparing copper-aluminum alloys, and giving the results of many different tests of the physical and chemical properties of the alloys. 60c.

2719—BRITISH COLUMBIA—Kootenay and Boundary Smelting Works. (B. C. Mg. Rec., Dec., 1906; 3 pp.) Describes briefly the progress at the principal smelting works of the interior of British Columbia, and discusses the processes used at the plants. 40c.

2720—MANGANESE COMPOUNDS—Sur un nouveau Siliciure de Manganèse. G. Gin. (L'Echo des Mines, Jan. 28, 1907.) A short and interesting note of the production in the electric furnace of a proto-sulphide of manganese which is not reducible by carbon, but which holds that element in solution. 40c.

2721—METALLURGICAL PROBLEMS—Unsolved Problems in Metallurgy. R. A. Hadfield. (Lecture delivered before the British Instn. of Civil Engrs., May 2, 1906; 36 pp.) Discusses the general nature of various metallurgical problems which now demand solution, and takes up the special consideration of investigations which have to do with alloys.

2722—OPEN-HEARTH FURNACE—Metalurgical Calculations. J. W. Richards. (Electrochem. & Met. Industry, Feb., 1907; 4 pp.) Continuation of this series of articles, dealing in the present instalment with gas producers and regenerators, and giving the solution of specific problems relating to open-hearth furnace practice. 40c.

2723—ROASTING of the Argentiferous Cobalt-Nickel Arsenides of Timiskaming, Ontario, Canada. H. M. Howe, Wm. Campbell and C. W. Knight. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 9 pp.) Gives the results of an investigation of the behavior of an argentiferous cobalt-nickel arsenide from Ontario during roasting, with the idea of learning the temperature at which the arsenic is most rapidly expelled, the efficiency of the roasting through prolonged heating, and the effect of adding charcoal at different times during roasting.

2724—SILVER—Zur Kenntnis des kolloidalen Silbers. A. Gutbier and G. Hofmeier. (Zeit. f. Anorg. Chemie, Band 45, Heft 1; 4 pp.) Describes briefly four allotropic forms of silver, giving their chief characteristics, and methods for producing them.

2725—SULPHIDES—The Constitution of Ferro-Cuprous Sulphides. H. O. Hofman, W. S. Cayless and E. E. Harrington. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 12 pp.) Paper to be read at the April, 1907, meeting of the A. I. M. E., discussing the results of an investigation to determine the constitution of ferro-cuprous sulphides by means of cooling curves. Description of the apparatus used and details of the microscopical examination of some of the products obtained are included.

#### MINING AND METALLURGICAL MACHINERY, ETC.

2726—AIR COMPRESSOR—A High-duty Air Compressor. O. P. Hood. (Proceedings Amer. Soc'y of Mechan. Engrs., Feb., 1907; 2 pp.) Discussion by W. L. Saunders of the above paper, which was previously mentioned in the Index.

2727—AIR COMPRESSORS—Factors Affecting Compressor Capacities and Efficiencies. (Pract. Engineer, Feb., 1907; 2 pp.) A brief analysis of the various conditions which affect the capacity and efficiency of an air compressor. 20c.

2728—CABLES—Recherches Expérimentales sur la Résistance et l'Elasticité des Câbles d'Extraction. L. Denoel. (Revue univ. des Mines, Dec., 1906; 10,000 w.) Continuation of article previously indexed, this instalment giving results of tests to determine the relation between the modulus of elasticity of hemp cables as found with test pieces and as found on cables in actual use; also results of experiments on cables of great length and account of tests on metallic cables. \$1.

2729—CENTRIFUGAL PUMP—Bemerk-

ungen über Hochdruckzentrifugalpumpen. (Bergbau, Jan. 24, 1907; 3½ pp.) Discussion of the leading features of centrifugal pumps, and of the considerations which will lead to their selection and installation for pumping. 40c.

2730—CENTRIFUGAL PUMPS, Their Theory, Design and Performance. R. C. Williams. (Eng. & Mg. J., Feb. 16, 1907; 3 pp.) Gives an account of the theory, design and performance of centrifugal pumps, and discusses the design especially from a mathematical point of view; gives also tests upon pumps to determine their mechanical efficiency. 20c.

2731—FANS—Contribution a l'Etude des Ventilateurs Centrifuges. H. Bochet. (Annales des Mines, Tome X, 10 livraison de 1906; 56 pp.) A very thorough account of many tests upon centrifugal fans, and a discussion of the conclusions drawn from the results of the experiments.

2732—GAS ENGINE PRACTICE. (Bi-monthly Bull., Amer. Inst. Mg. Engrs., Jan., 1907; 12½ pp.) Discussion by various members of the Institute of the papers by H. Hubert, T. Westgarth and K. Reinhardt, which were read at the London (July, 1906) meeting of the Institute.

2733—GAS ENGINES—Essai d'un Moteur a Gaz de Haut-Force. H. Hubert and A. Witz. (Revue univ. des Mines, Dec., 1906; 9500 w.) An introduction giving an historical account of the defects of early gas engines utilizing low-quality gas, and their development. Also a very excellent and thorough account of an exhaustive series of tests on the application of blast-furnace gas to a gas engine. \$1.

2734—GAS ENGINES—Large Size Gas Engines on the Continent. A. Gradenwitz. (Engineer, Feb. 15, 1907; 3 pp.) Discusses the application of large-size gas engines to iron works and collieries, and gives a brief account of gas generation, and purification of the producer gas. 20c.

2735—GAS POWER—The Evolution of Gas Power. F. E. Junge. (Proceedings, Amer. Soc'y Mechn. Engrs., Feb., 1907; 16 pp.) Continuation of the discussion on the above paper which was previously read by the author before the Society.

2736—GAS PRODUCER—Die Entwicklung der Steinkohlengaserzeuger für den Hüttenbetrieb. Ing. Gilie. (Dingler's Poly. J., Jan. 5, 1907.) Illustrated description of a gas producer using anthracite coal. To be continued. 40c.

2737—GAS PRODUCERS—The Use of Suction-gas Producers for Power Purposes. N. T. Harrington. (Jl. Assn. of Eng. Societies, Jan., 1907; 22 pp.) A very complete consideration of the design and operation of suction-gas producers, and discussing many of the weaknesses and defects of such systems and the method by which they are overcome. 40c.

2738—HAULAGE—Compressed Air versus Electric Haulage. G. B. Hodges. (Coal, Jan. 24, 1907; 1 p.) A reply to an article on electric haulage published in the January issue of *Coal*, enumerating the various advantages of compressed-air traction over electric haulage, and giving some of the disadvantages of electricity when used for transmission in mines. 20c.

2739—HOISTING—Elektrische Förderanlage der Zeche Zollern II. W. Vorkort. (Bergbau, Jan. 31, 1907; 2½ pp.) A description of the electric hoisting apparatus at the works of the Gelsenkirchen Mining Co. in Germany, giving an account of the ligner system of regulating the machines as applied to this installation. To be continued. 40c.

2740—HOISTING—Ermittlung des Dampfverbrauchs an einer Fördermaschine mit Zwillingsstandemanordnung. (Glückauf, Jan. 12, 1907; 1200 w.) Gives the results of two efficiency tests of three and five hours, respectively, upon a compound-driven hoist at the Friedrich-Wilhelm mine at Mülheim, Germany. 40c.

2741—HYDRO-ELECTRIC POWER—British Hydro-electric Installations. A. H. Bridge. (Elec. Rev., Feb. 9, 1907; 2 pp.) Describes the construction and equipment of the power plants at Loch Leven, Scotland, which are to furnish increased facilities for the production of aluminum by the British Aluminum Co. 20c.

2742—HYDRO-ELECTRIC POWER—The Pueblo and Suburban Traction and Lighting Company's Hydro-electric Plant. (Elec. Rev., Jan. 26, 1907; 5 pp.) Describes the construction of the power plant, the station and transmission equipment of this company, which is to supply the Cripple Creek district and the city of Pueblo. 20c.

2743—LOW GRADE FUEL—Burning Bituminous Slack and Lignites. G. P. Hutchins. (Elec. Wld., Jan. 5, 1907; 2½ pp.) Discusses the principles of stoking with low grade fuel and describes

several types of mechanical stoker adapted to this type of fuel. 20c.

2744—LUBRICATING OIL—The Purification of Lubricating Oil. J. L. Grant. (Elec. Wld., Jan. 5 and Feb. 2, 1907.) Continuation of article previously indexed, giving a description of several types of filters for oils, and discussing the advantages of using filtered oil. 40c.

2745—MINE WAGONS—An Appliance for Automatically Stopping and Restarting Mine Wagons. W. Galloway. (Trans. No. of England Inst. of Mg. & Mechn. Engrs., Vol LVII, Part 1; 4½ pp.) Describes, with working drawings, the construction of this mine wagon and describes its method of operation.

2746—MINING PLANTS—Mistakes in the Design of Mining and Reduction Plants. S. A. Worcester. (Mg. & Sci. Press, Feb. 2, 1907; 1½ pp.) Cites several instances where lack of foresight in designing and altering plants has resulted in excessive cost of operation, and points out the advantages of having such designing done by a competent engineer. 20c.

2747—POWER—The Choice of Motive Power for the Workshop. R. E. Mathot. (Eng. Mag., Jan., 1907; 13½ pp.) The first of a series of articles on this subject, this instalment being on the comparison between steam and internal-combustion engines, and dealing chiefly with considerations of first cost and initial installation. 40c.

2748—POWER PLANT—The Necaxa Plant of the Mexican Light and Power Co. (Proceedings, Amer. Soc'y of Civil Engrs., Jan., 1907; 12 pp.) Discussion by members of the Society of the above paper, which was previously mentioned in the Index.

2749—POWER PLANT—The Planning and Construction of the Power Plant. A. E. Dixon. (Eng. Mag., Jan., 1907; 20½ pp.) The fifth of a series of articles on this subject, the present paper dealing with the selection and installation of the main and auxiliary machinery. 40c.

2750—PRODUCER GAS—Is Producer Gas a Possible Factor in Clay Working Operations. C. L. Smith. (Clay Record, Jan. 15, 1907; 2½ pp.) Paper read at meeting of the Iowa Brick and Tile Assn., Jan. 10, 1907, the possibility of adopting producer gas as a source of power for clay working is taken up and comparisons are given of the relative efficiencies of steam and producer gas as power generators. 20c.

2751—PUMP—Pompe a air comprimé, système Latta-Martin. (Géné Civil, Jan. 19, 1907; 1 p.) Describes and illustrates the construction and operation of a pump worked by compressed air, having the advantage that it may be installed at a distance from the source of power, and requires very little attention. 40c.

2752—PUMP—Test of a Rotary Pump. W. B. Gregory. (Proceedings, Amer. Soc'y Mechn. Engrs., Jan., 1907; 3½ pp.) Discussion by members of the Society of the above paper which was previously mentioned in the Index.

2753—PUMP—The Pulsometer Steam Pump. (Pract. Engineer, Feb., 1907; 1 p.) Contains a very clear and simple description of the principle of a pulsometer, describes the operation of one and gives indicator diagrams of steam consumption. 20c.

2754—PUMPS—Progress in Pumps. D. H. Maury. (Eng. Rec., Feb. 9, 1907; 1 p.) Outlines the progress in the design of pumps and comments briefly upon the various ways in which capacity and efficiency have been increased. 20c.

2755—SHAFT COUPLINGS. E. H. Naylor. (Practical Engineer, Feb., 1907; 1 p.) Describes various forms of shaft couplings now in use, and discusses the advantages and disadvantages of the most frequently used types. 20c.

2756—SKIP—A Single Balanced Skip for Lowering in Inclined Workings. S. A. Worcester. (Eng. & Mg. J., Jan. 26, 1907; 3½ pp.) A very complete illustrated account of the design, construction and installation of a dumping skip for Liberty Bell mine in Colorado, and a complete description of the methods of loading, hoisting and dumping. 20c.

2757—SKIP—Water Skip with Automatic Discharge. W. R. Francis. (Inst. of Mg. & Met., Bull. No. 28, Jan. 10, 1907.) Describes and illustrates an improved valve apparatus for a water skip, allowing increased speed in filling and discharging.

2758—SKIPS—Notes on Skips for Compound Shafts. H. L. Templer. (Jl. Transvaal Inst. of Mechn. Engrs., Dec., 1906.) Reply of author to the discussion of his paper which was previously indexed. 60c.

2759—WASTE GASES—Some Considerations Affecting the Application of Waste Gases for Power Purposes. F. E. Junge. (Power, Jan., 1906; 4½ pp.) Enumerates the various sources of power from waste gases and contains a discussion on equipment of waste heat installations and distribution of power. 20c.

## INDUSTRIAL CHEMISTRY

2760—NITRATES—The Artificial Production of Nitrates from the Atmosphere. J. B. Van Brussel. (Eng. News, Feb. 7, 1907; 1 p.) The application of electricity to the conversion of the nitrogen of the air into various forms in which it can be utilized is described. 20c.

2761—LIME BURNING—Vorrichtung zur Herstellung von Kalkhydrat. (Tonindustrie-Zeit., Dec. 22, 1906.) Describes briefly some machines and methods in use in the United States for making lime and calcium salts. 40c.

2762—SULPHURIC ACID—Ueber verlorene Wärmeln der Schwefelsäurefabrikation und deren Nutzbarmachung. A. Zanner. (Zeit. f. ange. Chemie, Jan. 4, 1907; 2½ pp.) A discussion of principles governing the utilization of lost heat during the manufacture of sulphuric acid, which comments on some proposed plans for such utilization. 40c.

2763—THORIUM NITRATE—La fabrication du nitrate de thorium. L. Pierron. (Revue de Chimie Industrielle, Dec., 1906; 5 pp.) The materials employed in making thorium nitrate, the various methods of obtaining the compound, its quality and prices are all discussed in this article. 40c.

## ANALYTICAL CHEMISTRY

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