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Zacatecas, a Famous Silver Camp of Mexico

Few Veins Have Been Developed at Depth and as Only One Mill Is Now Running in the District the Silver Output Is Small

BY CLAUDE T. RICE

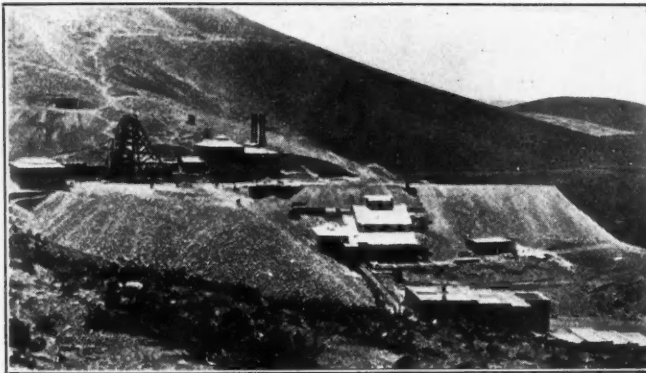
On the train from Torreon to Zacatecas several mining camps are passed, but at present these camps are producing little ore. At Jimulco the Jimulco copper mine, which has been shut down for some time, is to resume soon, but the famous camp of Fresnillo is very quiet. At Somberete, which is reached from Gutierrez, the Towne mines are shipping some ore, and it is said that considerable development work is being done.

that the MacDonalds were remodeling an old stamp mill near Zacatecas at the time that the financial depression began to be felt in the United States.

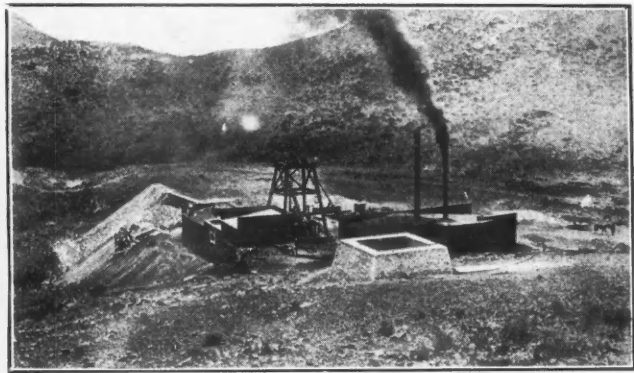
Scattered through the camp are old ruined *haciendas de beneficio* and surmounting the shafts are the horse *malacates*, well named the *malacate de sangre* (the blood-power hoist) in contradistinction to the *malacate de vapor* (the steam hoist). The dumps scattered over the

ing ore in bull hides from a depth of 192 meters.

To the stranger the crudity of hoisting with a *malacate* is appalling. A horse whim is a luxury compared to a *malacate*, and when one thinks of the deep mines that the Mexicans worked by means of these, such as the Valenciana and others on the Veta Madre at Guanajuato, the Viscaina and others at Pachuca, and still others elsewhere in Mexico, and remem-



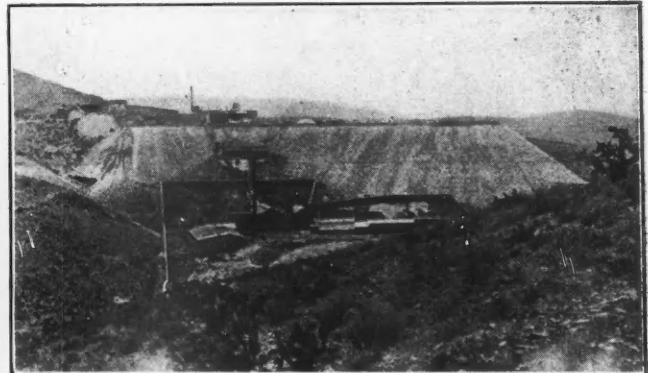
MAGISTRAL MINE



SAN ROBERTO MINE



EDEN MINE



EL BOTE MINE

In summer the all-day ride from Torreon to Zacatecas is hot, dusty and uninteresting as the train slowly climbs to Zacatecas, the highest point on the Mexican Central between El Paso and Mexico City. At present Zacatecas is one of the most backward of the famous camps of Mexico. It is where Guanajuato was when the MacDonald brothers entered that district, and it might be mentioned

district, the idle *malacates*, and the dismantled *patios* are indicative of conditions at Zacatecas. As if representative of the last throes of that magnificent past, only eight months ago some ore from the Veta Grande mine was treated by the patio process, and *malacates*, the exact reproduction of these hoists which Agricola pictured 350 years ago, are in operation at the Parroquia where *gambucinos* are hoist-

bers that some of these mines were very wet, he wonders how they ever did it; surely only a Mexican would have been able to stick to such methods so long. The *malacate* at the Parroquia mine was the only one I saw in operation while in Mexico, and possibly this one is far cruder than most of them. As used at Zacatecas, the headframes are low and no bucket or rawhide sack is used for hoisting, but in-

stead the ore is laced up in a bull hide. This load is landed on a platform at surface and there unlaced, the ore being raked off into a wheelbarrow, as is shown in an accompanying illustration.

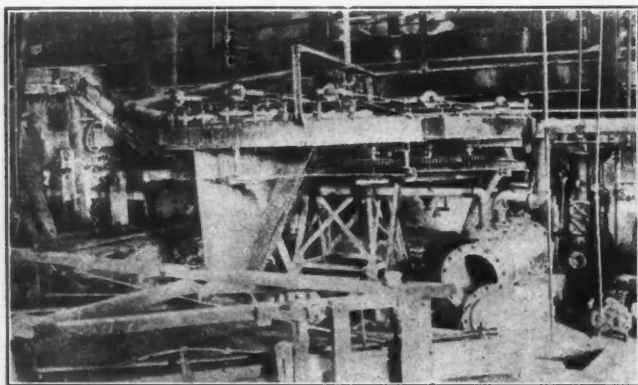
HISTORY OF THE CAMP

Zacatecas is one of the oldest silver camps in Mexico for, as ore was found in 1546 at the San Bernabe mine, by Juan de Tolosa, it is several years older than Guanajuato. Soon afterward ore was discovered at the Veta Grande and the Quebradillas, the workings of which extend under the Alameda, one of the beautiful parks of Zacatecas. The camp flourished for in 1585 the town of Zacatecas, which had been founded in 1548, was

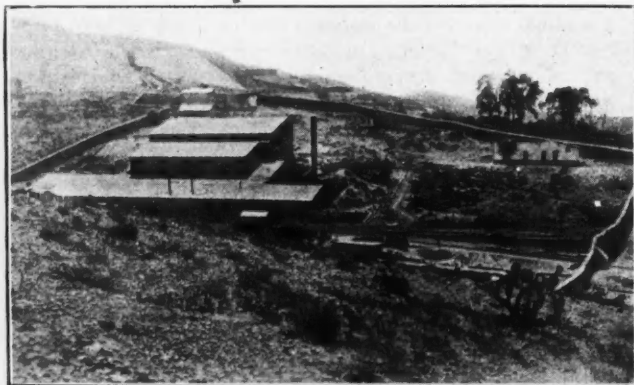
offering a cheap rate and settling immediately for 95 per cent. of the silver content of the ore. As the extraction by the *patio* process, owing to the baseness of the ore, had dropped to 65 per cent., Zacatecas miners gladly abandoned it. A little later there was a drought which lasted several years, so that the death of much of the stock and the higher cost of fodder caused the abandonment of what few *patios* continued to run. Many of the mines, owing to the higher cost of mining, were forced to shut down and later, when the smelter raised the rates on silicious ores, more mines were allowed to fill with water. A few of the best mines continued to work, shipping their ore to the smelter. The El Bote company erected a pan-amal-

above the surrounding country, which connect on the west with the foothills of the Sierra Madre range.

As the accompanying map (slightly modified from that given by Burkart¹, who worked out the geology of the district in the first half of the century) will indicate, the main rock of the district is a diorite which in places is capped by a later rhyolite. To the west of town are slates, the oldest rock of the district, which in some places have been altered by intrusions, especially near the contact with the later diorite, so that they are quite schistose in character. Near the town occurs a reddish rock called by Burkart a conglomerate, but which is probably an agglomerate as it is said to resemble the agglomerate of



RIDGWAY FILTER, EL BOTE MILL



EL BOTE MILL



SORTING ORE AT MAGISTRAL MINE



SORTING ORE AT EL BOTE MINE

raised to the rank of a city by the King of Spain. In the early days the camp was a large producer and, at the time of Humboldt's visit to Zacatecas, in the early part of the nineteenth century, the production was estimated by him to be from 300,000 to 400,000 *marcos* (1 marco = about 8 oz.) of silver per year, and he states that from 1785 to 1798 the king's fifth amounted to 1,204,721 *marcos*.

During the time when Mexico was passing through the wars that led up to its independence, the production was large when the mines were working, but this production fell off greatly whenever either army was in the vicinity; by 1875 the production was declining. In 1889, the smelters entered the market for silicious ores,

gamation mill to treat its lower-grade ore, and has thus been able to continue to the present its unbroken series of dividends during a period of over 60 years.

For the last 12 years most of the mines and *patios* have been shut down so that the production from the district has been small, coming from only a few mines; the last *patio* that treated custom ores was the Florida *hacienda*. With the decline of local beneficiating, Zacatecas has declined so that now the district which once boasted 70,000 can scarcely find 25,000 inhabitants.

GEOLOGY OF THE DISTRICT

The Zacatecas district is composed of rounded ridges, rising 1000 to 1500 ft.

Guanajuato; since I did not visit any of the mines in that part of the district and therefore did not examine the rock, this is only a surmise on my part.

The veins have a northwest-northeasterly strike and dip generally to the southwest at a high angle, but the Mala Noche vein system and the Parroquia-Magistral vein are notable exceptions to this statement.

THE MAIN VEIN SYSTEMS

There are three main vein systems in the district, the Cantera, the Mala Noche and the Veta Grande. The Cantera,

¹J. Burkart, "Aufenthalt und Reisen in Mexico in den Jahren 1825 bis 1834." Stuttgart, 1836.

which is the most southerly of the three, is the largest and longest vein in the camp. On the east end this vein, which starts near Guadalupe, follows the contact between the diorite and the so-called red conglomerate; but to the west it cuts through the diorite and in the Bote property passes into the slates, being conformable with them in dip. The Cantera is on its western end more a vein system than a vein, for there are many branches, as can be seen on the map. South of town are the Veta de San Rafael and the Veta de los Campos, which appear to be especially strong spurs from the Cantera system, and to the northward is the Magistral-Parroquia vein, which also appears to be a branch of the Cantera system.

The ore from the Cantera system is characteristically silicious and quite free from sulphides other than those of silver.

south. The ore carried a great deal of pyrite, but no copper; the pyrite content varies considerably along the vein, for on the west end, in the San Roberto mine, the ore has an excess of iron over silica, while in the San Bernabe on the eastern end where the vein is in the diorite, the ore is silicious, but carries 20 per cent. iron. On the east end the vein splits into several small veins, but to the west it strengthens and unites so that in the San Roberto mine, where the vein follows the contact between the diorite and the slate, present development shows a width of 100 ft.; beyond the San Roberto the vein passes out of the diorite and in the Zaragoza is entirely in the slate.

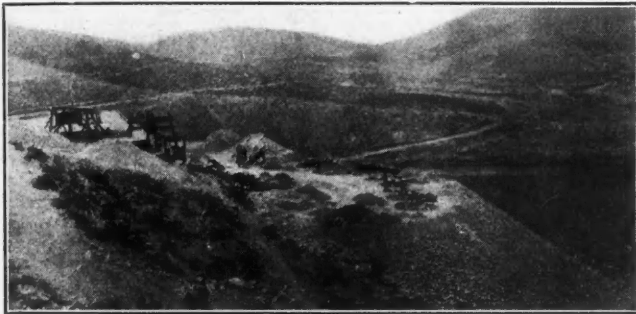
To the north of the Mala Noche vein is the Veta Grande system of fissuring. The veins of this system have a north-west-southeast strike and dip at a high

one of the mines on this lode system, that the MacDonald brothers began to convert the old stamp mill, with which the mine was equipped, into a cyanide plant.

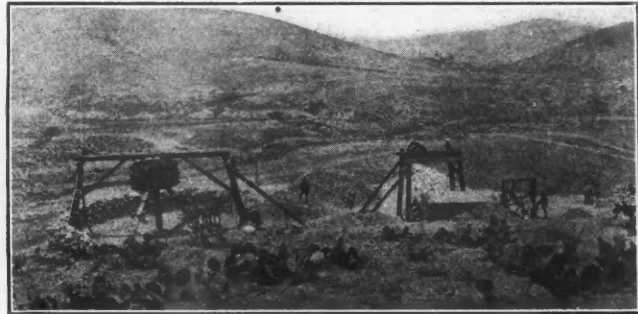
There are also a series of barren cross veins, which cross the Cantera vein, and it is at these points of crossing that the richer orebodies of the system are found; but it is said that at the Veta Grande mine no such characteristic enrichment was noticed.

DEVELOPMENTS AT DEPTH

The zone of oxidation in the district extends to a depth of 150 ft., and at a depth of from 480 to 500 ft., a barren zone occurs in many, if not all, of the veins. The finding of this barren zone at several of these mines has discouraged deep development, but the fact is that very little is known about the veins in depth at



PARROQUIA MINE; MEXICANS SORTING ORE ON PATIO



MALACATE IN OPERATION, PARROQUIA MINE



THE MALA NOCHE MINE



COPPER BELT OF ZACATECAS

In the zone of oxidation the silver occurs as a bromide, iodide or chloride and also native, but below this zone argentite is the most important silver mineral, although in some parts of the vein much ruby silver is found. In the Magistral-Parroquia vein, although apparently it belongs to the same zone of fissuring, the ore is a silicious silver-copper ore in which chalcopyrite and pyrite are the chief metal-bearing minerals.

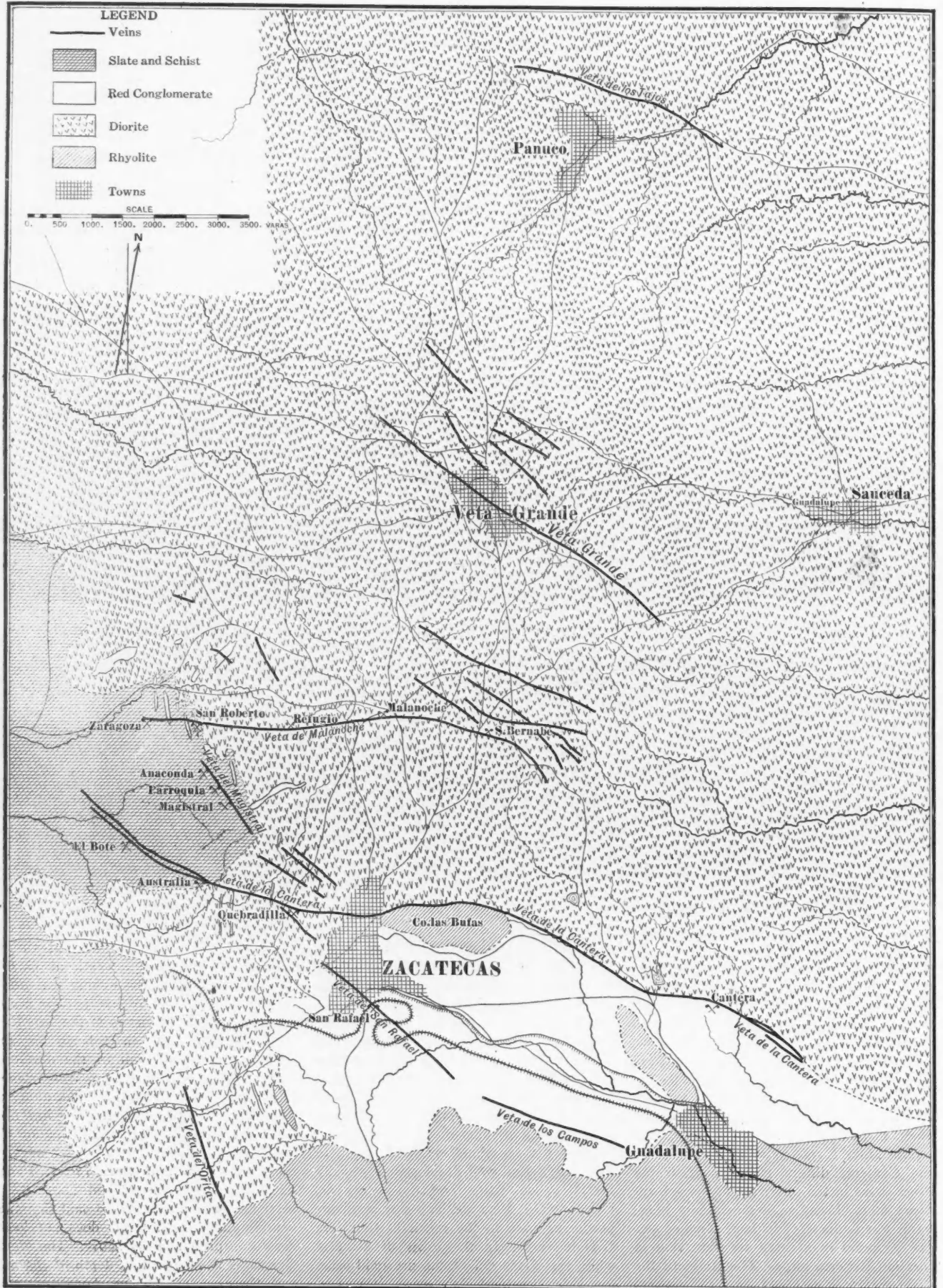
The Mala Noche vein, to the north of the Cantera, differs radically from the other veins in the district, and the ore appears most closely related with the Magistral-Parroquia ore; in fact, some copper ore is found in a small separate vein in the San Roberto mine. The strike of the Mala Noche is east and west and the dip is toward the north instead of toward the

angle to the southwest. The ore in the Veta Grande vein system is a silicious silver ore resembling the ore mined from the Cantera vein. The Veta Grande mine, which has been one of the largest silver producers in the Republic, is the chief mine on this lode, but there have also been several other smaller producers and at present to the west of the Veta Grande mine some virgin ground on the same lode is being developed.

Besides these three main veins, there are others less well-developed, especially the Veta de Tajos and the Vetas del Oritas. The Veta de Tajos is a silver-producing lode to the north of the Veta Grande and near the town of Pánuco, while the Vetas del Oritas are gold-bearing lodes south of Zacatecas. It was in order to treat ore from the Cristóbal mine,

Zacatecas, for, although the Mexicans worked to considerable depth at Guanajuato, at Zacatecas the mining was done mostly above a depth of 500 ft. The deepest shaft in the district is at the San Rafael mine, the Lete shaft being 420 m. deep, but practically all of the development in that mine has been done above that depth. As the shaft is sunk along a barren part of the vein, the ore has not been developed by the small amount of work done on the deepest level of the mine. The Bote mine is 1000 ft. deep and most of the ore developed above that level has been mined. It is said that the vein in the deepest levels does not look nearly as promising as above. The Veta Grande is developed to a depth of 365 m., and there, while fewer bonanzas are found on the lower levels than near sur-

GEOLOGICAL MAP OF ZACATECAS, SLIGHTLY MODIFIED FROM THE MAP BY J. BURKART



face, the ore is said to be more uniform in character and of good grade. The Mala Noche shaft is 303 m., or about 1000 ft. deep. At that depth the walls of the fissure are said to be well defined, but the filling of brecciated country rock is not strongly mineralized.

THE ORES

At present there are two classes of ore shipped from the district—copper ore and silver ore. The copper ore comes from the Magistral, the Parroquia, and a little from the San Roberto. About 1500 tons of copper ore per month are at present shipped from the district. This assays from 8 to 9 per cent. copper and 400 grams silver, but carries no gold. Ore assaying as low as 4 per cent. copper has been shipped in good times, but the present low price of the metal requires that the ore be hand-picked in order to bring it up to about 9 per cent. copper. The ore carries considerable iron as the main sulphides in the ore are chalcopyrite and pyrite, but the silica is in excess.

At present less silver ore is shipped from the district than copper ore, although probably few people outside of Mexico know that any copper ore is mined at Zacatecas. In fact there are only 600 tons of silver ore shipped per month. There are two classes of this silver ore—the iron-sulphide ore and the straight silicious ore. The iron-sulphide ore comes from the properties along the Mala Noche vein, but there is also said to be considerable of this class of ore in the Quebradillas mine.

The iron-sulphide ore shipped assays 1500 grams silver and 20 grams gold per metric ton, 20 per cent. silica, 30 per cent. iron, and 2 per cent. zinc, with occasionally a little lead. The ore shipped from the San Roberto mine, which carries the largest excess of iron, averages about 2000 grams silver and 16 grams gold per metric ton, 31 per cent. iron, 2 per cent. zinc, 24 per cent. silica, and 38 per cent. sulphur. The ore shipped from the San Bernabe mine assays 1200 grams silver and 15 grams gold per metric ton, 20 per cent. iron, 5 per cent. zinc, 24 per cent. sulphur and 40 to 45 per cent. silica. In these ores native silver and ruby silver are found as well as argentite. Much of the silver, however, occurs in the pyrite. The straight silicious silver ore, such as comes from the Veta Grande and the Cantera vein systems, is highly silicious, often containing as high as 75 per cent. silica. This ore, as shipped, carries, per metric ton, 1500 grams silver, 2 to 10 grams gold, and no lead, the silver occurring mainly as argentite, but also native and as ruby silver.

It is said that in the gold veins at the San Cristóbal much of the ore carries, per metric ton, 100 grams silver and 12 grams gold, in a highly silicious gangue.

MINING CONDITIONS

The Bote and the Magistral are the only

two mines that are doing any stoping at present; the veins are wide, being for much of their distance 20 to 30 ft., and in places as much as 60 ft. wide. The walls in both these mines are slate and stand well. In the Bote underhand stoping, with undercut drift and raises put up through the orebody, is used, but in the Magistral overhand stoping is used with waste filling. At the Magistral the ore is blasted down until the stope is filled; then it is mucked out and the stope again filled with waste. The diorite walls in the Veta Grande mine are said to stand well as do the walls of the Mala Noche, so that Zacatecas seems to be as fortunate as most of the other camps in Mexico in regard to strong walls.

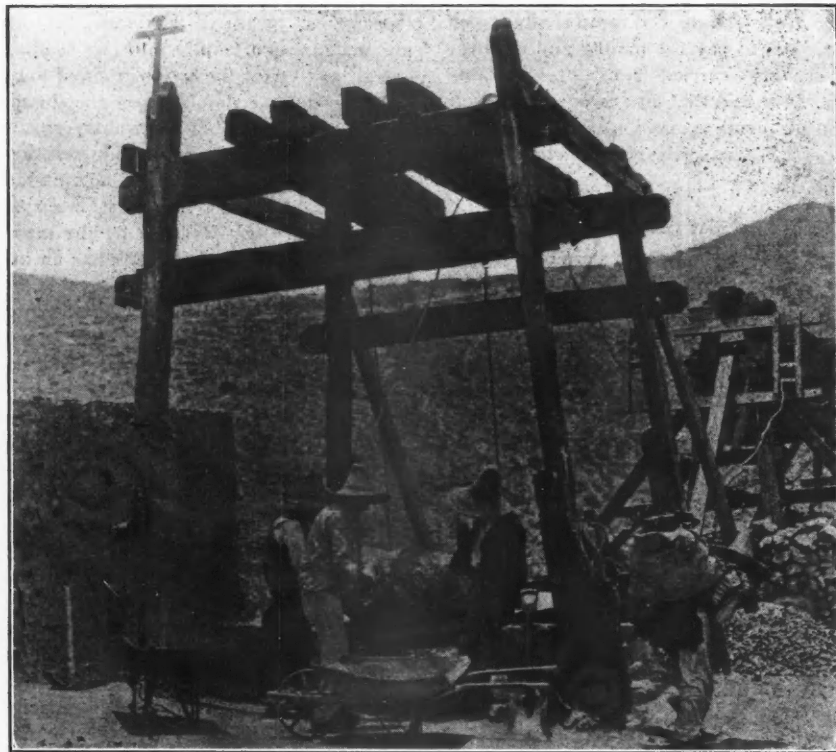
The mines are not wet, for the Bote, which has been working on a large scale

is the only one that ever ran for any length of time.

THE BOTE PAN-AMALGAMATION MILL

Owing to the present low price of silver, the Bote mill, in which the Boss continuous process is used, is one of the few pan-amalgamation mills in Mexico now running. The ore from the Bote mine is crushed in a separate breaker house in a large gyratory crusher to 1½-in. size and then in rolls to ¾-in. size. It is then fed to six 8-ft. Chilean mills which crush through a 55-mesh screen, but the resulting pulp is so fine that 60 per cent. of it will pass through a 200-mesh screen.

Before feeding the ore to the pans the pulp goes to dewatering tanks where it is thickened so that it is said to contain only about 50 per cent. moisture. There are 18



HOISTING WITH A MALACATE; LANDING THE LOAD

for 60 years and has as extensive workings as any other mine in the camp, makes less than 150 gal. of water per minute, this being handled by a Cornish pump. The Veta Grande mine makes a little more water, but probably no mine in the district makes over 200 gal. per minute. While the Bote, the Magistral, the San Roberto, the Mala Noche and some other of the properties are equipped with good steam hoists, the majority of the shafts still have only *malacates* for hoisting, and within the last few years large mines have been unwatered with nothing but a bucket and *malacate*.

While formerly many *patios* were running in the district, very few are now intact, and although several mills have been erected, the Bote pan-amalgamation mill

of these pans, 5 ft. 4 in. in diameter and 3 ft. deep, the pulp overflowing from one pan to another. In the pans there is a muller rotating at 65 r.p.m., but on this muller no shoe is used as no grinding is done in the pans; the mill superintendent says that less mercury is lost through flouring when the shoes are not used. The pulp flows then to four settlers, 8 ft. in diameter and 3 ft. deep, running at 14 r.p.m., in which wooden shoes are used on the mullers. The tailings are then sent to seven 6-ft. Frue vanners and two Standard tables for the removal of sulphides which have escaped amalgamation. The pulp going to the pans is heated to 150 deg. F. In the first six pans 300 kg. of mercury are charged; in the second six pans 200 kg., and in the last six pans

100 kg. Six kilograms of copper sulphate and 30 kg. of salt are added per ton of ore, 9 to 10 kg. of this mixture being added every five minutes.

The amalgam, which is lighter than the mercury, works out of the pan into an outside amalgam well connecting with the pan, from which the amalgam is removed every two hours. At the last pan lime is added so as to precipitate as much of the dissolved silver and gold as possible before the pulp leaves the pans, and at the settlers the pulp is greatly diluted so as to aid settling of the amalgam, quicksilver, etc. The amalgam coming from the wells is put into filter sacks, the amalgam from the day and night shifts being kept in separate bags, although retorted together each day.

The mill is treating 2200 tons of ore per month, and it is said this ore must assay from 800 to 900 grams silver per metric ton to pay for mining and milling; the ore also carries from 6 to 8 grams gold. It is said that an average extraction of 80 per cent. is made. All ore assaying over 1200 grams silver per metric ton is shipped.

COST OF MINING AND SUPPLIES

At Zacatecas there is an abundant supply of labor, so that it is low-priced but dear. The cost of driving varies considerably in the district, for the rock varies greatly in hardness throughout the camp. At the Magistral a 5x7-ft. drift is driven on contract for 16 pesos per meter, the mine furnishing everything and delivering the rock at the shaft. At the San Roberto a 6x6½-ft. crosscut in ore is driven, when the ore is soft, for as low as 12 pesos, but in harder ore from 20 to 35 pesos is paid.

At the Bote where the vein is wide the drilling and blasting (powder cost not included) averages about 50 centavos per ton. At the San Roberto, where mucking is done on contract, the ore is shoveled and delivered at the shaft for 20 centavos per ton.

For sorting the ore the price varies at the different mines. At the Bote for sorting the silicious silver ore 1.50 pesos per ton of accepted ore is paid; at the San Roberto mine for sorting the iron-sulphide-silver ore 2.25 pesos is paid per ton of accepted ore; at the Magistral 1.25 pesos is paid to the rough sorters per ton accepted, for sorting the chalcopryite ore, all the ore being re-picked by company sorters before being accepted.

The wages in the district vary somewhat. At the Magistral property all men underground are paid 75 centavos per eight-hour shift. At other mines the miners are paid 1 peso per 10-hour shift, and *peones* 75 centavos to 1 peso. Head timbermen are paid 1.50 pesos; helpers, 1 peso; blacksmiths, 1.75 pesos; carpenters, 1.50 pesos; hoisting engineers, per eight-hour shift, 1.50 pesos; firemen, 1 peso; foremen, 30 pesos per week; shift-bosses, 2.50 pesos per day.

The prices of mine supplies bought in small quantities at Zacatecas are: Dynamite, 60 per cent., per case, 20.50 pesos; 40 per cent., 17.25 pesos; caps, 1.25 pesos per box of 500; fuse, ordinary, per 100-ft. roll, 50 centavos; gutta percha fuse, per 100-ft. roll, 1 peso; candles per kg., 40 centavos.

As has been said, labor is abundant, but only double-hand drilling is used as the miners at Zacatecas are poor with the single-jack hammer.

THE PROPERTIES AT PRESENT WORKING

At present the Bote mine is still mining ore, but almost all the developed ore has been mined, although recently a small cross-vein assaying well in gold was found. The company is awaiting the arrival of large pumps before commencing to develop the vein at greater depth. The company has begun to transform the old pan-amalgamation mill into a cyanide plant so as to treat the 800,000 tons of low-grade ore now accumulated on the dump. The ore will be crushed in gyratory crushers, rolls, and ground in cyanide solution in Chilean mills. The ore will be agitated by compressed air in a tank 16 ft. in diameter by 38 ft. high, designed by the manager, J. S. Pattison. This tank has an inclined bottom, sloping toward one side, at the bottom of which is the hole connecting with the outside tube to which compressed air is admitted. This forces the slime up through the tube, which discharges into a cylindrical ring; this ring extends down some distance into the tank, confining the agitation and allowing an annular space in which, while the tank is being charged, clear solution can rise and overflow. This tank is also equipped with a decanting tube. The overflowing and the decanted solution will go to filter presses and the filtered solution will then be sent to the zinc boxes; the slime will be washed on some kind of filter. A Ridgway filter has been tried, but this only gave a capacity of 31 tons per day. Also at the Guanajuato Consolidated Company's mill at Guanajuato, where the Ridgway filter was tested, the capacity was low, although mechanically it worked nicely. The agents say that to obtain the full capacity with a flocculent slime, one containing less than 50 per cent. moisture must be fed. This would require the use of special thickeners, like the Dorr thickener. The successful operation of this cyanide plant will mean much to the district.

The San Rafael mine, belonging to A. E. Stillwell and associates, is at present idle but it is rumored that the mine will soon start up and that a 50-ton cyanide plant will be erected. On the Cantera vein the Australia mine is doing a small amount of development work.

The Parroquia property, belonging to F. O. Palmer, is being worked by *gambucinos*, while the Magistral property, next to it, is the largest shipper in the camp at present. In fact it is this prop-

erty, on the vein whence once the *magistral* used in the patio process was obtained, which has made most interesting history in the last few years. About six years ago D. H. Norris and C. O. Gilbert began to develop this property. Since that time the mine has been developed to a depth of 650 ft. Nearby the mine a 250-ton smelter is being erected under the supervision of C. A. Heberlein, who also designed it, to treat the ore direct from the mine. This smelter will have a 46x150-in. blast furnace, 12 ft. high from tuyere to feed floor, and will be equipped with a blower having a capacity of 9000 cu.ft. per minute. Limestone for flux will be obtained from a nearby quarry which the company owns. Iron ore for flux will be obtained from Iron mountain, near Durango. This smelter site is near the tracks of the Mexican Central, so a short broad-gage spur will be built to the smelter. It is expected that this smelter will be running by Sept. 1.

But the latest development of importance is in the San Roberto, where work done by T. F. Van Wagenen, of Denver, has proved a width of 100 ft. for the Mala Noche vein at that point. Mr. Van Wagenen is also working the San Bernabe with good results. At the San Roberto a depth of 260 ft. has been attained and three levels have been driven. At the San Bernabe a depth of 400 ft. has been reached. The Zaragoza mine to the west of the San Roberto is also being developed and a depth of 300 ft. is said to have been reached in the shaft. Some development work is being done at a few other properties in the district, but only on a small scale.

CONCLUSIONS

The geology of Zacatecas is very similar to that of Guanajuato, for the same rocks, apparently of the same age, occur at both places. The ores are similar except that at Guanajuato no copper ore is found, and little silver ore carrying a large amount of pyrite, such as occurs in the Mala Noche vein. But at Guanajuato the Mexicans mined to considerable depth, while at Zacatecas their work has not been deep. This fact, together with the occurrence of a barren zone at a depth of about 150 to 170 m., has caused the impression that the ore does not "go down." The fact is that little deep mining has been done at Zacatecas, and therefore, practically nothing is known about the camp in depth. The camp needs development, for up to the present most of the mining at Zacatecas has been gophering. There is much virgin ground in the district and the developments at the San Roberto show the possibilities of good common-sense mining.

The camp will need, after the mines warrant their erection, cyanide mills for the silicious silver ore and concentrating mills for the ore from the Mala Noche vein in order to prosper. The mines

furnish enough water for cyanidation provided the water is properly conserved, but for concentration water will have to be brought into the district or the ore hauled to the water; probably the latter is the more feasible.

The camp is not a shipping camp and will not flourish until the ores are again treated locally. The Bote, the only company which has run continuously for the last 70 years, has been enabled to do so because it has a mill to treat its low-grade ore. The other mines will have to do the same to be successful. The silicious ore can be cyanided as successfully as the Guanajuato ore and the iron-sulphide silver ore can be easily concentrated. It is not a question of metallurgical treatment upon which the future of Zacatecas depends, but upon the developments at depth in the mines, and it hardly seems possible that veins as large as those at Zacatecas and which have produced so large a tonnage, will not furnish milling ore at depth. Zacatecas, with its own special problem, lies waiting as did Guanajuato only a few years ago.

Determination of Sulphuric Anhydride in Sulphuric Acid

BY EVANS W. BUSKETT*

The amount of sulphur trioxide in sulphuric acid is generally determined by titrating a weighed portion of the acid with a standard solution of potassium or sodium hydrate. The standard solution is prepared by mixing 30 c.c. of concentrated chemically pure sulphuric acid with about 300 c.c. of water and diluting to one liter.

There are several ways of standardizing sulphuric acid, but the sodium carbonate method is probably the most satisfactory for it gives the total acidity, which is not true of other methods. With litmus as an indicator the titration must be done at a boiling heat in order that all of the carbon dioxide may be driven off. The presence of carbon dioxide obscures the blue color of the litmus, which is the end point. Methyl orange is not supposed to be affected by carbon dioxide, but the presence of the gas in excess certainly obscures the end point. To prepare a solution of methyl orange for indicator dissolve 1 gram of methyl orange in one liter of water. Use about 2 c.c. of this solution to a one liter wash bottle, with which the acid is washed from the weighing bottles.

STANDARDIZATION OF ACID

To prepare sodium carbonate for standardizing, about 50 grams of chemically pure sodium bicarbonate is placed in a platinum dish in an air bath and heated

to 200 deg. C. The temperature is then raised to 275 deg., but not as high as 300 deg. At 275 deg. the water and carbon dioxide are driven off converting the bicarbonate into carbonate. After heating for one hour the dish is removed and cooled in a dessicator. The carbonate will be found free from lumps and readily soluble in water.

To standardize weigh, in a weighing bottle, between two and three grams of the sodium carbonate. Wash the contents of the bottle into a No. 3 beaker, using about 100 c.c. of cold water. The water used should be tested for alkali with methyl orange and if any is found it should be neutralized with standard acid. In titrating run in the acid solution until the color of the methyl orange disappears. Remove the beaker and boil until all of the carbon dioxide is driven off. This generally takes about five minutes of active boiling. Transfer the solution to a 6-in. evaporating dish, cool, and complete the titration. Toward the end the solution should be added a fraction of a drop at a time, noting the change of color very exactly. The results are calculated according to the following equation:



The temperature of the acid solution should be noted and a correction made accordingly. If the temperature was 20 deg. when the factor, 0.039592 was obtained, it would have the values given below at the temperatures named.

Degrees C.	Factor.
10	0.038792
15	0.039692
20	0.039592
25	0.039492
30	0.039392

STANDARDIZATION OF ALKALI SOLUTION

To prepare the standard solution of alkali weigh 560 grams of chemically pure potassium hydrate into a large evaporating dish and add about 500 c.c. of water, dilute to 10 liters and allow to stand for several days before standardizing. A thermometer should be suspended in the solution and a drying tube containing potassium hydrate should be inserted in the stopper. All air entering the bottle should pass through this tube, thus preventing any alteration of the solution by the action of moisture or carbon dioxide. The solution is siphoned through a glass tube only a short piece of rubber for the pinch cock being used.

To standardize the alkali solution draw 40 c.c. of the standard acid from the acid burette into a 6-in. evaporating dish and titrate carefully with the alkali until there is no further change of color. It is customary to run three checks when standardizing, the average of the three being taken.

ASSAY OF THE ACID

After violently shaking the sample so as to get a uniform mixture, 1 c.c. is

drawn off into a weighed bottle. The pipette for this purpose is kept standing in a bottle of acid and is washed out two or three times with the sample acid before the portion for assay is drawn off. Weigh the bottle containing the sample to one-tenth of a milligram. Wash the sample into a 6-in. evaporating dish with water containing methyl orange. Wash the bottle and stopper until there is no longer any pink color. Titrate with the standard alkali until the color shows a decided change. Stir and wash down the sides of the dish. Finish the titration very carefully, taking only a fraction of a drop off the burette with the stirring rod, and noting the change of color when this is added to the assay. When no further change of color is detected the operation is complete.

Hydrocyanic Acid Poisoning

Three Kafirs died suddenly last April at the Kleinfontein mill while cleaning out the tank which receives the decanted liquor from the vat used in digesting the short zinc with sulphuric acid. One Kafir had been working on the tank for an hour when another Kafir entered the tank to aid him in the work. Soon after that the two evidently became conscious of some overpowering agent, and began desperately to try to escape from the tank. A white man and two Kafirs hurried to their aid. The Kafirs entered the tank, but before they could get the others out they also were nearly overcome, and it was with difficulty that the white man at the top of the tank, who had also become very faint, succeeded in pulling out one of the Kafirs. According to the *South African Mining Journal* (May 23, 1908), it has been suggested that the accident was due to hydrocyanic acid, generated by the introduction of cyanide into the tank, in some unknown manner, by the second Kafir. This cyanide, on coming in contact with the dilute sulphuric acid in the tank, generated hydrocyanic-acid gas. To guard against a similar accident a compressed-air pipe has been connected to the bottom of the tank through which air may be blown when men are working in it.

This accident again calls attention to the constant guard that must be kept to prevent poisoning at cyanide plants, and shows that a careful watch should be kept to prevent the contact of acid and cyanide. In this connection it may be noted that at many cyanide mills in Mexico, especially at Guanajuato and Pachuca, acid treatment is not used, but instead, the short zinc caught on a 40- or 60-mesh screen is returned to the boxes and there used for precipitation until there is no further action. The zinc is fluxed off when the precipitate is melted. Thus the dangers attendant upon the presence of acid about the cyanide works are avoided.

*Peoria, Ill.

The Pyritic Origin of Iron Ore Deposits

An Examination of the Evidence For and Against the Theory that Oxidized Orebodies Are the Result of the Decomposition of Pyrite

BY H. MARTYN CHANCE*

The argument which is presented in this article has been prepared to prove the following theorem:

All important deposits of iron ore occurring as magnetite, hematite or limonite, in strata of sedimentary origin, are residues from the oxidation of sedimentary deposits of pyrites,¹ excepting only the bog-ores and the oxidized outcrops of carbonates.

As a corollary of this proposition, it may be added: such deposits may be expected to continue in depth below the zone of oxidation as pyritic sediments commensurate in size with the residual bodies of iron ore remaining in the zone of oxidation.

Within the last few years, geologists who had rejected the sedimentary theory of the origin of iron ores, and taught by master minds of the preceding generation, have, by reason of the evident stratification of the Mesabi deposits, found it necessary partially to abandon the theories of secondary origin. Reverting to the views of earlier writers, they now ascribe the origin not only of the Mesabi ores, but practically of all of the "Lake" ore deposits to an "iron formation," sedimentary in origin and containing or including iron as chemical precipitates, precipitated, laid down, interstratified and commingled with the sands, muds, silts, clays and calcareous sediments which now form the inclosing rocks. There is, however, still a disposition to cling more or less tenaciously to the theory of "secondary" concentration.

EVIDENCE OF LEACHING

To support this theory diligent search has been made for data to prove that the iron was originally disseminated, and subsequently has been concentrated by percolating or circulating waters. This search has resulted in the discovery of the widespread distribution throughout the iron-bearing sedimentaries of granules or nodules of the mineral, grünerite (ferrous silicate), and of cherty iron carbonates, together with complex iron silicates which, taken collectively constitute a considerable proportion of the total rock mass, and in the aggregate perhaps contain sufficient iron to account for the vast quantities of iron ore, the origin of which is now ascribed to the decomposition of these minerals, the leaching out of their iron contents, and the reprecipitation of the iron in "concentrated" deposits.

*Consulting mining engineer, Philadelphia, Penn.

¹Sulphides of iron, pyrite, marcasite or pyrrhotite.

But before this theory can be accepted, it will be necessary to show at least one locality in which the "iron formation" has thus been leached of its iron, and to show the changes resulting from such leaching. This has not yet been accomplished; neither has it been explained how silicates are decomposed and the iron dissolved, nor has the character of the residual rock mass after such decomposition been explained; nor has it been explained how the same waters have decomposed both carbonates and silicates and dissolved out their combined iron. If it be necessary to picture the decomposition of impure iron carbonates by meteoric waters loaded with carbonic acid, the removal of iron by such waters as carbonate in solution, and its reprecipitation as carbonate or as ferric oxide or ferric hydrate, and also the simultaneous breaking up of silicates by these same waters, and the selective removal of the iron, we must assume that in carbonic waters a universal solvent has at last been found, capable of performing astounding feats of chemical jugglery. If we credit these meteoric waters with such extraordinary decomposing and dissolving properties, it should indeed be difficult to find any portions of the original rock mass that can be recognized as such remaining near the surface, or above water level.

THE CARBONATE THEORY

There seems to be a decided tendency on the part of those studying the genesis of iron ores to favor the theory that a large part of the iron has been precipitated originally as carbonate of iron, more or less disseminated and subsequently leached and reprecipitated, and this extends not only to the conclusions of those who speak authoritatively upon the origin of the "Lake" ores, but applies as well to the writings of those who have discussed the origin of our eastern limonite deposits. This tendency seems unaccountable, because wherever carbonate ores exist there will be found a refutation of the theory. The fossil carbonates of the South, the Silurian carbonates of the North (as at Hudson, N. Y.), the Coal Measure carbonates of this country, those of the Cleveland iron district and many similar deposits, all conclusively prove: (1) That carbonate of iron is not readily soluble in meteoric waters; (2) that oxidation of iron carbonates is a very slow process, rarely proceeding at a rate much more rapid than that of the erosion of the surface; (3) that oxidation of iron carbon-

ates usually extends to very slight depth beneath the surface; (4) that iron carbonates in oxidizing drop practically all of their iron, as insoluble oxides, *in situ*.

In other words, carbonate of iron in the presence of carbonic meteoric waters must be considered as a comparatively stable chemical compound, and, as compared with many other salts, relatively insoluble. By similar reasoning we may dismiss the theory that silicates are a source from which leaching meteoric waters are able to extract large quantities of iron; for while it is doubtless true that iron silicates, in common with other silicates, are slowly decomposed by carbonic waters, forming carbonates and oxides of the bases and freeing silicic acid, we are not warranted in assuming that by selective action the iron silicates are attacked and other silicates remain unaltered; for such an assumption inevitably leads to certain entirely untenable conclusions, which may be briefly stated.

If we assume the decomposition and selective removal by meteoric waters of the iron silicates, the residual honeycombed masses remaining after such leaching is completed could not well escape observation and description; but no such rock masses have yet been described. If, on the other hand, no such selective action has occurred, then we must assume that the whole rock mass must be decomposed and dissolved to extract the iron; the solvent waters in this event being loaded with salts of alumina, lime, magnesia, soda and potash, and silicic acid, which in the aggregate enormously exceed in quantity the dissolved iron. Under such conditions there is little reason to believe either that the iron would not oxidize at once and be precipitated *in situ*, or that it would be carried to certain horizons in the slates and there be precipitated in a relatively pure form; for precipitation implies either oxidation and replacement, and as precipitation is supposed to occur *below* the zone of oxidation, and as no reasonable theory of replacement has yet been formulated, this hypothesis does not appear to be based upon reasons which are plausible or in consonance with accepted chemical theories.

OBJECTIONS TO THE THEORY

While the solution of rock masses by meteoric waters is doubtless second only in importance to aerial and mechanical erosion in lowering the level of the surface, in the disintegration of the formations and in providing material from

which chemical precipitates are added to sedimentaries during the deposition of these sedimentaries, the quantity of iron so dissolved and carried away probably forms a very small part of the total iron contained in the original rock mass; for the tendency of iron in the zone of oxidation is to oxidize to ferric oxide or ferric hydrate, and most of it is removed mechanically in these forms with the other products of erosion.

Another objection to these theories is that they fail plausibly to explain the occurrence of the grünerite nodules, the ferruginous jaspers and cherts and complex iron silicates as integral parts of a sedimentary formation; for it is not and cannot be assumed that these minerals are fragmental detritus derived from older rocks. To account for these occurrences it cannot be assumed that the grünerite nodules were precipitated as such, and it is begging the question to state that they are concretions; for the bands of jasper, of ferruginous silicates and the chert, as well as the carbonate masses, are as important integral parts of the "iron formation" as the grünerite.

The sparing occurrence of pyrite in these rocks is a feature which, in my opinion, supplies a key to the unlocking of this problem. Its significance has apparently been overlooked or underrated. It furnishes a simple and rational explanation of the present condition of the "iron formation" in the Lake region, the occurrence of the ferruginous cherts, jaspers, grünerite and carbonates which doubtless owe their origin to disseminated pyrites, the iron ores being the residues of and concentrations from more concentrated pyritic sediments.

HOLLOW MASSES OF LIMONITE

In an article on the "Origin of Bombshell Ore," read before the American Philosophical Society, April, 1908, I have shown how limonite in hollow masses (empty, or partly or completely filled with sand or clay), is formed by the oxidation of pyritic slate or pyritic sandstone. The iron sulphide oxidizes to ferrous sulphate and sulphuric acid, the ferrous sulphate oxidizing to ferric oxide or hydrate and ferric sulphate, or the oxidation being direct to ferric oxide or hydrate and sulphuric acid. The sulphuric acid decomposes the clay (silicates) of the gangue, removing it partially or wholly as sulphates of the bases and free silicic acid, which latter leaches out in solution or combines with iron oxides to form iron silicates. This action proceeds from the exterior toward the center of each integral block or fragment and finally leaves a hollow shell of limonite, containing in its interior the residual clay, sand, quartz, or other materials. Many specimens of "bombs" in various stages of formation, from pyritic slate or sandstone with an outside film of limonite, to the completely

oxidized bomb, clearly show the method of formation.

Precisely the same reasoning will enable us to explain the origin of the nodules of grünerite and the masses and layers of chert, jasper and ferruginous silicates and carbonates of the "iron formation." In a slate or shale rock containing disseminated pyrite, each pyrite particle may, by the action of oxidizing waters, produce a nodule of grünerite; for the oxidation of the pyrite (FeS_2) to ferrous sulphate (FeSO_4), and sulphuric acid (H_2SO_4), will be accompanied by decomposition of the adjacent clay by the sulphuric acid, forming sulphates of the bases and freeing silicic acid which, reacting on the ferrous sulphate as this is being subjected to further oxidation, may form such ferrous silicate as grünerite, or other silicates of iron. Some of the iron is thus retained, the balance passing into solution as ferrous or ferric sulphate, to be redeposited perhaps in other zones where the decomposition of concentrated pyrite is progressing.

COMPLEX IRON SILICATES

By the same process of reasoning the oxidation of pyrite, existing in more concentrated masses or layers, may readily account for the complex iron silicates, jasper, chert, chalcedony, and other forms of silica existing throughout the "iron formation," these being silicious residues formed from the silicic acid set free by decomposition of clay slates, or other silicates, by the sulphuric acid resulting from oxidation of the pyrites. The carbonates are also readily accounted for by the precipitation (partial transposition) of ferrous sulphate by the carbonates of the alkalis and alkaline earths dissolved in these waters, together with oxidation of the pyrite and ferrous sulphate, such transposition and precipitation occurring practically simultaneously and *in situ*. The subsequent metamorphism produced by the heat of igneous flows and intrusions readily explains the subsequent cementation and induration of these rocks and the highly crystalline character of their enclosed minerals.

Hence, if this theory be accepted, the origin of the "iron formation" becomes one of extreme simplicity; it can be ascribed merely to ordinary mud, clay, silt, or sandy sediments containing more or less generally disseminated pyrite and some more or less concentrated layers of sedimentary pyrite.

CONDITIONS OF OXIDATION

An extension of this line of reasoning only is required, to account for the orebodies, it being necessary merely to assume that in some of the sedimentary strata large concentrated bodies of pyritic material were deposited. Under such conditions the pyrite either oxidizes directly to ferric oxide or hydrate, or the

ferrous sulphate oxidizes to ferric sulphate, precipitating some of its iron as ferric hydrate, the percolating waters transporting the balance to portions of the deposit where active oxidation is progressing, and where the ferric iron may again be reduced to the ferrous form. These reactions occurring and recurring, eventually result in the precipitation of practically all of the iron contained by the original pyrite deposit at or near the site in which it was originally deposited, the precipitation of iron brought in solution from other portions of the formation, containing disseminated pyrite, resulting in an enrichment and enlargement of the orebody.

These reactions proceed slowly and the resulting ferric oxide or hydrate is virtually precipitated *in situ*, and the soluble bases of the gangue are removed as sulphates, while some of the silicic acid may escape in solution, or all, or a part may remain with the ore as various silicates of iron, jasper, chert, chalcedony quartz or sand.

Whether the chemistry of these various reactions be correctly described or not, the fact remains (as described in the article on "bombshell" ore above referred to, and as later elaborated in an article shortly to appear in the Bulletin of the A. I. M. E., explaining the "Genesis of Eastern Limonite Deposits"), that some extensive deposit of limonite ores owe their origin to the oxidation in place of pyritic slates and sandstones. In other words, these ores are gossans overlaid by an altered pyrite. Possibly in the Lake region, the pyritic strata may have been completely oxidized, or if any unoxidized portions remain, these may exist only at great depth, but in the Appalachian region oxidation of the precisely similar Siluro-Cambrian sedimentary pyritic deposits has in some places been quite shallow, the unaltered pyrite being found at depths of less than 100 ft. below the present surface.

OXIDATION IN THE ABSENCE OF FREE OXYGEN

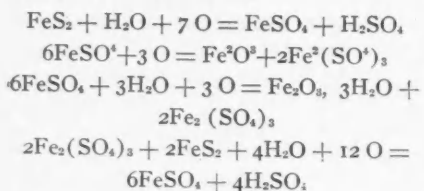
The preceding discussion has been confined to oxidation by meteoric waters carrying oxygen, and no attempt has been made to review the conditions of oxidation by hydrolysis in the absence of free oxygen, and although it has been shown by Stokes and others that pyrite, marcasite and pyrrhotite can thus be oxidized, I prefer to defer discussion of the conditions necessary to such reactions until the results of further experimental research now in progress are available for publication.

The reactions by which pyrite and marcasite are oxidized below the surface rarely set sulphur free, although this frequently occurs when these minerals are oxidized in the open air, especially if oxidized in the presence of organic mat-

ter, the equation commonly being written:

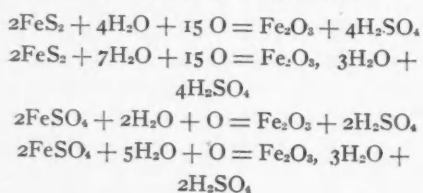


Some probable reactions illustrating the formation of hematite and limonite by oxidizing water containing free oxygen, and the incidental formation of sulphuric acid, involving the oxidation of ferrous sulphate with precipitation of iron as ferric oxide and hydrate, and the de-oxidation by pyrite of the resulting ferric sulphate to ferrous sulphate, may be variously written, thus:



the ferric sulphate continuing to react upon the sulphide to produce ferrous sulphate and sulphuric acid and the ferrous sulphate being oxidized to ferric oxide or hydrate and ferric sulphate, resulting finally in the *complete oxidation of the pyrite to ferric oxide or hydrate and sulphuric acid*.

The direct oxidation of pyrite or of ferrous sulphate to ferric oxide and hydrate and sulphuric acid, as shown by the following equations, is improbable except possibly in the presence of electrolytic polarization due to earth currents.



It is, however, unsatisfactory to attempt an exact analysis of possible reactions, because the iron in these sulphides has been shown by Dr. A. P. Brown to exist both as ferrous and ferric iron, and the oxidizing processes may, therefore, be complicated by corresponding differences in behavior, and further, many reactions, which must be more or less indeterminate, doubtless occur with the salts carried in solution by the meteoric waters. An illustration of the importance of this latter consideration is found in the large quantities of phosphorus found in the Siluro-Cambrian (Pottsdam formation) limonites of the Appalachian range, which evidently have been introduced by the oxidizing meteoric waters; for the pyritic deposits of which these limonites are the gossans contain small quantities of phosphorus.

PRECIPITATING AGENTS

The influence of the salts of lime, magnesia, and the alkalies held in solution by these waters in causing precipitations, and as affecting oxidation, cannot accurately be predicted. In addition to these difficulties are those which may arise from the possible formation of other acids than normal sulphuric acid and from the pos-

sible formation of basic salts. In a similar manner we are halted in any attempt to portray in detail the part played by silicic acid (set free by the action of sulphuric acid upon clay and other sediments) by the uncertainty as to the particular type or types of silicic acid thus set free, and the possible behavior of such acids; our reasoning is, therefore, practically limited to speculations concerning the behavior of orthosilicic acid (H_2SiO_4) and metasilicic acid (H_2SiO_3).

The most common forms in which iron appears to have been precipitated in quantity and in concentrated deposits are as carbonate of iron and as pyrites. It appears to have been precipitated freely as carbonate only in the presence of conditions favorable to the deposition of calcareous sediments, most of the large and important beds of carbonate of iron being interstratified with or associated with limestone.

The deposition by precipitation of iron as pyrites is apparently confined to no class of deposits, pyrite being found indifferently with calcareous, argillaceous and arenaceous rocks, but precipitation appears to have occurred in larger quantity and more generally during the deposition of clays and sandstones, or in localities where these were being laid down; the more important deposits of this mineral being found in slates and sandstones.

The reduction and precipitation of iron as bisulphide is usually attributed to organic matter, and has been supposed in some cases to be due to the reducing action of growing vegetation. The precipitation of pyrite in marshes and peat-bogs has been accounted for in this way, and it is quite possible that the pyrite occurring in coal-beds may have a similar origin. It does not seem at all improbable that a profuse growth of marine vegetation (seaweeds) may have caused the precipitation of pyrite in quantity during the deposition of the sands and muds, and possibly the granular form of the pyrite may be due to the growth of pyrite in this form upon masses of floating seaweed, (similar to that found adhering to the sphagnum), the granules becoming detached and sinking to the bottom as the seaweed died or decayed. Other conditions may have caused a reduction and precipitation of the iron as bi-sulphide, conditions which our present knowledge does not enable us to imagine or describe. The subsequent concentration and distribution by waves or currents of the pyrite grains or granules, and the classification of these into coarse grains depositing with the sands and fine material depositing with the muds is easily understood.

The Evje nickel works produced 5781 tons of nickel ore in 1907, says the *London Mining Journal* (May 30, 1907); 5493 tons were smelted, which gave 200 tons of copper-nickel product, containing 81 tons of nickel and 53 tons of copper.

Hydrochloric Acid for Cleaning Cloths of Slime Filters

W. R. Dowling (*Journ. Chem. Met. and Min. Soc. of South Africa*) describes a method devised at the Knights deep mine, Transvaal, to overcome a not uncommon difficulty with slime filters. The tonnage of ore having increased, it was found necessary to install more solution clarifying arrangements. A filter-press containing 36 hollow frames and served by a 3-in. high-lift centrifugal pump was erected. The frames were 30 in. square and contained 450 sq. ft. of filtering area, admitting a 1-in. cake of slimes.

The pump suction was at first connected directly to the decanting main. With this arrangement it was found that the cloths had to be changed at least every 24 hours and sometimes oftener. The effect of steam applied for two hours for dehydrating colloidal silica was tried. This extended the life of the cloths up to 12 hours, but the cloths soon became hard, and the pores choked even after vigorous scrubbing in water.

On analysis it was found that 90 per cent. of the hardening deposit in the cloths consisted of carbonate of lime. Treatment with 10 to 20 per cent. hot hydrochloric acid, with rubbing to release the bubbles of carbon dioxide, left the cloths soft and apparently uninjured. The carbonate of lime which caused the trouble was apparently drawn into the suction pipe from the surface of the undisturbed slime solution. The suction of the pump was introduced into the sides of two of the ordinary sand filter vats at a point opposite the inflow and about 18 in. above the sand level, and a box open at top and bottom was placed over the intake to prevent the floating carbonate of lime from being drawn in. These means were so successful that cloths could be used three or four days, clarifying up to 800 tons per day.

Mining in China

The province of Shantung, China, according to Wilbur T. Gracey, U. S. Consul at Tsingtau, has valuable mineral resources, but these have not been worked extensively. At Tschoutschong there are deposits of mica of good quality. Copper and gypsum deposits as well as clays of good quality have also been found. On the Tiehshan (Iron mountain) near the railroad station of Tsinglingtschen an iron deposit of good size occurs. It contains both magnetite and hematite, and carries 65 per cent. iron. The German Mining Society is working this deposit and development is said to indicate a length of 2 km., and a thickness of 35 m.; the deposit dips at a high angle. Iron ore has also been found on Sy-bau mountain near the railroad station of Tschangtien.

Reclaiming Caved Ground after a Squeeze

By J. J. RUTLEDGE*

In mining the iron pyrite deposit at the Davis mine, Davis, Mass., it has been the practice for several years to stope out the ore entirely from foot to hanging wall, between the levels, usually by underhand stoping, commencing at the shaft pillar and working outward away from the shaft. For some years it was customary to leave a 12- to 14-ft. horizontal pillar under each level. This pillar was in most cases backed up with timber from below, but, notwithstanding this precaution, the pillar usually fell, owing to the fact that the headings of the stulls fell out as the hanging wall began to crumble. This pillar in falling carried away all the stulls below it and ceased falling only when it reached solid ground, which ground was, of course, the stoping ground then being worked.

DISADVANTAGE OF THE METHOD

While this practice of stoping out the entire orebody between each pair of levels and from wall to wall yielded the maximum amount of workable ore in the vein, still it had several drawbacks. When the ore was stoped out entirely and no horizontal pillar being left, it was necessary for the men working on the stopes to work under open ground, since the underhand system was employed. It was also necessary to tear up the track in the upper level, when two stopes were being worked together, before the bench could be started on the lower stope. When the pillar was left it was necessary to drive the drift below it, and such drifts had to be driven at every level where a pillar was left, whereas, when no pillar was left, it was only necessary to drive the drift at the uppermost level.

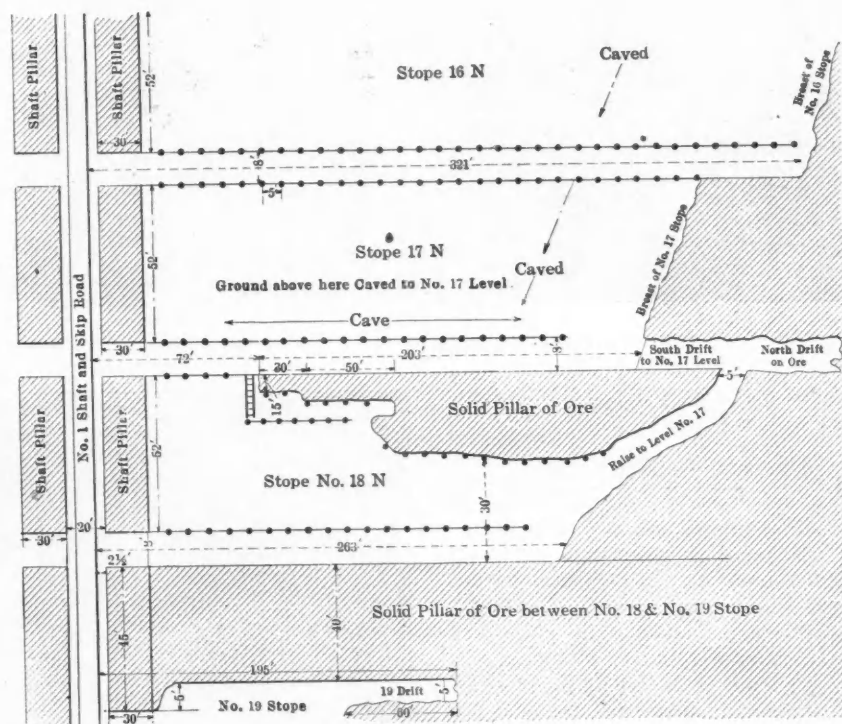
But the greatest drawback to the exhaustive method of mining and the one which to my mind renders debatable the utility of the method, is the fact that, when no pillars are left, the surface water has free access to the entire workings of the mine, and increases greatly the pumping and timbering cost, and compels every employee to work in a wet and disagreeable mine. The water running over the stopes causes the fine ore to set like so much cement and renders the mucker's work very hard and unpleasant.

To meet these conditions some mining men who have visited the mine have advocated leaving an entire level unstoped, say, every third or fourth one, merely driving the drifts above and below and blocking out the ground without stoping it. But this method was not practicable, and the following compromise plan was

adopted several years ago. A horizontal pillar about 30 ft. thick was left over the level, a drift driven, and the ore below it worked by back-stoping.

This plan worked very well. All the water coming down the old workings was caught by shallow sumps made on the upper side of the pillar and pumped to the surface. The workings below the pillar were entirely dry. However, as no vertical pillars were left to support the horizontal pillars and, in some cases, but little timber was placed under the pillars, the pillars eventually fell from the additional influence of the crumbling of the hanging walls. The management appreciated the temporary character of these pillars, and always planned to have a new pillar protecting the advanced workings when the old pillar fell. In one instance the old

weight on the hanging so that the caving pillar eventually fell to level No. 17. This level had been splendidly timbered with heavy rock-maple stulls, but as stope No. 18 immediately below it was being worked at this time, legs resting on mud sills strung lengthwise of No. 17, were placed under the heads of the bottom stulls. This was necessary because No. 18 was also being worked by underhand stoping. The weight of the pillar was transmitted through the hanging-wall at No. 17, and the legs were pushed out from under the heads of the stulls. The entire No. 17 level was closed at one point by a mass of broken ore and rock. After the ground had settled and the noise made by the crushing ground had ceased, an examination of level No. 17 was made and a current of air was found passing through



SKETCH SHOWING POSITION OF CAVED GROUND, DAVIS MINE

pillar fell before the newer workings were provided with the protecting pillar, and a description of the method of recovering the caved ground may be of interest.

RECOVERING THE CAVED STOPE

The vein varies from 10 to 20 ft. in thickness, and dips at an angle varying from 70 to 80 deg.; hence any weight on the ground is rapidly transmitted through the brittle hanging-wall of quartz schist. In this case, illustrated in the accompanying sketch, the pillar which fell lay over level No. 15, and above it all ground was caved to the pillar at the surface. Stopes No. 16 and No. 17 north were being worked at the time, and the advent of a cross-slip in the hanging in No. 17 north, aggravated the caving due to the

caved material. This convinced the management of the presence of open ground inside the fall. The condition of the caved level is shown in an accompanying illustration; also its appearance after the loose material had been cleared away. The debris was carefully cleared away with the result that the stulls were found to be still resting in the hitches, but with their previous slope reversed. Upon crawling under the stulls in the water, which now poured out through the caved ground, it was found that 20 or more of the stulls had felt the effects of the fall and had been crushed down, as shown in the illustration. Near the breast of stope No. 17, ten stulls were still upright and uninjured, for the main fall of ground had occurred between the breast and the shaft.

*Mining engineer, Baltimore, Md.

This being the case, it was determined to attempt to reopen stope No. 17 from below. Previous to the fall of ground stope No. 18 had been worked underhand to a distance of about 72 ft. from the

to permit the muck made in driving it to fall by gravity to the level below, was driven to reopen the breast of No. 17 stope. The work was carried out, as shown in the sketch, the raise being about

able, it was not thought advisable to construct chutes; hence the muck was permitted to fall on the sole of level No. 18, and was mucked and trammed from that point. The work was completed as shown in the sketch.

Below level No. 18 and between this level and No. 19 a solid pillar of ore 40 ft. thick was left. This pillar was 45 ft. thick at the shaft and 40 ft. thick north of the shaft pillar. It was securely supported below by stulls, levelers, and lagging. A 5x7-ft. drift under the pillar opened up stope No. 19, which was worked underhand, beginning at the shaft.



STOPE NO. 17 AFTER CLEARING AWAY THE DEBRIS

shaft to the point where the ladder appears in the sketch.

USE OF A PROTECTING PILLAR

The first displaced stull in No. 17 was notched, as shown, to permit of a Koppel car being used in cleaning up the level and the level was mucked out to the breast, where some caved material was also encountered. The stulls which had been displaced were braced by sprags, and the level south of the fall secured by cap and single-leg timbering, as shown in the illustration. A ladderway was made between No. 17 and No. 18 so as to give access to the breast of No. 17 from No. 18 when No. 17 level between the shaft and the ladderway should become closed by caving material. A pillar about 15 ft. thick was left between No. 17 and No. 18, and a drift started with the intention of working No. 18 stope underhand, as this method had been demonstrated by experience to be best adapted to the mine. But the back of the drift scaled off after a distance of about 30 ft. had been driven, and the pillar was increased to a thickness of 20 ft., and driven a further distance of 50 ft., when it was found desirable to abandon the attempt to underhand-stope the ground and to leave a 30-ft. pillar, back-stopping the remaining lower portion of the ground between No. 17 and No. 18.

As soon as work in No. 18 had reached a point below the solid ground in No. 17 a raise, having an angle sufficiently great



CONDITION OF STOPE NO. 17 AFTER THE SQUEEZE

5x5 ft. in cross-section, and reaching the solid ground a short distance north of the breast of stope No. 17. Level No. 18 was protected by bottom stulls, well lagged, as shown in the sketch. As there was but a small amount of stoping ground avail-

able, it was not thought advisable to construct chutes; hence the muck was permitted to fall on the sole of level No. 18, and was mucked and trammed from that point. The work was completed as shown in the sketch.

The average number of men employed in or about the mines during the quarter was 6774, of whom 6698 were white men and 76 Chinese.

Mineral Production of Tasmania

The report of the secretary of mines of Tasmania for the quarter ended March 31, 1908, gives the total production of gold in the State, including that in copper and lead bullion, at 16,739 oz. The production of copper was 2117 tons blister copper, containing 2090 tons fine copper, 167,142 oz. silver and 5446 oz. gold. The production of ores—other than those from which the metals reported above were won—was: Silver-lead ore, 17,818 tons; copper ore, 44 tons; tin ore, 1046 tons; iron ore, 1000 tons; tungsten ore, 3 tons; bismuth ore—obtained in connection with tin ore—0.15 ton. The coal mined

Douglas Smelting Works, Fundicion, Sonora

By W. P. TUCKER*

The accompanying illustrations of the new smelting plant at Fundicion, Sonora, Mexico, one of the properties of the Douglas Copper Company, show some interesting details of this modern works which recently began operations. Fig. 1 is a view of two of the traction engines

handle about 20 per cent. of the load on a steep grade. One of these auxiliary trucks is shown in Fig. 2. Fig. 3 shows the general arrangement of the ore-handling machinery.

The entire plant is served by a 36-in. narrow-gage railway. An ore train in yards and the trestle approach to the main ore bunkers are shown in Fig. 4. These narrow-gage cars have a capacity of five tons each. Ore is stored in heaps dumped from the trestle, as shown in Fig. 5. The general arrangement of No. 1 copper fur-

turn are dumped into the boots of Jeffrey steel pan conveyers, and carried, thoroughly mixed, to the charge floor.

Figs. 7 and 8 give general views of the furnace building from the slag dump; Fig. 10 shows a part of the tapping floor, and Fig. 9, the arrangements for handling concentrates and flue dust. This material is run from the bins to the boots of elevators, and delivered to the pug-mill, the mixture consisting of flue-dust, concentrates, quick-lime and water. After being thoroughly pugged, it is forced through

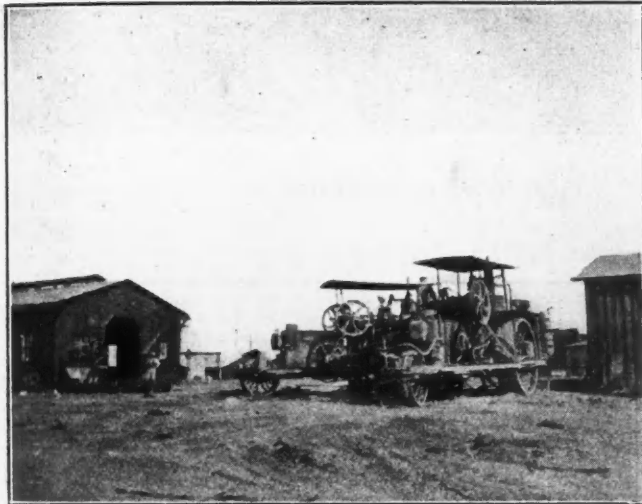


FIG. 1. TRACTION ENGINE FOR HAULING ORE FROM THE MINES

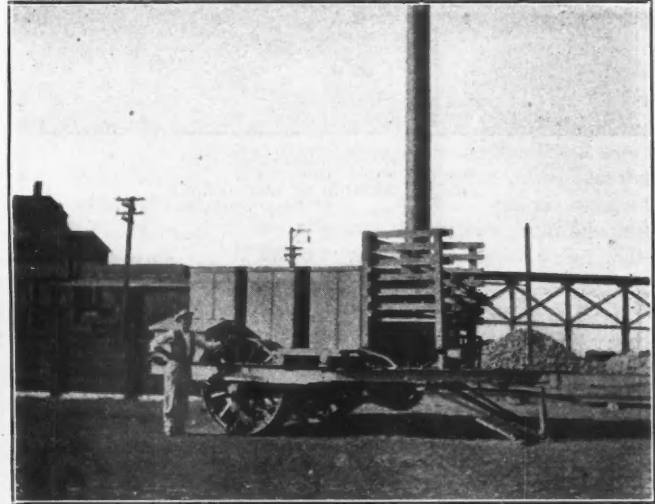


FIG. 2. TRUCK CARRYING AUXILIARY ENGINE

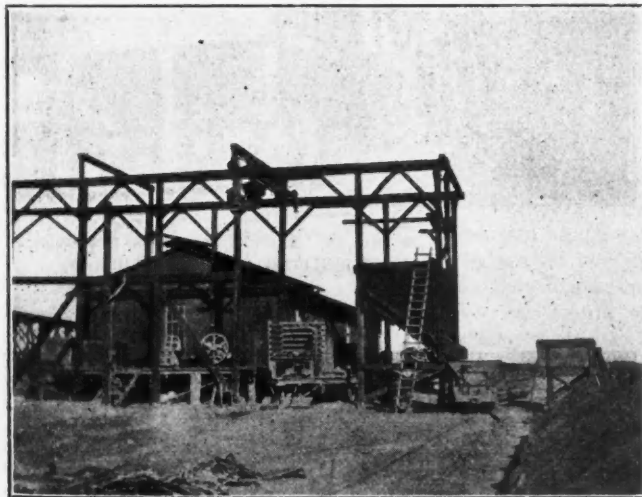


FIG. 3. UNLOADING ARRANGEMENT. TRACTION TRAIN IN SHED

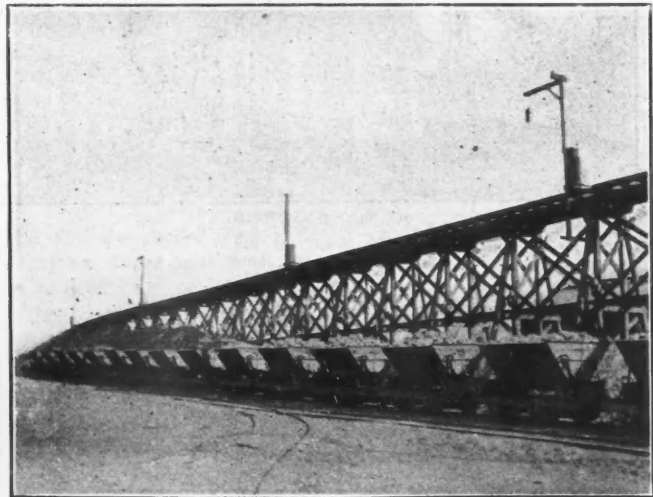


FIG. 4. NARROW-GAGE ORE TRAIN IN YARD

which haul an effective load of 45 tons of ore from the mines per trip; the train consisting of an engine and five trucks, each truck carrying three steel four-ton ore buckets. These buckets are picked up by an electric crane at the smelter and dumped into bins, from which the ore is drawn into narrow-gage cars. The first truck of the train, or the one which immediately follows the engine, has an auxiliary engine with a capacity sufficient to

nance is illustrated in Fig. 6. This furnace is 44x160 in., and is connected by means of a steel down-take with a balloon-shaped dust flue 150 ft. long, and of 12 and 15 ft. diameters, which discharges into a self-supporting steel stack 177 ft. high, 14 ft. in diameter at the bottom, and 8 ft. at the top. This equipment will carry two additional furnaces of the same size, thus giving the plant an approximate capacity of 1000 tons daily. The ore is hauled to bunkers, from which it is drawn in definite proportions into cars, which in

disks at the end of the mill, cut into sections, and dropped into narrow-gage cars standing on the track below.

MINING AND SMELTING COSTS

The plant during the short time it has been in operation has proved itself to be satisfactory in every respect. The labor efficiency has been as high as 17½ tons of ore smelted per man employed, a record in the smelting practice of Mexico.

It was not until July 1 that the company, as a result of the operation of the plant

*Compania metalurgica y Refinadora del Pacifico, Fundicion, Sonora, Mexico.

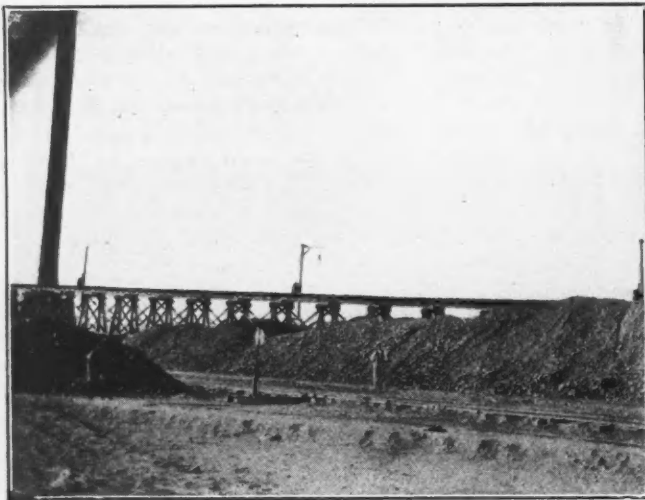


FIG. 5. METHOD OF ORE STORAGE



FIG. 6. GENERAL ARRANGEMENT, NO. 1 COPPER FURNACE



FIG. 7. FURNACE BUILDING FROM SLAG DUMP



FIG. 8. FURNACE BUILDING AND DUST FLUE

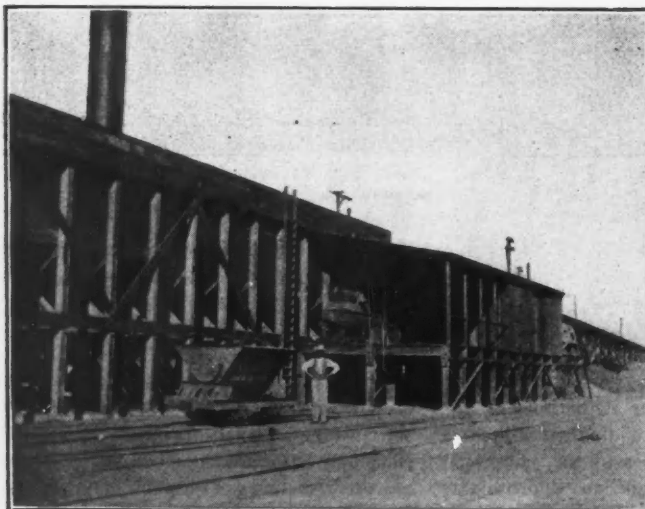


FIG. 9. HANDLING FLUE DUST AND CONCENTRATES

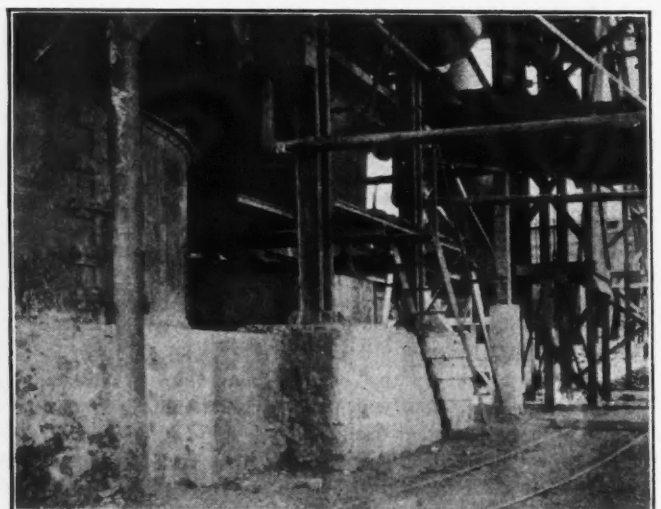


FIG. 10. TAPPING FLOOR

during June, was able to determine positively what its working costs would be. It was gratifying to find that they are quite within the provisionally estimated costs made by the company's engineers.

MINING COSTS, EL COBRE, PER TON OF 2000 LB.

Direct Charges.	Ore Ex- traction.	Surface Handling.
Labor.....	\$1.75	\$0.72
Supplies.....	0.67	0.30
Power.....	0.24	0.15
Blacksmith shop.....	0.10	0.06
	<u>\$2.76</u>	
Less timbering (pro rata).....	0.65	
Total.....	\$2.11	\$1.23
Indirect Charges.		
Salaries.....	\$0.54	
General expense.....	0.11	
Total.....	\$0.65	\$0.65
Transportation, El Cobre to Fundicion.		
Labor.....	\$1.12	
Fuel.....	0.58	
Repairs.....	0.35	
Supplies and tools.....	0.16	
Total.....	\$2.21	\$2.21
Grand total, mining and transportation.....		\$6.20

SMELTING COST, PER TON OF 2000 LB.

Unloading, Sampling and Yard Charges.		
Labor.....	\$0.40	
Wood for locomotives.....	0.01	
Tools and supplies.....	0.01	
Steam power.....	0.15	
	<u>\$0.57</u>	<u>\$0.57</u>

Direct Charges.		
Labor.....	\$0.33	
Coke.....	1.96	
Wood and Sundries.....	0.01	
Tools and supplies.....	0.01	
Repairs.....	0.03	
Steam power.....	0.14	
	<u>\$2.48</u>	<u>\$2.48</u>

Indirect Charges.		
Administration.....	\$0.06	
Taxes, etc.....	0.01	
General expense.....	0.10	
Laboratory expense.....	0.03	
Salaries.....	0.20	
	<u>\$0.40</u>	<u>\$0.40</u>

Total smelting costs.....	\$2.88	
Grand total mining and smelting.....	\$9.65	

SUMMARY OF ALL CHARGES.

Mining.....	\$3.99
Development.....	1.25
Transportation, El Cobre to Fundicion.....	2.21
Sampling, handling and yard charges.....	0.57
Smelting.....	2.88
Fluxes (estimated maximum).....	1.50
Refining, transportation, selling commissions, etc.....	3.09
Federal government, taxes, etc.....	0.24
Total.....	\$15.73

These charges include all costs; mining of the ore, its transportation to the smelter, smelting, refining, transportation of product to market, selling commissions, and all the government charges.

It will be observed that an allowance of \$1.25 per ton is made to cover future development. In the actual cost of production, this item should not be included. The allowance is estimated to be more than ample to develop an additional ton of ore for each ton extracted from the mine, thus making the company's visible tonnage an approximately constant quantity. On a basis of an average 5.65 per cent. copper recovered, with copper at 13c.

per lb., and an average of \$9.63 per ton gold and silver, the ore has a gross value of \$23.67; and deducting the working costs of \$15.73, will leave a net profit of \$7.94, or a cost of 5.64c. per lb. of electrolytic copper produced.

The company's limestone carries an average of \$1.20 in precious metal per ton, which is sufficient to cover the cost of mining and transportation to the smelter, and as the actual cost of smelting the limestone is included pro rata in the cost of smelting, there is no further charge against that item. The result is that the limestone flux costs the company nothing.

The company expects to develop in its own properties, or to secure as custom ore, a sufficient quantity of ore running high in iron to satisfy the iron requirements of the silicious ores of its El Cobre property.

With the handling of a larger tonnage, and a general improvement of conditions, as a result of the further development of the mining industry on the west coast of Mexico, and the completion of the railroads which are now building, making it possible to bring a large tonnage to the smelter, the working costs should be materially reduced.

Is China Clay a Mineral?

SPECIAL CORRESPONDENCE

In one of the English courts a case which lasted several days has recently been tried, the issue of which depended on whether china clay was a mineral or not. Important interests were at stake and no expense appears to have been spared as regards counsel or scientific witnesses by either side. The nature, origin, composition and uses of china clay were discussed at great length and the record of the trial may be regarded as an exhaustive treatise on the subject. The action was fought over the ownership of certain china-clay deposits in Cornwall, underlying a railway. Under certain agreements the china clay belonged either to the railway company or to the original vendors of the land and their successors, according to whether china-clay was a mineral or not.

The china-clay deposits in Cornwall undergo a series of washing and purifying operations before becoming a marketable article and the defendants claimed that the china clay was only decomposed granite, and, therefore, only the soil or subsoil and not a mineral. The view taken by the judge was that as the china clay occurred in such a manner that it could be readily distinguished from the granite with which it was associated and from which it was derived, it must be regarded as a separate substance and that that substance could properly be called a mineral. It was so regarded by geol-

ogists, mineralogists, and text-book writers for many years past, not only in England, but in America, France and Germany. The names of Professor Lapworth, Doctor Hatch, Professor Dana and Professor Miers were quoted as authorities who classed china clay as a mineral. The defendants made a distinction between kaolin of the text-books and china clay of commerce, but the judge considered these convertible terms, saying that the mere fact that clay can be turned to commercial uses without being altogether dissociated from foreign substances cannot alter its real character. Two of the witnesses, Professors Boyd Dawkins and Lapworth, called to prove that china clay was not a mineral, gave evidence only a few years back in another case that the two words kaolin and china clay were synonymous terms. These views they now discarded after more careful microscopic and local examination of china clay and the sources from which it is derived, and the conclusions that these examinations led them to are directly opposed to those which they shared with the scientific world generally down to the summer of last year. They now degraded china clay to an artificial product, a heterogenous compound or mixture of everything that is in the china-clay rock and unredeemed by any one of the qualities that, according to Doctor Hatch, are the essential characteristics of a mineral, namely definite mineral composition, definite physical qualities and definite crystal forms.

The case did not, however, depend on whether the term mineral for china clay was scientifically accurate or not, but whether the substance called china clay was a mineral within the meaning of the act of Parliament. The substance had been universally regarded as a mineral before the passing of the act and for 60 years after and ought now, so the judgment decided, to be treated as falling within the class of substances therein referred to as minerals.

Work of the British Mint

The coinage of the British Mint for the full year 1907 is reported as follows, in number of pieces struck:

	Imperial.	Colonial.	Total.
Gold.....	22,692,084	.....	22,692,084
Silver.....	37,343,094	18,392,687	55,735,781
Bronze.....	68,570,880	2,600,000	71,170,880
Nickel.....	.....	2,676,848	2,676,848
Aluminum.....	.....	8,202,599	8,202,599
Total.....	128,606,058	31,872,134	160,478,192
Total, 1906.....	100,585,974	12,298,843	112,884,817

The total face value of the imperial coinage was £14,054,590 in 1906, and £23,198,378 in 1907. The gold used included 4,134,547 oz. in bullion, and 685,892 in old light coins; 4,820,439 oz. in all. The coinage of aluminum pieces is the only example of such use of that metal, we believe.

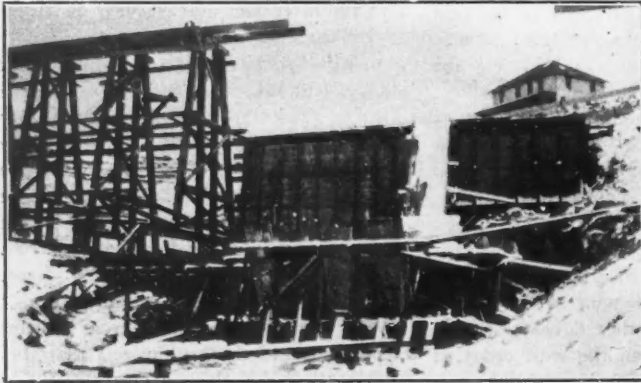
The Goldfield Consolidated Mill

The new mill now in course of construction for the Goldfield Consolidated Mines Company, at Goldfield, Nev., which is expected to go into operation in November, will include a crushing plant, stamp mill and amalgamation plant, concentrating plant, regrinding and amalgamating

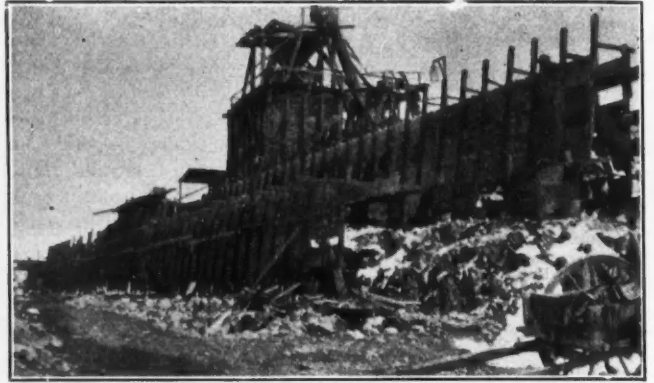
"K," Gates breaker. The product of this machine will be delivered into an iron frame Gates revolving screen, 48 in. in diameter by 14 ft. long, the oversize being delivered into two No. 4, style "K," Gates crushers with specially constructed heads for fine crushing. The product from these crushers, together with the undersize from the revolving screen will be de-

so planned that a sample can be taken automatically from the stream of ore as desired, the sample being cut down to the required size for assaying by an arrangement of automatic samplers, crushing rolls and sample grinders, delivering the ground sample to the sampling floor.

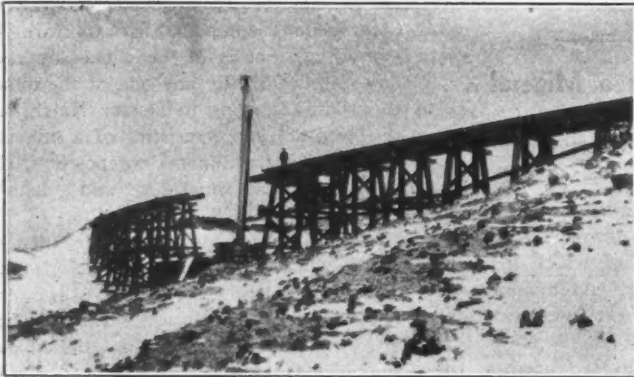
The ore from the conveyer will be delivered upon a 26-in. belt conveyer extend-



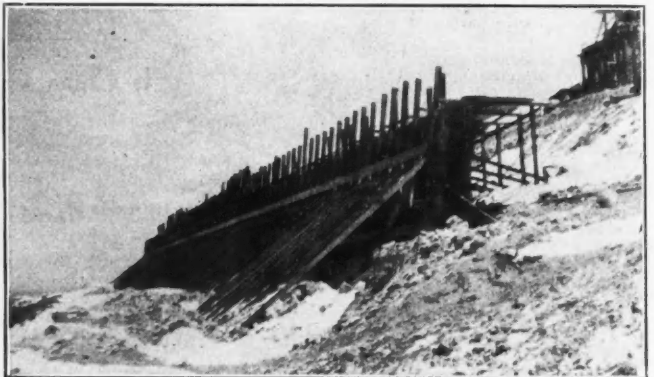
FOUNDATIONS FOR CRUSHING PLANT



FOUNDATIONS OF BATTERY FLOOR AND ORE BINS



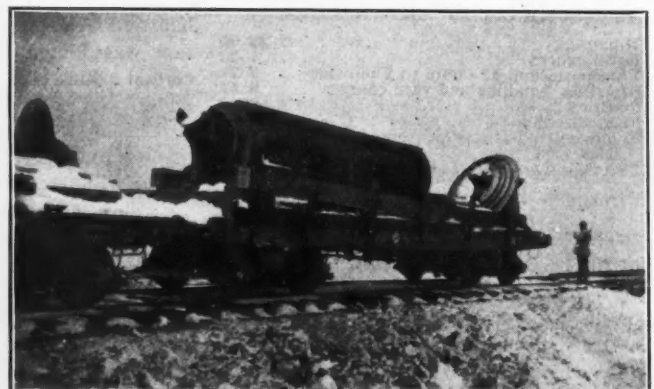
TRESTLES LEADING TO CRUSHING PLANT



WALL, LOWER END TUBE-MILL FLOOR



THE FIRST CARLOADS OF MACHINERY



SCREEN FOR THE CRUSHING PLANT

plant, cyanide and filtering plant and refining plant. The ore will be brought to the crushing plant over an elevated trestle in cars and delivered to the bins, from which it will be fed into a No. 7½, style

NOTE—A detailed description of this mill will appear in an early issue of the JOURNAL.

livered to the stamp mill by a 26-in. belt conveyer which travels up an incline. The conveyer will pass an automatic weighing and recording machine which automatically records the weight of ore delivered to the mill.

The discharge from this conveyer is

ing entirely across the bins above the stamps, and will be automatically distributed into these bins by a reversible self-propelling tripper. The ore, drawn from these bins through gates, will be delivered to the batteries by Challenge suspended feeders. The batteries will in-

clude 100 stamps, each weighing 1050 lb., arranged in batteries of 10 with five stamps in a mortar. The batteries are set on concrete foundation and are provided with special extra-heavy mortars for this purpose weighing about 11,000 lb. each.

The product from the stamps will be passed over amalgamating plates and then through an amalgam trap into a cone classifier or sizer. The overflow from these classifiers will be delivered to the concentrating tables and the spigot product to the tube mills through six Dorr mechanical classifiers to remove the slimes which are to be sent directly to the cyanide plant. The coarse sands will go to six 5x22-ft. tube mills, provided with silex linings and Danish flint pebbles, to be re-ground. The product from these mills will pass through six cone classifiers to remove any remaining coarse sands which will be returned by spiral sand pump back to the mills for further grinding. The fine product, after passing over amalgamating plates and through amalgam traps, is to be delivered to the cyanide plant.

In the cyanide plant the pulp will first be subjected to treatment in agitating tanks for the required time and then delivered to the pulp storage tanks, from which it will be drawn into the Butters vacuum-filtering system where the solution will be removed and the residue discharged. The gold-bearing solution will be precipitated by zinc dust and the solution returned for re-use.

The entire mill will be driven by induction motors arranged for individual drives. The capacity of this plant will be about 600 tons a day. The machinery is furnished by Allis-Chalmers Company. The accompanying illustrations show the plant soon after the beginning of construction. The plant was designed under the direction of J. K. Mackenzie, general manager of the company; F. L. Bosqui, consulting metallurgist, and G. B. Shipley, representing the Allis-Chalmers company.

Copper in British East Africa

According to a report of the commissioner of mines, copper has been found in British East Africa in the valley of the Tsavo river, which flows from Kilimandjaro eastward. The discovery was made by prospectors, who have been seeking for metals for a long time in the country about the Uganda railway.

The principal deposit lies about 70 km. eastward from the station of Tsavo on the Uganda railway, and consists of a quartz lode parallel to the railway carrying copper. The lode extends from the foot of the Kiulu mountain through the Tsavo valley in a southeasterly direction.

Besides the copper, the quartz contains gold in small quantities. Assays made in Nairobi show 30 per cent. of copper.

Hunter Dredge, Oroville. Cal.

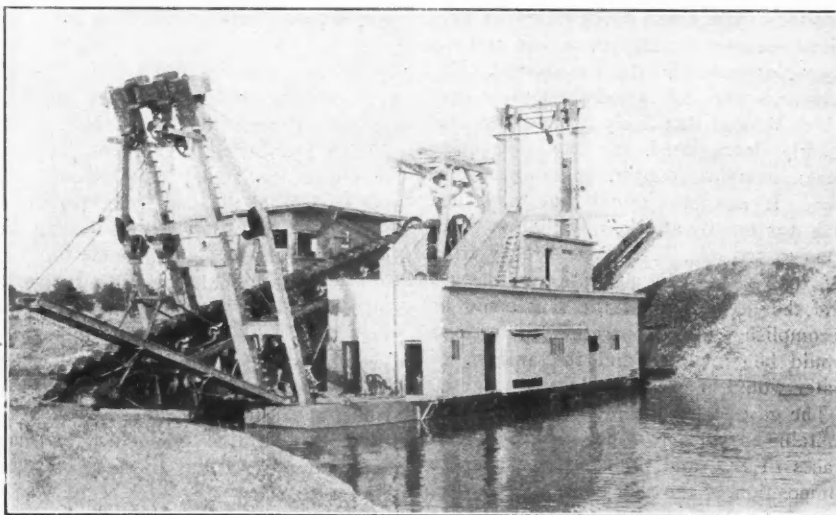
The "Hunter" dredge shown in the accompanying illustration was erected at Oroville, Cal., in 1907, for the Oro Water, Light and Power Company and has been working placer ground averaging 38 ft. in depth from water line to bedrock. The hull is trussed along the well-hole line with an overhead structure. The bow gantry, supporting the digging ladder and buckets, is constructed so as to minimize warping of the bow pontoons. The buckets, each of 5 cu. ft. capacity, are close connected, and are provided with heavy, manganese steel lips. There are 82 buckets in the chain. A revolving screen, 6 ft. in diameter by 26 ft. long, having sections of perforated plates graduated to the size of material handled, disintegrates the gold-bearing gravel and

raised and lowered until the dredge has stepped ahead to the position required.

This machine is operated entirely by electric power, current being delivered at 4000 volts and transformed on the dredge to 400 volts. The motors are all of the Westinghouse type "C. C. L." for the constant speed, and type "F" for those having a variable speed.

The entire cost of the dredge is \$90,000, ready for operation; 106,000 cu.yd. of gravel were recently handled by this machine in one month's run, and still better results are looked for as soon as the machine reaches ground which is easier to handle.

The dredge was erected by the Western Engineering and Construction Company, of San Francisco, the dredging machinery proper being supplied by the Bucyrus Company, of South Milwaukee.



THE HUNTER DREDGE

clay under pressure from an 8-in. centrifugal pump. The gold is washed free from the gravel during its passage through the revolving screen and is carried through the perforated plates to a system of gold-saving tables under the screen. The tables are furnished with riffles of wood shod with iron. These catch the fine gold as it drops from the screen.

Large stones and boulders rejected by the revolving screen are passed through a hopper and carried well astern of the dredge by means of a 30-in. belt conveyor.

There are two winches on the boat, both placed forward; one on the port side, by means of which the digging ladder is raised and lowered; the other on the starboard side carrying the auxiliary lines used in swinging the dredge from side to side. The digging ladder is held up to the face of the cut by means of a steel spud 24x36 in.x50 ft. long.

A wooden spud is also provided, of the same dimensions as the steel spud, and this is chiefly used to move the dredge forward when a new cut is necessary. In this process, both spuds are alternately

Shaft Sinking on the Rand

The Brakpan Mines, Ltd., which holds the record on the Rand for fast shaft sinking in vertical shafts, has made a new record by sinking the inclined portion of the shaft 223 ft. during the month of June. The incline starts from the vertical portion of the shaft at a depth of 3096 ft., and had at the end of June a length of 580 ft. The broken rock was hoisted from the inclined shaft by a 4x5¼-in. air winch, and through the vertical shaft by a 10x15-in. hoist, the rock being transferred at the curve where the two parts of the shaft meet. The inclined portion of the shaft is timbered only with sills placed at 7-ft. centers; the dip is 13 deg. and the size 19x7 ft. Holman ¾-in. drills were used. By bratticing off one of the compartments an excellent ventilation was obtained so that the men could return to work quickly. During the month 35 shifts were worked, 1376 holes, or 30.6 per round, of an average depth of 5.06 ft., were drilled, and 114 cases, each holding 50 lb. of ¼-in. gelatine, were used.

The Westby-Sorensen Process

By E. P. JENNINGS*

Experiments were made at the Utah Consolidated smelter, near Murray, Utah, in 1905 and 1906, to determine if a practical method could be devised to absorb and utilize the gases from the roasters which were discharging daily 400 tons of sulphur dioxide into the air. Plans and estimates had been furnished by a New York chemical engineer for a coke tower plant to absorb the SO_2 by water, but this would require 40,000 tons of water daily if a 1-per cent. solution were made, and the disposal of this amount of acid water would be as serious a problem as that presented by the smoke itself.

George C. Westby, a chemist employed at the smelter, discovered that the reverberatory slags could be decomposed by a dilute solution of sulphurous acid and the copper contained in them recovered. Experiments were conducted along these lines which showed that finely ground slag was readily decomposed, the iron and other bases, including copper, going into solution. It was also found that moistened slag was readily attacked by the hot gases (300 to 500 deg. F.), taken directly from the roasters. If the absorption of the gas and the dissolution of the slag could be accomplished in one operation, the process would be simplified and the amount of water would be greatly reduced.

The gases from the McDougall roasters contained from 2 to 5 per cent. SO_2 with traces of SO_3 and thionates, the average composition of the slag being: SiO_2 , 39.6 per cent.; FeO , 53; CaO , 2; MgO , 1; Al_2O_3 , 3; S, 1; Cu, 0.4. Twenty per cent. of the copper was in the form of Cu_2O ; the remainder was matte. The process as proposed by Westby and Sorensen, the inventors, is: (1) The treatment of finely divided, moistened slag by sulphurous smoke whereby decomposition of the slag is effected; the bases being converted into sulphites, sulphates, and thionates; (2) the precipitation of the copper by the thionate in the solution upon the application of heat; (3) the recovery of the iron. This is of minor importance and need not be described. The process is also applicable to the treatment of lead and zinc slags, and the recovery of their contained metals.¹

INITIAL EXPERIMENTS

The first experiments were made in a wooden tower 50 ft. high and 2 ft. square, fitted with a large number of narrow shelves and connected with the outlet flue of a McDougall roaster, the gas being drawn through the apparatus by an aspirator. Slag wool was made by blowing steam through a stream of molten slag; the product, which was about one-third

wool and two-thirds granules, was distributed on the shelves of the tower by the aid of a stream of water. Roaster gas, together with a small amount of water, was turned in, and the absorption of SO_2 and the solution of the slag began immediately. Slag wool was charged from time to time and the experiments were varied from day to day by changing the amounts of gas, wool, and water used.

The absorption of SO_2 often reached 90 per cent. when the tower was properly charged with fresh slag wool. This would continue for several hours, or until the gelatinous silica which formed began to coat the undissolved slag; then the rate of absorption would begin to diminish, but would still be satisfactory for many hours. The solutions from this tower were of a dark red color, due to the presence of ferric sulphite, and contained about 1.5 per cent. iron and up to 0.03 per cent. copper, some of which was derived from flue dust drawn in with the gas. Sulphates, thionates, and a little free SO_2 were always present. Copper could be precipitated completely from this solution, as Cu_2S by heating. An excess of water far above the actual requirements, was used to prevent the slag from clogging on the slats. This diluted the solutions and lowered their temperature below the point at which they would be most active, as well as allowing the absorption of a little SO_2 . The experiments with this tower were considered successful from a chemical point of view, but the actual working of the apparatus was unsatisfactory because its operation could not be made continuous on account of the wool clogging on the slats.

MODIFICATIONS OF THE APPARATUS

The next experiments were made with a cylindrical tank 40 ft. long and 12 ft. in diameter, placed horizontally and capable of being revolved slowly. This tank was provided with shelves or baffles to increase the wetted surface and to produce a greater agitation of the slag and water. One end of the cylinder was connected with the outlet flue of a McDougall roaster and the other end with a tower 60 ft. high and 10 ft. square, filled with shelves similar to the first tower. Provision was made for admitting a regular supply of wool and water to both the tank and tower. Tests made with this plant gave excellent absorption. In one instance it was complete, but the tank was subject to numerous breakdowns that were both expensive and annoying, and its capacity was not proportional to the power required to operate it. Moreover the ratio of wetted surface to weight and cubical contents was too small for economical work.

Another plant, in which the agitation was obtained in a more inexpensive manner, was built. In consisted of a rectangular tank 40 ft. long, 15 ft. wide and 11 ft. deep, supplied with three revolving

cylinders 10 ft. in diameter and 14 ft. long, supported by wooden axles. The cylindrical surface was formed of cocoa matting fastened to cross pieces in such a way as to form a series of ridges. These cylinders were placed at right angles to the course of the gases and made three revolutions per minute. Slag crushed to 40 mesh was substituted for the slag wool of former experiments. Good results, so far as absorption was concerned, were obtained in this modified apparatus, but the design and construction was poor and frequent breakdowns occurred. Sufficient tests were made with the plant to show that crushed slag was as efficient as slag wool in absorbing sulphur dioxide. The work was abandoned after these experiments for reasons not known to me, my connection with the work having ceased some time before.

In the original process all the copper was expected to be dissolved and recovered later by some precipitation process. As 80 per cent. of the copper in the slag was in the form of matte, it was desirable to oxidize this to render it more soluble in the dilute acid solution. This was found to be readily accomplished by the combined action of the steam and air in the wool-blowing operation. In all the experiments with the first tower, the copper passed into solution. Although it was known that it could be precipitated by boiling, the reaction did not take place in the tower since the temperature of the gas was not sufficient to heat the volume of water used; but with the larger plant the temperature was higher and the copper was precipitated and mixed with the undecomposed slag and flue dust, and the process became one of concentration by the removal of a large percentage of the slag. The residue, which contained all the copper of the dissolved slag, together with that derived from the flue dust and undissolved matte, was rich enough to smelt direct in a reverberatory.

With this modified method, the need of oxidizing the matte was removed and finely ground slag could be substituted for slag wool. Some matte was always dissolved by the action of the iron salts and free acid but was precipitated, together with the copper contained in the slag as oxide, by the combined action of heat and thionates which were always present. The failure of the process at the Utah Consolidated smelter was due to the mechanical devices employed. If finely ground slag had been used in the first experimental tower instead of imperfectly made slag wool, which was difficult to handle in the plant, the results would, in my opinion, have been successful, both in the absorption of SO_2 and in the continuous operation of the plant.

The requirements of the process are simple. The contact of a slowly descending stream of finely divided, moistened slag with the hot ascending smoke is required. This could undoubtedly be ac-

*Mining engineer, Salt Lake City, Utah.

¹U. S. patent No. 875,222, Dec. 31, 1907.

completed in a tower fitted with a large number of shelves, placed at an angle, that would act as retarders to the slag and water. The shelves would increase the wetted surface greatly and in this way assist in the absorption. The separation of the silica is not a serious matter as the greater portion is retained in the solution until it has passed out of the tower.

This process differs in several particulars from the method proposed by James W. Neill for leaching copper ores with sulphurous acid, as shown in the accompanying comparison.

COMPARISON OF NEILL AND WESTBY-SORENSEN PROCESSES.

NEILL PROCESS.	WESTBY-SORENSEN PROCESS.
Treatment of copper ore with cold SO ₂ or roaster smoke in the presence of a large amount of water.	Treatment of slag by direct contact with hot roaster smoke and small amount of water.
Production of dilute solutions of sulphites and sulphates.	Production of saturated solutions, if required, of sulphates, sulphites and thionates.
Precipitation of the cuprous salts as cuprocupric sulphite by heat, followed by the precipitation of the cupric salts by iron or other suitable reagent.	Complete precipitation of copper as sulphide in one operation.
Excess of SO ₂ is essential to prevent separation of copper; requiring coke tower as an auxiliary if complete absorption is required.	Practically complete absorption of sulphur gases in one operation
Low temperature required to prevent separation of copper.	High temperature aids the reactions.
Oxidation avoided.	Oxidation desired.
Narrow application to oxidized copper ores	Wide application to slags and ores.

The Westby-Sorensen process has the advantage over the filtering devices installed at a few smelters, in that it retains all the dust and fume, removes the sulphur gases and recovers the metals in the slag. The cost of installation and operation would be about the same as for a "bag house" of equal capacity.

The Iron Industry and Resources of Canada

SPECIAL CORRESPONDENCE

The report for 1907 of the Mines Branch of the Canadian Department of Mines,¹ recently published, and prepared under the direction of Dr. Eugene Haanel, is largely devoted to the iron resources of the Dominion. The statistical information embodied in the report as to the mineral production of Canada during 1907, representing a total value of \$86,183,477, has already been given in a preliminary report published some months since. In addition to this feature the report presents the results of investigations made by the officials of the department with the object of promoting the mining and metallurgical industries in various parts of the country.

¹"Summary Report of the Mines Branch, Canadian Department of Mines, for the fiscal year 1907-8." Pp. 100; 8½x6¼ in., paper. Ottawa, Canada; King's Printer.

IRON ORE IN BRITISH COLUMBIA

One of the most important of these inquiries was undertaken by Einar Lindeman, who investigated the iron-ore deposits on Vancouver and Texada islands, British Columbia, and local conditions generally with a view of ascertaining the prospect for the establishment of the iron industry in that province. His report is to the effect that as regards ore supply, the deposits on Texada island and at Head bay, Klačanč river and Quinsam river on Vancouver island are of sufficient magnitude to furnish ore to a blast furnace for a number of years. These deposits of magnetite ore are all low in phosphorus, but as a rule high in sulphur, though not sufficiently so to render them unfit for smelting. The coal output of the collieries on Vancouver island for 1907 is estimated at 1,325,000 tons, with a coke production of about 17,000 tons. The coke contains from 15 to 16 per cent. of ash, but by more careful separation of the shale the ash could be reduced to about 12 per cent. The limestone deposits are of great extent and unusual purity, and would furnish an inexhaustible supply of excellent fluxing material. The deposits of raw material being adjacent to the coast are favorably situated for transportation, and shipments could be made all the year round direct to a furnace anywhere on the coast line. So far conditions for the establishment of an iron industry are favorable, the only drawback being that labor cost is higher in British Columbia than in other parts of Canada.

MAGNETIC SURVEYS FOR IRON ORE

Mr. Lindeman also made a magnetic survey of the iron-ore deposits on the Nipisiquit river, 15 miles from Bathurst, N. B., the results of which demonstrate the utility of magneto-metric surveys of magnetite, as it was found that the commercial value of the property did not consist in the deposits previously known, but in a large orebody on the other side of Austin brook, discovered by magnetic survey, and of which the value was proved later by boring. The location of the boreholes was fixed from indications of the magneto-metric survey. The property has been sold to a syndicate which will shortly begin operations.

Examinations by B. F. Haanel into reported iron ore occurrences near Penetanguishene, Ont., showed that there was no deposit of economic importance.

ELECTRIC PROCESSES FOR STEEL MAKING

The report contains a description of the Lash steel process, considered in regard to its application to an electric furnace for producing steel direct from iron ore, furnished by the Canadian Lash Steel Process Company, Niagara Falls. Successful experiments with the Lash process in the case of the open-hearth furnace on a commercial scale, indicated its possible

availability for electric smelting. In this process finely divided ore is intimately mixed with carbon, a certain quantity of carboniferous iron—such as cast-iron borings or granulated pig iron—sawdust and fluxes suitable for the ore under treatment. The working of the process can be explained by comparison with the open-hearth ore process—which consists in forming a bath of molten pig iron and then adding thereto a sufficient amount of ore (iron oxide) to reduce the carbon content of the metal to the desired amount. The oxygen of the ore combines with a certain amount of the carbon in the pig iron forming carbon-monoxide gas, and setting free the iron of the ore to mix with the bath of molten metal. In this way a mixture of approximately 75 per cent. pig iron and 25 per cent. ore can be worked up. But in the Lash process the proportions are very different, for a large proportion of ore can be used with a small percentage of carboniferous iron. A typical mixture has the following percentage composition: Iron ore, 54; cast-iron borings, or granulated pig iron, 27; sawdust, 4; limestone, 4; coal-tar, 3; coke, 8 per cent. These constituents are in a fine state of division and intimately mixed; when heated to a high temperature the reactions that occur are similar to those found in the open-hearth furnace. The cast-iron borings correspond to the molten bath of pig iron and react with the ore, but the latter being in large excess, it is necessary to supply a certain amount of free carbon in the form of coke for the complete reduction of the ore. The great economy of the process lies in the substitution of a large amount of ore for pig iron or scrap. In using the Lash mixture in the open-hearth furnace, it is necessary to have a bath of molten metal, as otherwise it would not be practicable to heat it to the reacting temperature without losing carbon in the mixture by combustion. If, however, the charge is put into an electric furnace, no difficulty of the kind is met with, since the gas in an electric furnace is neutral, in contradistinction to the oxidizing atmosphere of an open-hearth furnace. Experiments—using the Lash mixture—have been made in the electric furnace on a small scale with successful results.

The average cost of the materials in Canada for the production of 100 tons of steel ingots in the regular open-hearth furnace is placed at \$20.79 per ton; it is claimed that using the Lash mixture in the electric furnace this could be reduced to \$16.22 per ton, and that by its use the technical difficulties which have hitherto prevented the commercial production by electricity of steel directly from the ore will be overcome. Arrangements have been made to test various electrical furnaces with the object of ascertaining those forms to which the Lash process is applicable.

The Ferrites, Compounds of an Iron Acid

Oxide of Iron Forms a Number of Insoluble Salts When Heated in Contact with Zinc Oxide as in Roasting Ferruginous Blendes

B Y J . S . C . W E L L S *

Some time ago I was called upon to investigate a new process for the treatment of complex zinc ores, and the question of the possible formation of an insoluble compound of zinc and iron was an important one. The only literature on the subject available at the time was Prof. H. O. Hofman's article,¹ and a short reference by Ingalls,² both of which indicated the probable formation of such a compound, i. e., a zinc ferrite, not ferrate as it is there called. The ferrate would have the composition, $ZnFeO_4$, but as these compounds are unstable, there is almost no chance of its formation under the conditions existing in the roasting furnace. The composition of the normal ferrite would seem to be $ZnFe_2O_4$ (ZnO, Fe_2O_3).

Pelouze³ in a paper published in 1851 describes the formation of a calcium ferrite, and gives its composition as $4CaO, Fe_2O_3$, containing 41.66 per cent. Fe_2O_3 , and 58.34 per cent. CaO . His discovery of the compound was accidental. He was examining an earthy iron mineral containing considerable lime, and noticed that the yellowish white precipitate formed by adding potassium hydrate to a hydrochloric acid solution of the mineral changed after a few hours to a white one. On examination it was found to have the composition $4CaO, Fe_2O_3$. He made other experiments using ferric and calcium chlorides in varying proportions and always obtained a precipitate having the composition given. He describes it as "a light amorphous powder of a perfect whiteness," which when boiled with water containing carbonic acid or a soluble carbonate is decomposed and changed to a brick red color, the lime forming carbonate, and the ferric oxide being set free.

ANALOGOUS COMPOUNDS

Alumina and chromium oxides were also found to form similar compounds, but containing different proportions of lime. In the same volume⁴ Ebelman described an aluminate of magnesium, or a spinel, which he had made in 1847, and which was crystalline and identical in all its properties with the native mineral; also an aluminate of zinc (zinc spinel or gahnite) which he made by fusing in a porcelain furnace a mixture of alumina,

zinc oxide and boric acid, the alumina and zinc oxide being in nearly equivalent proportions. A mass of small octahedral crystals was obtained, transparent, and colorless, which scratched glass without difficulty. The specific gravity of the crystals was 4.58 and their composition, 55.9 per cent. Al_2O_3 and 44.1 per cent. ZnO , corresponding to the formula ZnO, Al_2O_3 .

He also prepared a chromite of iron, obtaining it in octahedral crystals and having all the characteristics of the native mineral, also chromites of magnesium, manganese and zinc, corresponding to the formulas MgO, Cr_2O_3 , MnO, Cr_2O_3 , ZnO, Cr_2O_3 .

The only ferrite he prepared was the ferrite of zinc which was obtained as small black crystals, octahedral in form

also be added to the list for Rinman's green is probably a cobaltite of zinc ($xZnO, Co_2O_3$) for I find that it can be made by igniting a mixture of Co_2O_3 and ZnO at a high temperature.

FORMATION OF FERRITES IN THE LABORATORY

The fact that ferrite of zinc does exist seeming thus to be well established, the next step was to determine under what other conditions it could be formed, and if it is likely to be produced in the roasting of ferruginous zinc ores. With this object in view I have made a series of tests, varying the conditions in different ways. Instead of using zinc oxide, as was done by Professor Hofman, a solution of zinc sulphate mixed in varying proportions with an iron salt was used in most cases. In this way the substances

TABLE I.

No.	Proportion of Iron to Zn. Fe: Zn.	Per Cent. Zn. Obtained as Ferrite.	Per Cent. Iron as Ferrite.	Hours Heating.	Remarks
1	56 : 65.4	50.	100.	2	Temperature bright red.
2	56 : 65.4	48.5	97.	2	Temperature bright red.
3	56 : 65.4	48.5	97.	2	Temperature bright red.
4	28 : 65.4	24.3	100.	2	Temperature bright red.
5	14 : 65.4	12.87	100.	2	Temperature bright red.
6	7 : 65.4	7.97	100.	2	Temperature bright red.
7	112 : 65.4	41.	41.	1	Dull red over Bunsen burner.
8	112 : 65.4	99.	99.	1	Bright red.
9	112 : 65.4	99.	99.	2	Bright red.
10	112 : 65.4	43.9	43.9	1	Red heat.
11	112 : 65.4	99.4	99.4	2	Red heat for 1 hour and 1 hour over blast lamp.
12	112 : 65.4	96.6	96.6	2	Bright red.
13	56 : 65.4	48.5	97.	2	Part of No. 3 heated over blast lamp.

and very brilliant. They scratched feldspar with difficulty, were slightly magnetic, had a specific gravity of 5.13, and were insoluble in cold dilute hydrochloric acid; the powder was dark brown. Their composition by analysis was, Fe_2O_3 66.5 per cent., ZnO 33.8 per cent., corresponding to the formula ZnO, Fe_2O_3 , containing 66.4 per cent. Fe_2O_3 and 33.6 per cent. ZnO .

He calls attention to the analogies between this compound and the mineral franklinite. The characteristics of the latter are all very similar to those of the zinc ferrite; both crystallize as regular octahedrons, are black with metallic luster, their powders are deep brown, and their densities are almost identical, 5.09 and 5.13.

The work of Pelouze and Ebelman has been confirmed by other investigations, and there seems no doubt that under certain conditions ferric oxide (Fe_2O_3) acts as an acid, also that the other sesquioxides, Al_2O_3 and Cr_2O_3 act in the same way.

Cobaltic oxide, Co_2O_3 , should probably

were in molecular contact and conditions were more favorable for a complete reaction than would be the case if a mechanical mixture of the dry oxides were employed.

As a solvent for the unacted-on zinc oxide I used a solution containing 200 grams ammonium chloride, 500 c.c. strong ammonia (sp. gr. 0.90) and 750 c.c. of water, the same as given by Low for the analysis of zinc ores. This was found to be a more reliable solvent for zinc oxide than ammonium carbonate, the latter sometimes failing to dissolve the oxide after it has been heated to a high temperature.

The results given in Table I were obtained by precipitating mixtures of iron and zinc sulphates with ammonium sulphide, filtering, and drying the precipitated sulphides, and then roasting in a muffle, first at a low heat and then in most cases for two hours at between 800 and 900 deg. C.

My idea in thus precipitating them was, as before stated, to obtain them in

*Columbia University, New York.

¹Trans. A. I. M. E., Vol. 35, p. 856.

²Metallurgy of Zinc and Cadmium, pp. 6 and 32.

³Ann. de Chim. et de Phys., Series 3, Vol. 33.

⁴Ann. de Chim. et de Phys., Series 3, Vol. 33, p. 34.

molecular contact, and to approach as nearly as possible the conditions under which we may suppose a ferriferous blende to be formed in nature.

TEMPERATURE AND CONTACT

The results show that when the temperature is sufficiently high, and the amount of zinc present is not less than one molecule of the oxide to one of the ferric oxide, that practically all of the iron is converted into ferrite and makes a corresponding quantity of zinc insoluble.

The ferrite obtained in Nos. 8, 9, 11, 12, was a light brown powder, very slightly magnetic, and soluble in hot hydrochloric acid (sp. gr. 1.10). A sample of the same digested with cold sulphuric acid (10 per cent.) for 18 hours yielded 20 per cent. of the zinc in the acid solution.

Test No. 13 was made to see if it were possible, at a high temperature and with an excess of zinc, to form a more basic salt than ZnO, Fe₂O₃; but this does not seem to be the case, at least under the conditions obtaining in the test. As will be seen later on it would seem that basic compounds are formed during the roasting of zinc ores on a large scale.

In Nos. 14 and 15, Table II, are given

precipitated with caustic soda, boiled for one hour, filtered and washed with boiling water, and the precipitate treated with the ammonium chloride solution. In this case there is a much larger amount of ferrite formed, no doubt due to the high temperature.

Nos. 18, 19, 20, 21, Table III, give the results obtained when using mixtures of ferrous zinc sulphates. In these tests the proportion of iron to zinc is only one-half that in Table II, and the average amount of iron converted into ferrite is greater than that obtained in tests Nos. 14 and 15; but none of the tests using mixtures of the sulphates give as concordant results as when using the sulphides.

Nos. 22 and 23 show results obtained by heating a mixture of ignited ferric acid and zinc oxides to a bright red heat in the muffle; No. 23 was also heated over the blast lamp for one hour. These oxides were mixed very carefully by grinding in an agate mortar until they appeared perfectly homogeneous.

The results are decidedly different from those given by Professor Hofman, perhaps due to the fine grinding and thorough mixing as well as to the high temperature. No. 24 was a sample of cal-

formation of a basic ferrite of the composition, 2 ZnO, Fe₂O₃, which would require 17.8 per cent. of the zinc to remain insoluble instead of 16.5 per cent., as given in the table. No. 2 corresponds to a ferrite of the composition 4 ZnO, Fe₂O₃, requiring 3.52 per cent. insoluble zinc instead of the 3.68 per cent. given. No. 3 probably has a similar composition requiring 12.42 per cent. Zn.

IMPORTANCE IN PRACTICE

Burleigh⁶ gives the results he obtained with an ore containing 32 per cent. Zn, 8 per cent. Pb, 14 per cent. Fe. This ore, when roasted to 0.18 per cent. S, only yielded 46 to 48 per cent. of zinc oxide soluble in caustic soda. This would indicate the formation of a basic ferrite having the composition 2ZnO, Fe₂O₃. The same ore quickly roasted to 3½ per cent. S., gave 78 per cent. of the zinc in a soluble form.

In all these results obtained from roasting on a large scale the ferrite formed seemed to be a basic one and not the normal one, ZnO, Fe₂O₃. From all the results noted it would seem that if a blende contains iron it is almost certain to form a ferrite during roasting, and the more intimate the mixture the greater will be the amount produced.

If the ore should consist of separate particles of blende and pyrite it is probable that the greatest amount of soluble zinc oxide would be obtained by roasting the ore in as coarse a condition as possible and so prevent to some extent the contact of the two oxides. When the iron and zinc sulphides are intimately mixed, it would seem to be almost a hopeless task to obtain all the zinc in a soluble form.

So far as it concerns the smelting of zinc ores, the production of ferrite is of little importance, except for the extra amount of heat necessary for its decomposition, an amount which is probably small. In leaching processes, however, it is of very great importance and no doubt accounts for many of the failures in that line.

FERROUS FERRITE

When making the tests on zinc ferrite it occurred to me that if it could be formed in the ways mentioned that it ought to be possible to make ferrous ferrite, Fe₃O₄, in the same manner; so some iron salt was precipitated with ammonium sulphide, and the air-dried precipitate used for the tests. A portion of it roasted at a red heat gave, as was to be expected, nothing but Fe₂O₃. Another portion heated carefully to 200 deg. C. gave a strongly magnetic residue, evidently consisting of Fe₃O₄, although some of the iron had oxidized to Fe₂O₃. Some of the original sulphide that had been left on the filter paper for several days was distinctly magnetic, probably due to the

TABLE II.

No.	Fe : Zn.	Per Cent. Zinc as Ferrite.	Per Cent. Iron as Ferrite.	Time of Heating.	Remarks.
14	112 : 65.4	69.3	69.3	2	Temperature bright red.
15	112 : 65.4	97.4	97.4	2	Temperature bright red.
16	112 : 65.4	5.2			Precipitation by NaOH in cold solution.
17	112 : 65.4	27.			Precipitated by NaOH in boiling solution.

TABLE III.

No.	Fe : Zn.	Per Cent. Zinc as Ferrite.	Per Cent. Iron as Ferrite.	Time of Heating.	Remarks.
18	56 : 65.4	38.6	77.2	2	Temperature bright red.
19	56 : 65.4	47.9	95.8	2	Temperature bright red.
20	56 : 65.4	40.2	80.4	1	Temperature bright red.
21		49.6	99.2	2	Temperature bright red.
22	112 : 65.4	94.			Temperature bright red.
23	112 : 65.4	90.2			Temperature bright red and 1 hour over blast.
24	1 : 2.1	54.7	100.		Temperature 1000 deg. or over.

the results obtained by evaporating mixtures of ferric and zinc sulphates and igniting the residue in a muffle. It was noticed during the evaporation that the two sulphates seemed to have separated to some extent, which may account for the difference in the results. In No. 16 a mixture of the sulphates was made alkaline with caustic soda and allowed to stand for six days at the room temperature, then filtered, and the precipitate without drying was treated with the ammonium chloride solvent until the washings gave no test for zinc. The results show either that the reaction in the cold is very slight, or it may be that in the hydrated condition the ferrite is soluble in the solvent used to dissolve the zinc oxide.

In No. 17 a similar mixture was pre-

pared from a complex zinc sulphide ore that had been roasted in an Edwards furnace at a very high temperature, above 1000 deg. C. The percentage of insoluble zinc is very high and corresponds to a ferrite of the composition 4 ZnO, Fe₂O₃. The ore was "dead roasted;" so none of the zinc was left as sulphide.

Ingalls⁷ joins the following table showing the results obtained by Probst in a sample of roasted zinc ore:

No. 1 would indicate the probable

No.	Per Cent. Fe.	Per Cent. Zinc.	Zinc Soluble in Strong Ammonia.
1	15.20	45.29	28.82
2	1.50	62.86	59.18
3	5.28	57.80	43.16

⁷Metallurgy of Zinc and Cadmium, p. 32.

⁶Electrochem. Ind., Sept., 1904.

formation of magnetic pyrite or pyrrhotite, as this residue still consisted largely of sulphide.

If ferrous and ferric sulphates are mixed in the proportion of one equivalent of each and the mixture precipitated with sodium or potassium hydrate a black precipitate forms having exactly the same appearance as iron sulphide. It is no doubt a ferrous ferrite FeO , Fe_2O_3 , or Fe_3O_4 .

The formation of a magnetic sulphide and of magnetic oxide of iron, the latter by the oxidation of ferrous sulphide (FeS) at a comparatively low temperature may be of interest to our friends, the geologists.

Finished Iron and Steel Production

The production of rolled iron and steel in the United States in 1907, according to the report of the American Iron and Steel Association, was as follows, in long tons, showing a total increase of 276,354 tons, or 1.4 per cent.:

	Iron.	Steel.	Total.
Rails.....	925	3,632,729	3,633,654
Structural shapes...	3,973	1,936,379	1,940,352
Plates.....	30,277	2,629,783	2,660,060
Sheets.....	43,761	1,545,011	1,588,772
Nail-plate.....	15,095	36,932	52,027
Wire-rods.....	1,550	2,016,033	2,017,583
Forging billets.....	691	227,091	227,782
Merchant bars.....	1,440,356	2,530,632	3,970,988
Skelp.....	444,536	1,358,091	1,802,627
Splice-bars.....	10,115	183,108	193,223
Hoops.....	200,168	200,168	200,168
Bands & cotton-ties.....	4,650	469,529	474,179
All other kinds.....	204,157	899,250	1,103,407
Total.....	2,200,086	17,664,736	19,864,822
Total, 1906.....	2,186,557	17,401,911	19,588,468

The production of forged iron and steel in various forms in 1907 was: Iron, 23,772; steel, 357,033; total, 380,805 tons, an increase of 28,164 tons over 1906.

Iron blooms, slabs, billets and bars made in charcoal bloomaries from pig iron and scrap in 1907 were 84,623 tons, a decrease of 10,376 tons from 1906. No blooms or billets are now made directly from ore, the last Catalan forge in the United States—Helton forge in North Carolina—having been abandoned in 1901.

The production of nails and spikes in the United States in 1907 was, in kegs of 100 lb. each:

	Iron.	Steel.	Total.
Cut nails and spikes..	309,968	799,170	1,109,138
Wire nails.....	.....	11,731,044	11,731,044
Total.....	309,968	12,530,214	12,840,182

There was a decrease of 80,101 kegs of cut nails, but an increase of 244,397 kegs of wire nails, as compared with the previous year. Cut nails last year were only 8.6 per cent. of the total, wire-nails being 91.4 per cent.

Reopening Old California Mines

SPECIAL CORRESPONDENCE

A recent feature in California mining has been the reopening of old mines and the revival of old districts, which were abandoned years ago as unprofitable.

Many instances could be given, those which follow being the more prominent.

The once famous old Mariposa mine on the Fremont or Mariposa grant in Mariposa county is about to be reopened, and again worked after many years idleness. At the old mill-site a 10-stamp mill is being erected, and the main shaft is to be unwatered and retimbered. Leases will then be let on the different levels where bodies of paying ore are known to exist. Pay rock in quantities is known to exist also in the Stockton Creek end of the old mine. It is now the property of the Mariposa Commercial and Mining Company, which is preparing facilities for convenient and thorough working of the mine by leasers.

Another old and once productive mine being put in shape for thorough working again is the Idaho-Maryland at Grass Valley. The main shaft is being cleaned out and reopened to the 1000-ft. level, where the large pump has been under water several years. This once recovered, the entire mine may be unwatered. The main vertical shaft has already been retimbered to the 800 level, and while the rest of the unwatering is going on three shifts will work on the old 700 level north. When that is cleaned out, a drive will be made for the new ledge met in the 500 level. The main work is being done on the Idaho mine proper.

The old Boston mines, in Mokelumne river district, Calaveras county, at one time worked on an extensive scale, are being reopened by the Boston Consolidated Mines Company. The Boston itself is a quartz property carrying ore which can be worked to a profit in these days. The placers were worked in the early fifties, but considerable ground is still left. Power may now be obtained from one of two companies, and the extensive holdings can be developed and worked more cheaply than was the case during former operations.

The old camp at Darwin, Inyo county, profitably worked 40 to 50 years ago, has been inactive for many years, and was virtually given up when silver and lead declined in commercial value. Now the opening of the smelter at Keeler, and the advent of the new railroad to Mohave have made the abandoned properties of value again. In addition to this there have been recent discoveries of free-milling gold ore, and the old camp is experiencing a revival. The old Defiance has lately been surveyed, and the owners are deciding on the best method of operating it. The Lucky Jim is being operated by Boston men, and is making shipments of ore to the Keeler smelter. The Christmas Gift is also shipping some ore. The Rio Tinto copper mine has been acquired by Ely, Nev., men, who will work it; and an extension of the Modoc has been located and is being worked. In addition to these old mines a number of new ones are being opened and developed.

When the silver mines in the vicinity of Daggett and Barstow in San Bernardino county were in full blast years ago, extensive mills were built and operations carried on upon a large scale. At that time all the prospectors in the vicinity were searching for silver ores and hundreds of prospect holes were dug. Finally, when silver mining did not pay, the mines and mills were closed and the population left. For some years after a few leasers did more or less work, but not of any extensive character. Now all the old claims which were not patented have been relocated, and numbers of new ones have been taken up in the district and are being worked for gold. Most of these new gold claims are within a few miles of Barstow, but one of the groups, the Fremont, is 18 miles north on what is supposed to be the same mineral belt. The last named group is being worked on an extensive scale, as are other groups of gold properties in the vicinity. At two of the groups within a few miles of Barstow new mills are about to be erected for working the gold ores.

Production of Arizona Mines in 1907

SPECIAL CORRESPONDENCE

In 1907 the Territorial Legislature, of Arizona, passed a law requiring all mining companies, whose production in one year had a gross value of \$3750, or more, to file with the county assessor and the Territorial auditor a statement in detail of the gross product. These reports are used as a basis for assessment, the law providing that the valuation for assessment purposes of all productive mines shall be 25 per cent. of their production for the year. The valuation of the metals is determined by the average value in New York for a year, and for 1907 the figures reported by the ENGINEERING AND MINING JOURNAL were accepted, as follows: Gold, \$20.67 per ounce; silver, 65.327c.; copper, 20.004c. per lb.; lead, 5.325c. per pound.

The returns for the year 1906 and 1907 have become available, but this is the first time that a condensed report of every productive mine in the Territory has been compiled and tabulated in the detail presented for 1907 in the table herewith.

The statement represents practically the total mineral production of Arizona, as the output of any mines which produced in a year, metal valued at less than \$3750, is negligible. The gold, silver and copper production is itemized in all instances, and where there was any production of base metal it has been figured in the total valuation, but not itemized. The base metal production in the Territory, however, is not important, as its value in 1907 was only about \$150,000 in all.

A comparison between 1906 and 1907 is as follows:

	1906.	1907.	Changes.
Producing companies.....	62	79	I. 17
Copper, lb.....	255,012,155	252,784,698	D. 2,227,457
Gold, oz.....	125,015	118,375	D. 6,640
Silver, oz.....	2,704,045	2,423,723	D. 280,322
Total value.....	\$53,801,781	\$54,788,674	I. \$ 986,893

The output in Yavapai county and in

Cochise county, in the famous Warren district, shows a slight decrease in 1907 from 1906, while in Gila and Graham counties, the other two great mining districts of the Territory, increases were made. The totals for the Territory show a slight decrease in production, but an in-

crease in valuation, owing to the higher average value of copper for the year. In 1908 it is expected that production will not be lessened materially.

Development work was active all through the year and 17 new companies came into the productive class.

STATEMENT OF THE GROSS PRODUCT OF MINES AND MINING CLAIMS OF ARIZONA IN 1907.
Compiled from the Verified Statements Filed with the Territorial Auditor.

	NAME OF COMPANY.	LOCATION.	PRODUCTION.			
			Copper, Lb.	Gold, Oz.	Silver, Oz.	Value.
COCHISE COUNTY.						
1	Copper Queen Consolidated	Bisbee	66,916,972	4,197	338,723	\$13,694,107
2	Calumet & Arizona	Bisbee	30,039,473	5,647	154,359	6,226,664
3	Superior & Pittsburg	Bisbee	9,602,553		55,465	1,957,128
4	Shattuck-Arizona Copper	Bisbee	5,091,542			1,018,512
5	Tombstone Consolidated	Tombstone		6,321	454,412	*507,009
6	Commonwealth Mining and Milling	Pearce		2,734	314,898	262,228
7	Arizona Consolidated	Johnson	245,040		3,123	51,058
8	Bonanza Belt Copper	Johnson	220,840		7,126	48,832
9	Copper Belle	Clifton	64,982		307	20,843
COCONINO COUNTY.						
10	Canyon Copper	Grandview	80,989		468	16,507
GILA COUNTY.						
11	Old Dominion Copper	Globe	23,294,496	2,407	69,067	4,754,703
12	United Globe Mines	Globe	3,399,084		12,382	688,041
13	Gibson Copper	Globe	3,340,777			668,289
14	Saddle Mountain Mining	Christmas	1,751,264	255	7,454	360,461
15	Arizona Commercial Copper	Globe	1,638,610		1,644	328,862
16	Warrior Copper	Globe	1,397,612		325	279,791
17	Live Oak Mining	Globe	588,347			117,693
18	Keystone Copper	Globe	208,801			41,769
19	D. D. Sullivan and others	Globe	67,021			13,407
20	Globe Arizona Copper	Globe	57,231		431	11,730
GRAHAM COUNTY.						
21	Arizona Copper, Ltd.	Clifton	30,794,092			6,160,050
22	Detroit Copper	Morenci	17,346,411	176	4,814	3,476,660
23	Shannon Copper	Clifton	10,874,619	950	34,038	*2,217,735
24	New England & Clifton Copper	Clifton	1,981,189	62	19,578	410,397
25	Standard Copper	Clifton	497,286			99,477
26	Gila Valley Copper	Safford	110,858	6	233	*22,732
27	Standard Consolidated Copper	Clifton	78,097	4,717		18,704
28	Ash Peak Mining	Duncan			18,214	11,899
MARICOPA COUNTY.						
29	Relief Gold Mining	Phoenix		509		10,522
MOHAVE COUNTY.						
30	Gold Road Mining and Exploration	Gold Road		21,597	10,397	453,210
31	Arizona-Mexican Mining and Smelting	Wallapai Dis		384	12,291	*63,149
32	Gold Star Mining and Milling	Wallapai Dis		1,962	6,634	44,858
33	Cerbat Mountain Mining	Kingman		655	1,209	14,329
34	Chloride Gold Mining	Kingman		409	4,701	*11,519
35	Schee Brothers	Wallapai Dis	16,930	17	3,564	6,059
PIMA COUNTY.						
36	Imperial Copper	Imperial	5,267,401		63,170	1,094,958
37	Oxide Copper	Silverbell	319,591		3,338	66,112
38	Helvetia Copper	Helvetia	191,666	7	1,394	39,388
39	Mineral Hill Consolidated	Pima District	169,538		1,478	*38,582
40	Paymaster Consolidated	Pima District	64,735		20,000	*25,914
41	Twin Buttes Mining and Smelting	Twin Buttes	94,056		342	19,038
42	El Tiro Copper	Silverbell	68,023			13,607
43	Omega Copper	Helvetia				†10,318
44	Pontotoc Copper	Tucson	51,536			10,309
45	Gould Copper	Tucson	45,036			9,009
46	Pontotoc Copper	Tucson	40,553			8,112
47	L. D. Chillson	Pima District	21,712			4,343
PINAL COUNTY.						
48	Kelvin-Calumet Copper	Ray	178,516			35,710
49	Silver Queen Mining	Superior	108,027	60	13,749	*31,924
50	Mohawk Gold Mines	Mammoth		1,151	177	23,907
51	Lake Superior & Arizona	Superior	92,120	189	1,041	23,011
52	Casa Grande Mining and Smelting	Casa Grande	86,344			17,274
53	Copperosity Copper	Casa Grande	72,698			14,543
54	Sultana-Arizona Copper	Riverside District	45,838		653	9,595
SANTA CRUZ COUNTY.						
55	Duquesne Mining and Reduction	Duquesne	421,487		9,622	*95,662
56	Frank & Josephine Powers	Harshaw	16,733	25	106,628	*74,210
57	Santa Cruz Mines and Smelter	Mowry	5,117	37	17,659	*43,802
58	C. B. Wilson	Patagonia	54,486		3,789	13,371
YAVAPAI COUNTY.						
59	United Verde Copper	Jerome	33,015,457	11,734	356,939	7,080,126
60	Ideal Mining and Development	McCabe	361,257	12,005	117,583	397,212
61	De Soto Mining	Harrington	1,016,170	933	22,216	237,079
62	Arizona Exploration	Humboldt	922,263	786	19,657	213,552
63	Congress Consolidated Mines	Congress		9,100	13,855	197,147
64	Poland Mining	Poland		4,217	16,609	*130,466
65	Tiger Gold	Harrington	19,010	4,313	9,938	*100,870
66	Octave Mining	Octave		2,393	7,899	*59,283
67	American Copper and Gold	Blanchard	3,933	1,253	35,491	*56,705
68	Geo. A. Treadwell Mining	Mayer	18,063	47	1,157	*34,428
69	Interior Mining and Trust	Wickenburg		1,616		33,403
70	Yaeger Canon Copper	Prescott	145,849		3,893	31,719
71	Lincoln Gold Mining and Milling	Crown King	2,568	836	7,342	*31,220
72	Commercial Mining	Prescott	125,598			25,125
73	Lone Pine Mining	Huron	91,098	166	2,602	*24,641
74	Spar Mining	Mayer	3,098	151	3,660	*9,525
75	Rincon Mines	Congress Junction		366	366	*8,562
76	Independence Mining	Jersey		217		4,474
YUMA COUNTY.						
77	King of Arizona	Kofa		12,022	4,775	251,622
78	Harqua Hala Mining	Harqua Hala		1,440	309	29,960
79	A. B. Rodgers, Manager	Kofa				†9,775
Totals			252,784,698	118,374	2,443,723	*\$54,788,674

* Includes a production of base metal figured in the value of the product, but not itemized.
† Value of product estimated.

Chemical Control of Coal Washers

Methods of Sampling Preliminary to Laboratory and Physical Tests.
Washery Determinations where a Calcium Chloride Solution Is Used

BY RANDOLPH BOLLING*

Coal washers operating with the Feldspar jig require careful chemical control in order to remove the impurities, slate and pyrites, and at the same time to prevent losses in coal passing over with the slate refuse. In the system of coal washing adopted by the Nova Scotia Steel and Coal Company, at the Sydney mines, the

and dust) goes over the fine jigs. Sizing of the coal is accomplished by a shaking screen with water jets playing on the plates; the separated sizes are carried by trough and flushing system to the different jigs arranged in two batteries of four each. The slate refuse from the coal-washing process is carried by an 8-in. pipe

physical test. These portions are weighed in tarred pans and desiccated on a steam plate. The sample for chemical analysis is placed in the drum of a ball mill which is rotated by a 2 h. p. electric motor until reduced. The physical test sample is crushed in a laboratory jaw crusher to pass a half-inch sieve.

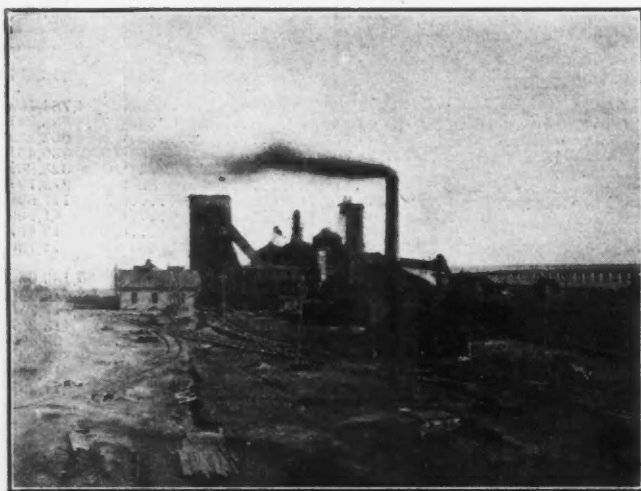


FIG. 1. GENERAL VIEW OF NOVA SCOTIA STEEL AND COAL COMPANY PLANT

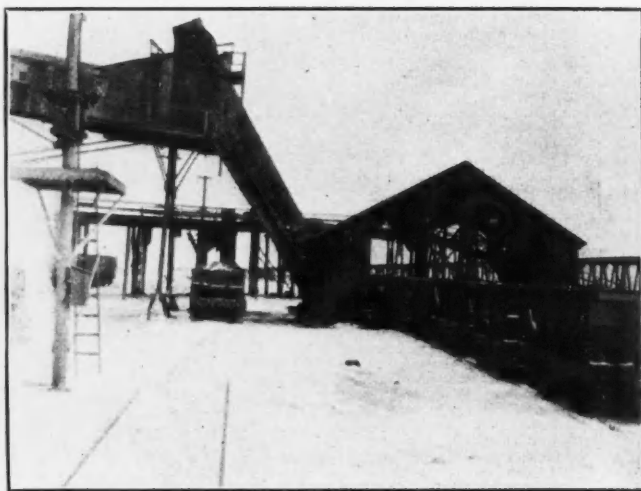


FIG. 2. ELEVATING RAW SLACK FROM 6-TON HOPPER TO ROBINS BELT CONVEYER



FIG. 3. SHOWING ROBINS CONVEYER DELIVERING SLACK TO WASHERY



FIG. 4. SOUTH SIDE OF WASHER BUILDING, SHOWING TANK FOR RECEIVING WASHED SLACK

methods of operating are as follows: Slack coal from collieries Nos. 1, 3, and 5, is assembled at the disintegrating department of the washery and is crushed to pass a one-half inch, and a one-quarter inch screen. The half-inch coal passes over what are known as the coarse jigs and the quarter inch size and "duff" (fine coal

flushed with sea water to the sea beach 900 ft. away.

SAMPLING OF RAW SLACK

Cars are dumped at the elevator boot and samples taken from every third bucket of the elevator to the crushing rolls. These samples are quartered down and one-quarter is reserved for chemical analysis; also one-quarter remains for the

SAMPLING WASHED SLACK AND SLATE

The discharge from the washed slack chute of each battery of jigs is caught at regular intervals of 10 min. in sacks and placed in large cans with perforated bottoms, the mixture is allowed to stand four hours to drain and is then mixed, quartered and desiccated, and made into two samples, one of which is ground in the ball mill and the other is reserved for

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physical test. The slate is caught in sacks at the same time as the slack. In this system, the fresh water is kept circulating in the jig department by a large centrifugal pump and samples of the water are taken every hour.

LABORATORY METHODS

As the plant works two shifts of ten

hours, the loss being reported as volatile and combustible matter. The crucible is now heated to a low red to avoid fusing the ash until the coke is burned off, the sample is weighed again, and the loss reported as fixed carbon. This weight minus the weight of the empty crucible gives the weight of ash. Sulphur is determined by the Eschka-

cantation twice on a 9 c.c. S. and S. No. 589 paper, and finished by wash bottle irrigation. The filtrate is caught in a 400 c.c. beaker and we then add 15 c.c. of bromine water, 5 c.c. of hydrochloric acid, 1.20 sp. gr., and the solution is boiled on an electric hot plate until colorless. A pipette is now used to add 10 c.c. of 10 per cent. barium chloride and the entire



FIG. 5. ELEVATOR FROM WASHER TO TOWER, AND PIPES CARRYING SEA WATER FOR SLATE FLUSHING

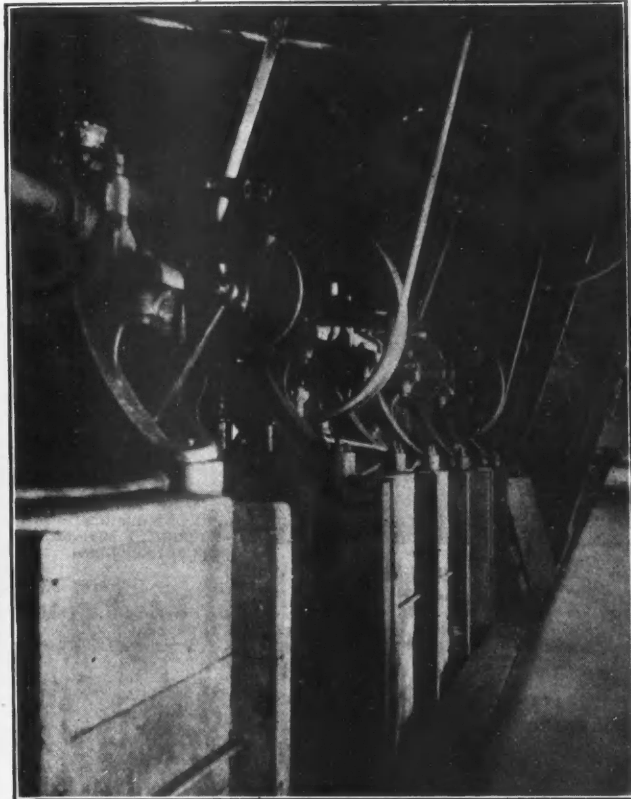


FIG. 6. SHOWING ECCENTRIC AND PLUNGER BOX OF LUHRIG FELDSPAR JIGS

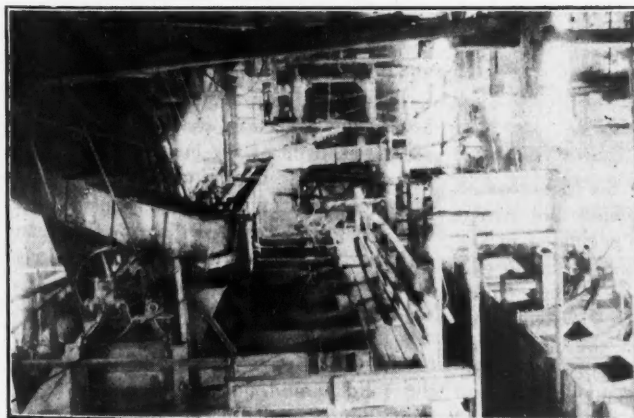


FIG. 7. GENERAL INSIDE VIEW OF WASHERY, SHOWING SIZING SCREEN IN BACKGROUND

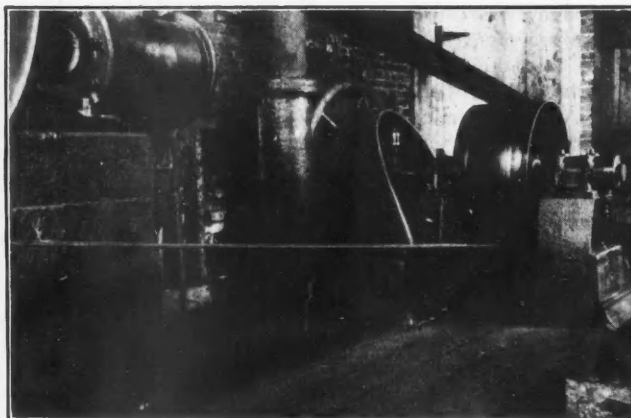


FIG. 8. CENTRIFUGAL BELT-DRIVEN CIRCULATING PUMP FOR ENTIRE PLANT

hours and handles about 900 tons in 24 hours all samples are grouped so that each lot represents the work of each shift.

For chemical analysis, 1 gram of raw coal is weighed into a 10c.c. platinum crucible with lid, and heated 7 min. over the full flame of a 1/2-tube bunsen burner; the crucible is supported by a platinum triangle. The sample is cooled in a des-

Fresenius method; 1 gram of coal is ground up with soda-magnesia powder, using 3 grams, and the mixture is then transferred to a 40 c.c. platinum crucible; the coal is here incinerated at a low heat to avoid blowing out at first and is finally finished at bright red heat. The powder is transferred to a 100 c.c. beaker, boiled with distilled water, and washed by de-

mixture is allowed an hour to settle. The barium sulphate is filtered on a Gooch crucible with asbestos felt; the precipitate is then washed, ignited, cooled and weighed, and the weight multiplied by the factor 0.1375. The result is reported separately as sulphur. The washed coal and slate receive the same chemical treatment as the raw coal.

PHYSICAL TESTS

By far the most important tests for control are those of a physical nature. Only one reagent is required, a standard solution of calcium chloride having a specific gravity of 1.35, or 39 deg. Baumé. This solution is made up in carboy lots by stirring commercial lump calcium chloride (crystals) until the hydrometer floats at 1.35 sp. gr.

METHOD OF OPERATION

About 200 grams are weighed out and used in testing raw coal or washed slack.

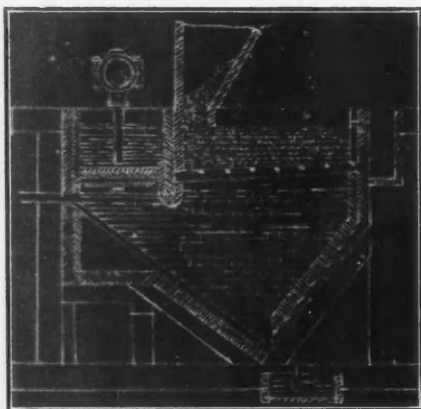


FIG. 9. DESIGN OF LUHRIG JIG FOR COARSE JIGGING

In testing slate, 100 grams is sufficient. Either of these quantities are placed in a one liter beaker and the calcium chloride solution is poured in with constant stirring until the beaker is completely full. The coal must be thoroughly wetted with the solution. The beaker should be allowed to stand 10 min. to allow deposition of all slate and fine pyritic dust.

The pure coal which floats at the top is scooped out with wire gauze dippers and these are plunged into a beaker of water to free the coal which promptly sinks to the bottom of the beaker holding water. After skimming off the coal and washing it by decantation with water, it is filtered on open pore filter paper, dried and weighed; the slate can be determined by difference, but I usually calculate it directly. The calcium chloride solution is used over and over again, its density is kept up by new lump calcium chloride and it can be siphoned off so as to obtain it clear.

REPORTING DETERMINATIONS

The following is a sample report of washery determinations:

CHEMICAL ANALYSIS

Raw Coal to Washer.

	Moisture.	Volatiles and Combustible Matter.	Fixed Carbon.	Ash.	Sulphur.
No. 1 slack..	4.86	29.11	56.73	14.87	2.14
No. 3 slack..	5.96	28.38	57.38	14.23	2.09
No. 5 slack..	6.51	23.11	54.27	22.61	2.45
Average..	5.77	26.87	56.13	17.23	2.23

Washed Slack Made

13.86 34.94 60.71 4.33 1.51

Slate Refuse from Jigs.

8.90 21.80 37.10 41.10 4.06

Calcium Chloride Tests

	Per Cent. Floating.	Per Cent. Sinking.
No. 1 slack.....	89.50	10.50
No. 3 slack.....	89.90	10.10
No. 5 slack.....	80.70	19.30

Raw Coal Mixture

Total ash.....	11.04	Total sulphur..	2.30
By jigs, total ash..	2.96	Total sulphur..	1.23
By calcium chloride total ash.....	2.36	Total sulphur..	1.10

Slate Refuse from Jigs

Ash..... 48.55 Sulphur..... 3.40

Slate Refuse by Calcium Chloride

Ash..... 55.56 Sulphur..... 3.47

(11.04-2.36) = 8.68 Free slate = combined ash, 2.36

(2.30-1.10) = 1.20 Pyritic sulphur=organic sulphur, 1.10

By Calcium Chloride

Slate, 11.04 ÷ (11.04 - 2.36) = 78.62 percent-
age of reduction.
Sulphur, 2.30 ÷ (2.30 - 1.10) = 53.00 percent-
age of reduction.

By Jigs

Slate, 11.04 ÷ (11.04 - 2.96) = 73.18 percent-
age of reduction.
Sulphur, 2.30 ÷ (2.30 - 1.23) = 46.52 percent-
age of reduction.

Slate Refuse Analysis

Percentage of coal float recovered from slate,
29 per cent.

Percentage of slate and pyrites sinking, 66 per
cent.

	Coal Floated.	Original Sample.	Clean Slate.
Volatiles and com- bustible matter.	34.50	21.80	15.10
Fixed carbon.....	62.00	37.10	14.80
Ash.....	3.50	41.10	70.10
Sulphur.....	1.77	4.06	6.37

Jig Water

	Grains per mp. Gal.
Pure from pipe line, total solid.....	3.17
After 1st hour, total solids.....	10.40
After 2d hour, total solids.....	15.90
After 3d hour, total solids.....	20.00
After 4th hour, total solids.....	29.90
After 5th hour, total solids.....	35.99
After 6th hour, total solids.....	42.04
After 7th hour, total solids.....	59.21
After 8th hour, total solids.....	65.14
After 9th hour, total solids.....	75.40
After 10th hour, total solids.....	89.90

The Feldspar beds on the jigs require close watching and the depth and stroke of the plunger should be regulated in accordance with the amount of impurities that have to be handled by them. However, with a close control system, and special determinations on the jigs, good work can be done. The general average specific gravity of the various materials is shown in the following table:

Specific gravity of slate.....	3.838
Specific gravity of coal.....	1.260
Specific gravity of bone.....	1.290
Specific gravity of pyrites.....	4.680

In Great Britain during 1907 there were 71 shaft accidents resulting in the loss of 97 lives, a figure considerably in excess of the average for the last 25 years, and a total which has only been exceeded three times and equaled twice during that period.

The Manufacture of Coke in Northern West Virginia

By JAMES W. KNOWLTON*

The chemical properties of coke consist of moisture, volatile matter, fixed carbon, ash, sulphur and phosphorus. Moisture is variable, but can be largely controlled by a good coke-boss. The higher the moisture, the more heat that will be needed at the furnace to drive it off. Moisture becomes excessive when the coke is watered too much, or when the coke is drawn too hot and a second watering is required after the coke is on the ground. This latter system not only makes the moisture high but spoils the color of the product. The coke should be watered dead the first time, unless water runs from the oven door.

The volatile matter in coke is the unconsumed gases of the coal which have not been entirely eliminated in the process of burning. When the volatile matter is high, there are probably black ends in the coke. In furnace work, this is a loss for the iron manufacturers, and can be avoided by the coke-boss seeing that the oven is burned off before watering down. The ash is the troublesome part, and here is where the mine-foreman should pay particular attention. As to the necessity of some ash, it is true that there could be no coal or coke without this constituent. Ash forms a nucleus around which the carbon is deposited, and is to the coke what the skeleton is to the human body. Ash gives us considerable trouble in the Upper Freeport seam, and eternal vigilance on the part of the mine foreman is needed to keep this constituent as low as possible. Besides a 2-in. binder of slate, the seam here worked contains much boney coal. This boney matter begins about 4 ft. from the bottom.

There is a natural parting between the boney and the clean coal, and if care is exercised, little of the boney coal will get into the ovens. In the headings when this dirty coal is taken down, considerable care has to be exercised to carry the clean 4-ft. section ahead; when both sections are mined, it is almost impossible to separate the bone from the coal in the dim light of the mine. In the rooms, only the 4-ft. section is mined. Shooting on the solid should not be permitted, as it blows into small pieces the binder of slate, thus making it impossible to separate the clean from the dirty coal. This system of shooting also mixes in more or less boney top coal, which is undesirable.

After making hundreds of analyses of our 4-ft. coking section, I am convinced that with the binder out, the coal will not run over 8 per cent. in ash, which would make about 12 per cent. ash in the coke. Therefore, when the coke runs over 12

*Chemical engineer, Elkins Coal and Coke Company, Morgantown, W. Va.

per cent. in ash it results from dirty mining.

SULPHUR AND PHOSPHORUS

The amount of sulphur in a coal is of great importance. The limit of this element has been placed at 1.2 per cent., but we try to have our coke run less than 1 per cent. Sulphur in coal generally occurs in the form of pyrite; the sulphur has five-eighths the heat value of carbon, but the iron combined with the sulphur has a disagreeable habit of making the ash run and thus form clinkers.

Phosphorus, the only other important element, is said to impart fluidity to coal and to act as a flux. There is nothing to guide the operator, as to the quantity of phosphorus, so far as physical appearance is concerned. A chemical examination is, therefore, the only course open to the coke producer, and it is advisable to make a thorough chemical examination of the measures, both vertically and longitudinally at regular points.

There is an increasing demand from furnace-men for low phosphorus coke, which usually means a coke containing about 0.015 per cent. of phosphorus. In view of the fact that the whole of this element in the coal goes into the coke, the maximum for the coal may be considered at about 0.010 per cent. to produce a coke with a maximum phosphorus content of 0.015 per cent. The physical characteristics of any good coke are as follows: Hardness of body, well developed cell structure, and lack of cross fractures. Hardness of body results from the carbonization of the charge from the top down as is done in the well known bee-hive type of oven. Most observers have noticed the bright deposited carbon at the top of coke; this condition is especially true where heavy charges have been burned off in hot ovens. The coke from by-product ovens lacks this luster, as here the gases are drawn off in the process of coking. For this reason, bee-hive oven coke is generally considered superior to by-product oven coke.

The coking property of a coal is due largely to some certain form of combination of the volatile matter, as well as to the total percentage present. In a typical coking coal, there seems to be an absence of cleats; it breaks more in the form of prisms.

The geological conditions in this field are the same as those of the Connellsville region. Our No. 1 mine lies directly in the Connellsville basin. Chemically, there is but little difference, and our main problem is merely a question of getting the proper percentage of ash. The coke made from Pocahontas coal is chemically more pure than ours, but does not have the same physical requirements in crushing strength; it also takes more pounds of coal per ton of coke, owing to the low volatile matter in the Pocahontas coal.

The scarcity of coking coals of merit compared with the amount of other classes of fuel makes these Northern West Virginia fields worthy of note.

METHODS OF OPERATION

At present we are using the most modern system of bee-hive oven practice, including machines to draw and load the coke. The coke-drawing machine has come up to expectations as a labor-saving device in that it admits of drawing and loading the coke at less than one-third the labor costs involved in hand-drawing; however, the abrasion of the coke in the conveyers and the coke dust in the various parts of the machine has made the cost of repairs considerable. Furthermore, the coke is broken up more in this method than by hand-drawing, making 50 per cent. more ashes and breeze; the great advantage is that less men are required. Rectangular ovens of various shapes and sizes are being experimented with, and the next few years will probably bring forth some interesting developments.

The Use of Cement for Tubbing in Deep Shafts

The great depth now attained in mine shafts in water-bearing soil renders tubbing difficult and costly, by reason of the increasing pressure which the tubbing has to resist; as a consequence, the iron circles or rings have to be made much thicker than heretofore. A new system of tubbing has recently come into use in France and has proved satisfactory. It consists in employing for any depth, rings not thicker than those ordinarily used ($\frac{3}{4}$ in.), as they are not required to support the pressure coming from the water behind them; this pressure is borne by an interior banking of armed cement in the form of rings of any required depth, which act as supports to the iron rings with which they are placed in contact. The principal object of the rings is to protect the armed cement from contact with the water. The thickness of these rings of cement may be calculated according to the general rules governing the pressure they are called on to support.

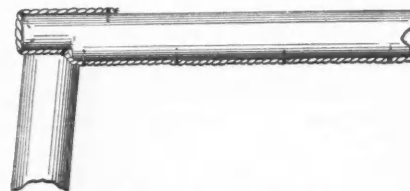
When installing tubbing by this method, first place the thin iron tubbing in the ordinary way, ascending or descending, singly or in layers as desired. At intervals place water faucets to give exit to the water coming from behind the tubbing, conduct this water to the interior of the mine by means of temporary pipes so as not to interfere with the "banking" of the armed cement. This lining wall is made in rings of varying depths according to circumstances. When the cement is hardened on the surface of the section of the tubbing extending between two watertight passages, the faucets mentioned, for which a corresponding passage through

the cement has been reserved, are closed. The tubbing is then in position, supported by the cement lining; the joints are well soldered, which prevents any great quantity of water from coming in contact with the cement; subsequently, through their taps, an injection of thin cement is forced under pressure behind the tubbing. This latter mixture completely seals up all the issues to the water, insuring in this way indefinite preservation of the work.

Such a system of tubbing can be easily kept in repair, for, if at any point a filtering of water is observed, the taps in the neighborhood can be opened in order to overcome as much as possible the pressure at this point; after the pressure is thus relieved, the annular section of cement is demolished and the process commenced over again. The advantage of this method consists in the fact that iron tubbing of $\frac{3}{4}$ in. thickness, instead of $4\frac{3}{4}$ in. for a shaft 19.8 ft. in diameter represents an economy of 20 tons of iron for each 3.3 ft. depth of the shaft; also it would be virtually impossible to obtain iron tubbing of more than $4\frac{3}{4}$ in. thickness in cases where it might be required.

Reinforced Timber Cap

A simple method of adding to the strength of a timber cap upon which heavy pressure is likely to be exerted has been put into operation at a couple of German mines. It consists in nailing a piece of discarded wire rope, of not too great



REINFORCED TIMBER CAP

diameter, to the underside of the cap, as shown in the illustration, allowing the ends to lap up over the ends. The weight of the rocks coming on these ends assists in holding the rope secure. Caps armored in this way have seldom been known to break transversely.

According to P. N. Dennison, "for thawing large quantities of dynamite, it is best to have a thaw house heated by hot-water pipes, the radiators being at the back or sides of the building and protected by a wooden partition. If it is arranged that the cartridges may be laid out on grooved shelves, each stick by itself, so much the better, for each cartridge will then obtain a uniform and regular heat. The house should be so constructed that a man could not get in on the explosive side at all; the door should open directly on the dynamite shelves. A door in the rear would enable a man to make the necessary repairs on the radiators."

Colliery Notes

The North Franklin colliery at Shamokin, Penn., is to be fitted with an electric underground hoist from the Buck Mountain seam, the first of the kind in the region.

The coal mines of the United States consume annually about 15,000,000 tons of coal for steam purposes. The railroads of the country consume 125,000,000 tons per year.

About 25 per cent., or over 120,000,000 tons, of the soft coal produced in the United States is machine mined. The average output per machine per year is estimated to be 10,000 tons.

An increase or decrease of atmospheric pressure has little or no effect on the volume of air passing through a mine in a given time, although it alters the weight of the air, which is a point of much importance.

The large deposits of peat in America which have hitherto been of small value may prove to be of great worth if the recent experiments of a French chemist in distilling alcohol from peat proves to be practical.

Loblolly and pitch pine are readily treated by the open-tank method of preservation. By immersing first in hot and then in cold, preservative fluids, green timber can be penetrated to a depth of 1 in.; by aqueous solutions of zinc chloride, common salt or creosote, dry timber is capable of being penetrated to a depth of from 4 to 5 inches.

The officers of the department of mines of Victoria, Australia, have invented a new diamond drill, called the "Pioneer Diamond Drill." It is portable, the total weight of the machine being only 400 lb. It can be worked either by hand or motor power, being capable of boring to a depth of 300 ft. by hand and 500 ft. by motive power. It bores a 2-in. hole, and produces a core $1\frac{1}{8}$ in. in diameter.

In mines where electricity is used, much attention should be given to the wiring. The entrance to all butt-entries should be provided with switches, so that in case falls of roof or other accidents cause a short circuit or break in the cable, the trouble can be located with the loss of but little time. Wires should never be carried beyond the air current, and if possible, should be kept away from all gas.

Where seams are low and no gas is given off, electric locomotives for gathering purposes have a decided advantage over mule gathering. Where electricity is used, it is not necessary to brush the roof or take up the floor to make hight, as is often necessary in mule haulage. An electric locomotive can be used with as low a clearance as 3 ft., while mule haulage

requires at least $5\frac{1}{2}$ ft. clearance above the rail.

The following figures give the principal causes of fatal accidents in the anthracite mines of Pennsylvania during the year 1906, with the total percentage ascribed to each:

	Percentage
Falls of roof and coal.....	47
Explosions of gas.....	9
Mine cars.....	15
Explosions of powder, etc.....	6
Premature blasts.....	12
Total.....	89

This leaves but 11 per cent. for all other causes.

Hoisting accidents may be greatly reduced if not absolutely eliminated by observing the following points: (1) Have a good hand or foot brake attached to the engine in addition to the steam brake. (2) Have a plain indicator in proper working order, showing the passage of the cages in the shaft. (3) Have a code of signals that are thoroughly understood by those who use them. (4) Use improved detaching hooks, and automatic steam cut-offs. Above all employ only thoroughly competent engineers.

Gaseous mines should be provided with duplicate ventilating machinery. Fans and engines for use in such mines should have double the capacity of similar machinery designed for use in non-gaseous mines. To prevent the destruction of fans in case of explosion they should be placed as far back from the shaft mouth as is practical. The fan drift should be equipped with explosion doors placed directly over the top of the shaft. The fan should be so constructed that its action is reversible. Large slow-running fans give better results in gaseous mines than do small fans run at high speed, as they allow of greater expansion in the ventilating system.

A good tank for the preservative treatment of timber may be made from an old boiler. The latter should be set vertically in the ground to a depth of 5 ft.; it should be fitted with a double bottom, 1 ft. apart. In this space between the bottoms, run a coil of 1-in. pipe 20 ft. long, and containing a steam pressure of 110 lb. per sq.in. This amount of heating surface will give the preservative fluid a maximum temperature of 240 deg. F. Connect this coil to a 10-in. steam main. The timbers to be treated should be placed vertically in the tank, and kept in place by weights attached to their lower ends. A small hand derrick is necessary for handling the timber.

For mine flushing in Austria, clay, loam, fine sand and sandstone of rather coarse character are used; this mixture forms a dense packing similar in character to conglomerate. About 70 per cent. of the material used for the purpose is from $\frac{3}{4}$ in. to 3 in. in diameter. The proportion of water used for flushing is $\frac{1}{2}$ to $\frac{1}{3}$ cu.m. to 1 cu.m. of packing, which is a much

lower percentage than is often deemed necessary for such work. The addition of a small percentage of coke dust has been found effective in hastening the drying of the material in the mine. Cast-iron flushing pipes with armored bends are used for this work. The average life of the bends is 25 weeks.

With coal that breaks easily and when the seam is steep and pitching, a practical method of lowering the coal from the working face to the gangway is by the use of a self-acting incline or jig. A balanced car or weight is pulled up the incline by a descending loaded car; the weight in its turn descends and draws the empty car to the working face. The balance car may be run on a narrow track between the car rails, or on a separate track in a parallel opening. The jig generally used on such an incline is a heavy cast-iron box, equal in weight to half the weight of the empty and loaded cars. If it is intended to run on a narrow track between the car rails it should be built low enough to allow the cars to pass over it.

An oil-burning locomotive is being tried in the Hazleton No. 1 and the William A. mines of the Lehigh Valley Coal Company. It is hoped that these engines will reduce the expense of mine haulage which has increased rapidly during the last few years. Such engines can only be used in mines free from gas. The oil burner at Hazleton No. 1 weighs 15,500 lb., and is 15 ft. long. It is equipped with four driving wheels 24 in. in diameter and runs on a track of 42 in. gage. The top of the smoke stack is even with the top of the boiler and the cylinder lies close to the sides. These engines have a capacity equal to 10 mules, and are capable of hauling from 12 to 15 loaded mine cars up a 3-per cent. grade.

According to a report of D. T. Randall, engineer in charge of the "Government smoke abatement investigation," the following conditions are necessary for a smokeless furnace: "The coal should be supplied to the furnace in small quantities at frequent intervals. The more nearly the feed approaches a continuous and uniform supply, the better the results. The air supply should be slightly in excess of the theoretical amount required and should be admitted at the front or rear of the furnace to burn the gases from the coal. The temperature in the furnace should be sufficiently high to ignite the gases given off from the fuel bed. There should be a fire-brick combustion chamber of sufficient dimensions and so designed as to cause the thorough mixture of the gases and the air, permitting complete combustion before the mixture reaches the boiler surfaces. The efficiency of the furnace depends upon the skill of the fireman, proper design of the furnace and boiler setting, character of the coal, capacity of the boiler and furnace and the load carried."

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American Institute of Mining Engineers

On account of the existing "labor" troubles in Alabama, the next meeting of the American Institute of Mining Engineers, which was to be held at Birmingham, Ala., will take place at Chattanooga, Tenn., beginning Oct. 1, 1908. Particulars will be sent to members by circular.

How to Sell a Mine

We might perhaps better entitle this article "How to Sell a Mine, and How to Finance Development Expense." We receive many inquiries of this character, which we are obliged to answer, as we feel, in an unsatisfactory manner, but we do our best to aid our correspondents. The man who tries to sell a mine, or to secure money to continue the development of one, is not necessarily aiming to fleece the unwary investor. On the contrary, we prefer to believe that most men are honest and are endeavoring to do a legitimate business. What then can be done to assist the honest owner of mining property who is seeking capital?

Here is a letter recently received, which is a type of many: "Please give me the names of two or three brokers in New York, who make a specialty of handling mining stocks and bonds; also names of promoters of mining property."

Another correspondent, whose letter was received in the same mail, desired to have the names of half a dozen good bond salesmen, who might be able to market the stock of a mining company. Both of these correspondents little knew what they were asking. There is an erroneous impression that there is in Eastern cities, particularly New York, a market for mines wherein they may be sold as real estate is sold among the board of real estate brokers. If there be any such market, we do not know of it.

Nevertheless, there is an active market for mines among the houses which make a business of the development of mineral property, such as the Guggenheim Exploration Company, the General Development Company, the Mines Selection Company, the Venture Syndicate, and several others. These companies are constantly on the watch for good mining property; indeed they do not wait passively for such to be brought to them, but they send out agents to find them. Any property pre-

sented for their attention receives careful consideration if it shows any sign of merit.

However, when we refer to these companies, the man who asks us how he can finance his mine, is apt to draw a long face, and remark, "It is useless to go to them; they will not consider my property unless I will give them the whole of it, and they will not be willing to pay me what it is worth." Now in this respect we do not suppose that the big mining houses are very different from anyone else in the business; i. e., everyone aims to drive the best possible bargain. Furthermore, there are few, if any, mining houses that will not insist upon the control of the property which they are going to undertake.

The market for mines is not confined to the big houses. There are many smaller mining syndicates which do not figure so prominently in the public eye. Most of these are represented by a consulting engineer, who advises as to the purchase and operation of mining properties. It is, therefore, a good plan for the man who wants to sell his mine to address some of the well-known engineers (whose names and addresses are to be found in the professional directory published weekly in the JOURNAL) and inquire if any of their clients would be interested in what is offered. If the property offered is meritorious, the vendor may be fairly sure of developing interest in this way. But, again, he must be prepared to surrender the control of his property and also he must not expect to receive for it any more than it is worth.

This then is the real mining market, and when we have told about it, as above, we have given the best advice and assistance that we can. Any other species of mining market is amateurish or dishonest. By amateurish we mean this: An owner of a mine comes East to raise money, and putting up at the Waldorf aims to make the acquaintance of some person of means who will be attracted by the vision of great profit. (We refer to the Waldorf merely as an illustration; practically, its opportunities for such business are said long since to have ceased to be good.) After the failure which results nine times out of ten (or 99 out of 100) such persons have no further interest in mining. They are the amateurs. The sharks are the persons who seek anything—a mine, an invention, a manufacturing scheme—that can be offered attractively to the gullible

public. Neither the amateur or the shark has anything to do with the real mining market, although both buy mines, or alleged mines. However, the vendor or prospector who looks for assistance among such persons must seek it in his own way.

The Indiana Coal Miners' Strike

The strike of the miners in the bituminous coalfield of Indiana has been promptly ended by the president of the union. He reversed the action of the local authorities and insisted that the miners must abide by the clause of their agreement which provides that they shall not go out on strike while matters in dispute are subject to arbitration. In the Indiana case the trouble started over a comparatively trivial matter; but instead of submitting it to the board of arbitration, the district president ordered a strike. This the operators resented and threatened to withdraw from the agreement. Apparently there was the beginning of a long dispute, but it has been ended by the creditable action of President Lewis. The miners returned to work this week, and the original difference will be decided by the arbitrators.

The important point is the acknowledgment that the agreement is and must be binding on both parties—a point which the miners have not always been as ready to admit as they might. It is also an indication of the policy which is to be followed by the new officers of the union.

The strike in Indiana came just as the coal trade was beginning to recover from the depression of the earlier part of the year. If prolonged it would have seriously affected the Indiana mines in the competition which is sure to mark the revival of trade. Its early close will be a benefit to all parties.

The Decline in Coal Production

The appointment of a receiver for one of the larger coal-mining companies of Pennsylvania calls attention to the weakness of the coal trade which has resulted from the industrial depression. The returns of railroad traffic, which are made in sufficient numbers from various coal-producing sections to indicate the general course of the business, show that during the seven months of 1908 which have passed the production and shipments of steam coal have been only from 60 to 70 per cent. of those recorded in the corresponding

period of 1907. So serious a loss in business is sufficient to strain the resources of many coal companies; and to this is to be added a reduction in prices resulting from the smaller demand. The loss in earnings is offset only in a small degree by lower labor costs. Fewer men are employed, of course, but there has been no material decrease in the wage scales; while the general expenses, fixed charges and depreciation are unchanged.

In the special case to which reference was made in our news columns recently, the company for which a receiver was appointed is itself entirely solvent, its present difficulties being due to an expansion of capital through the medium of a holding company, a device so popular in recent finances. The basing of capitalization on the business of a boom year has been followed by the trouble and complications that have arisen in so many other instances.

There has been no previous instance in which the reduction in the coal trade—like that in iron production—has been so sharp as in the present year. Coal and iron are closely connected, and it was inevitable that one trade should be largely affected by the other. While some recovery is now reported here and there, it is slow and gradual; so that the current year will probably be as conspicuous by its small coal output as 1906 and 1907 were by their great increases in production.

Prospects for Gold Output in California

The shortage of water thus early in the season, not only in the Mother Lode region of California, but at other important points, will have a very bad effect on the gold output of this year. Accounts are now coming in of various properties closing down on account of lack of water for power for hoists, mills, etc., and for washing gravel, as well as for furnishing electric current. The recent exceptional hot weather in the mountain and foothill region of the State has evaporated the water so rapidly, that the companies are having a hard time to keep their ditches flowing. The reservoirs are also losing these contents rapidly. The snow is now gone except in a few places in the high Sierras, and this is bad for people in the valley towns as well as those in the foothills, as electricity generated by water power now supplies light and power. The

water in the rivers, on account of the light rains last winter and the continued heat, is at the lowest stage in years. Usually at this season there is plenty of snow in the Sierras, which feeds the streams, but this year snow is very light indeed. The Bay Counties Power Company has sent out a warning to people to be economical in their use of power. The South Yuba Water Company, which supplies Grass Valley, Nevada City, etc., has also officially warned the people and mining companies to be careful in the use of water.

The Mother Lode mines are frequently closed down in the fall for lack of water, but this does not generally happen with the mines in Grass Valley, the most productive quartz district in the State. In fact throughout the northern portion of California the streams are low and water is scarce. No rains of consequence are to be expected before November, so there are several months during which certain mining sections will not have water for power or washing purposes.

THE RECORD for treating low-grade gold ore comes very near being made by the Wanderer (Selukwe) mine, in Rhodesia, which reports for the year ended April 30, 1908, net earnings of 54.3c. per ton on a total extraction of \$2.097 gold per ton. The mine is, practically, a large open quarry, from which there were taken last year 190,377 tons of ore at an average cost for mining of only 46.56c. per ton. Treatment costs were equally low, being only 37.48c. for milling and 41.28c. per ton for cyaniding. An addition of 20.6c. for general expenses brought the total costs up to \$1.554 per ton. These figures, both for yield and costs, are lower than those of the Alaska-Treadwell, which have been generally accepted as the best made on a large low-grade mine.

THE PAYMENT OF its initial dividend by the Utah Copper Company marks the fructification of the first of the great enterprises for the mining of the disseminated copper-sulphide ore of the United States. The Boston Consolidated is gradually overcoming its difficulties and the Nevada Consolidated and Cumberland-Ely have begun to produce. Toward the end of 1909 these also ought to appear in the list of dividend payers. Next in order will be the Miami, at Globe, Ariz., which is developing a large orebody. The productiveness of these important mines marks a new era in the mining history of the United States.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice and
Debatable Points Suggested by Articles in the Journal

CORRESPONDENCE AND DISCUSSION

Sampling by Machines

When I sent to the JOURNAL the article on "Sampling by Machines," I was certain the discussion would be received with the attention which the subject merits, and the three valuable contributions from Messrs. Austin, Argall and Mathewson justify my expectation. Mr. Mathewson hints that I may not have seen *modern* mills, and considering the number of sampling mills that have been built recently it is probably true that I have not seen the very latest; but since the Great Cobar mill, which I had under consideration is a very recent construction I think I cannot be accused of gravely considering antiquated plans. The Anaconda works themselves offer a justification for bringing the subject of sampling mills to the fore. There have been many descriptions of the great plant with pages of illustrations, but Mr. Mathewson's *modern* mills were so little thought of that the best description confines itself to saying that the mill is five stories high, covers 42x60 ft. on the ground and has a capacity of 600 tons. A lot of admiration has been written about the superstructure, but not a word upon the foundation of the whole business. Fortunately I am able to offer an example of modern design, although the plant is not yet running. The Balaklala mill for home ores has a shaking feeder to the first sampler and also to each pair of rolls that crush for subsequent samplings. The Balaklala custom mill has a shaking feeder to each of the first two samplers and each of the last two pairs of rolls, a difference worthy of notice. This is a great improvement over the haphazard-delivery in the Cobar mill down to the last rolls, and it is undoubtedly debatable whether controlled feed to each and every machine is necessary, or whether a crusher and its sampler can be considered a coupled unit so closely bound together that controlled feed applied to one is sufficient for the other also. Experience alone can determine that question. The results of the Mathewson tests are of real interest in this aspect of the case.

RECENT OPINIONS ON SAMPLING

The JOURNAL's three correspondents give us valuable indications of the conclusions to which competent and experienced engineers have come in regard to sampling, in other words, upon the state of opinion which governs the best sampling of the present day. Mr. Mathewson

thinks that the tendency to what I may call automatic discrimination in mills has been overcome by reducing the length of spouts and using shaking feed for the crushers and rolls. Mr. Argall lays great stress upon a cut large enough to be fairly representative of the original mass of ore, undoubtedly an absolute essential. He, for instance, would increase the 15-per cent. cut on 3-in. ore of the Cobar mill to 25 per cent., and this very large increase is good evidence that there is not yet agreement among engineers on this subject. He also would increase very greatly the frequency to 25 to 50 of the cuts per minute and finally mix thoroughly after each crushing and feed "in a uniform and continuous stream" to the sampler.

I agree with Mr. Argall fully in emphasizing the importance of proportioning properly the size of the cuts. Such a succession as 15, 20, 15 and 15 per cent. again used at the Great Cobar seems to me illogical. If 15 per cent. is enough for 3-in. ore 20 per cent. is very much too large for 1-in., or $\frac{3}{4}$ -in. material.

The frequency suggested by Mr. Argall, 25 to 50 cuts per min., seems to me excessive. Both of Vezin's sizers, Nos. 1 and 2, run at 20 r.p.m. No. 1 has a peripheral speed of about 195 ft., and No. 2 about 250 ft. From blueprints before me (unfortunately on a rather small scale) I judge that the sampling diameter is about 31 in. for No. 1 and 38 in. for No. 2, and speeds in the sampling circle are about 162 ft. and 199 ft. per minute. Compare this with the directions given by the makers of the Simplex sampler, "The best results are obtained with this machine when it is run at a peripheral speed of 175 ft. per minute," which figures out to 11, 15 and 24 r.p.m., for the three sizes. This gives a speed in the sampling circle (the sampler at the scoop edges having diameters of 47, 31 and 17 in.) of 136 ft., 122 ft., and 107 ft., or about 2.25, 2 and 1.8 ft. per sec. Paul Johnson gives his samplers speeds of 6 to 7 revolutions for No. 1, (3- to 5-in. ore), nine revolutions for No. 2 ($\frac{3}{4}$ - to $1\frac{1}{4}$ -in. ore) and 12 revolutions for No. 3 ($\frac{1}{4}$ - to $\frac{1}{2}$ -in. ore); I do not know the diameter of the machines. Mr. Johnson has one spout (with provision for a second if wanted) on the first sampler and three spouts on each of the others which probably indicates his view of the requirements for good sampling of the different sizes. The Vezin has two spouts and the Simplex two.

SPEED AND SIZE OF MATERIAL

Here we have a diversity of view which is worth discussion, and in spite of the justified reverence with which Henry Vezin's ability is remembered I think it is an error to give to the coarsest sampler the greatest speed of passage across the ore stream. It should have the least. I think 200 ft. a minute in the sampling circle is too great for ore which is large enough to be knocked aside with violence by such velocity. Two and a half feet a second seems to me better than 3.3 ft. for that size and at least sufficient for other sizes. Johnson's opinion on this subject is very clear from his provision for frequency. Assuming that his machines Nos. 1 and 2 are of the same size as Vezin's Nos. 2 and 1 (they are of the same general type) he gets a frequency of 12 to 14 cuts (with two spouts) on No. 1 at a speed of 60 to 70 ft. in the sampling circle, which compares with Vezin's 40 cuts and 199 ft.; and a frequency of 21 cuts on the No. 2 machine at a speed of 72 ft., which compares with Vezin's 40 cuts and 162 ft. Here are important differences in practice, which intelligent engineers will weigh carefully, making their final choice after thorough experiment. Like all other steps in this important business this question of speed of movement across the stream of ore deserves attention.

Professor Austin says, "There is bound to be some irregularity in the stream of ore, but the automatic sampler acts indiscriminately." I said that also, but endeavored to show that the movement of ore to the sampler was not indiscriminate, but subject to selective retardation and acceleration. Vezin overcame this selection, as the JOURNAL in its editorial, and Austin and Argall in their letters point out, by reassembling the sample and treating it *de novo* as a new original mass. With modern work this must be done continuously which Vezin provided for by introducing a charging cylinder between each crusher and its sampler, and which I propose to accomplish by retarded and controlled flow over aprons and spouts. This has been done in a few mills, but they are too new to afford many examples of their work.

MATHEWSON'S TABLE

Mr. Mathewson's letter is especially valuable in giving us the first published results which, from his letter I am justified in assuming, were obtained in a mill of this kind. I have recalculated his table so as to show the variation between the

work of the three mills for each lot, omitting the gold which is in such small quantities as to be affected greatly by errors of assay. In fact it is the work done on the copper ore that is most significant. I identify the lots by his second number only and calculate the percentage difference always on *A* as compared with *B* and *C* and on *B* as compared with *C*. The amount of silver in the first eight samples is not great enough to be useful for comparison, but is given in the last five. Differences of less than one per cent. are disregarded. As the copper varies from 3.42 per cent. to 15.11 per cent., I assume that the ores used were of a kind that ought to yield fair comparative results in a modern mill.

Here are three samples of copper ores taken in *A* and *B* mills, which varied 11.7, 13.4 and 13.6 per cent., and three others which varied 4.1, 4.5 and 5.8 per cent. Of course, the quantity variation

not be ascribed to assaying in works that are conducted with the skill of the Washoe management, and when we find three other samples varying by more than 4 per cent., we are justified in wondering how Brunton obtained his agreement to 0.25 per cent.¹ Brunton also says, "No errors in sampling have ever occurred, even upon the richest ores." With such a record 20 years ago, improvement seems to have gone backward!

I reiterate that I believe these errors are real, that those who think that sampling has been, or is now really accurate, have failed to scan their results with care, and that the errors are due to removable causes, which the enlightened study of engineers can remove. We owe to Mr. Mathewson and Paul Johnson a very great debt for the full records they have published. Seven of Johnson's ores carried from 34.7 to 58.0 per cent. of insoluble and lime, and four had 63.7 to 93

crusher in both trials there will be retardation there the first time due to the crushing of the large lumps. These will be absent the second time and a series of machines that are so strung together as to take their initiative from the first machine will act under different conditions in the two trials. If my view of the important effects of retardation are correct the second sampling ought to be better than the first and Mr. Mathewson's tests show that *B* and *C* mills tallied better than *A* and *B*.

RETARDATION AND REPRESENTATION

Professor Austin says, "That a portion of the ore sent to the final storage bin has been separated from its neighbor, need not interfere with the fact that it has been represented in the sample." That depends upon whether the retardation is synchronous with the revolution or half revolution of the sampler. If not and it drops between the cuts it is not represented. Professor Austin also expresses confidence in the corrective effects of taking 13,200 cuts in 10 hours, but both the Johnson and Mathewson records show that averaging by great repetition cannot be trusted. The time has come when this fact should be recognized and an effort made to put sampling on a more satisfactory basis.

The JOURNAL's correspondents write with strong disapproval of the Cobar practice of taking every fifth car, but after all, the objections to the practice are that the "cut" is too large, two tons, and that the delivery is haphazard! Stevens' "Copper Hand Book," says that the ore is chalcopyrite and some pyrrhotite averaging about 4 per cent. copper and 0.5 oz. silver. The fifth-car practice is not so bad with such an ore as it would be with other kinds. It is 20 per cent., which is as much as can be afforded unless our mills are to be increased greatly in size. I call the attention of my critics to the fact that the real criticism upon the fifth car practice is not its proportion so much as the size of the cut. If the car were filled in 250-lb. doses taken from different bin spouts the conditions of the first automatic sampler would be repeated closely.

I have dealt with what may be called the theory of sampling rather than with details of construction, but these need to be considered also for they have a direct effect upon the application of whatever principles govern the work. For instance in the Cobar mill the second and third cuts are recrushed in 24x14-in. rolls with 144 r.p.m. As the second cut is 12 tons and the third cut only 3600 lb., it is evident that such heavy rolls at such a speed must dispose of their load almost instantly and the third and fourth samplers must run empty much of the time. Such variations cannot fail to be injurious to accuracy. Twelve inches is width enough for these machines, and their speed should

MATHEWSON'S TABLE RECALCULATED. PER CENT. COPPER. SILVER NOT COMPUTED.

Lot Number.	COPPER.			SILVER.			Difference Per Cent.		
	A	B	Difference Per Cent.	A	C	Difference Per Cent.	B	C	Difference Per Cent.
547	5.10	4.91	3.7-	5.10	4.80	5.9-	4.91	4.80	2.1-
548	3.42	3.82	11.7+	3.42	3.70	8.0+	3.82	3.70	3.0-
549	3.75	3.69	1.6-	3.75	3.71	1.0-	3.69	3.70	0.0
550	6.13	6.03	1.6-	6.13	5.86	4.4-	6.03	5.86	2.8-
554	4.42	4.22	4.5-	4.42	4.07	8.0-	4.22	4.07	3.5-
552	4.01	4.57	13.6+	4.02	4.48	11.4+	4.57	4.48	1.9-
5730	4.08	4.03	1.2-	4.08	4.01	1.7-	4.03	4.01	0.0
118	3.50	3.38	3.4-						

PER CENT. COPPER AND SILVER.

Lot Number.	COPPER.		Difference Per Cent.	SILVER.		Difference Per Cent.
	A	B		A	B	
38	7.03	6.95	0.0	6.9	7.8	1.3+
37	7.44	7.01	5.8-	6.6	6.9	0.0
40	9.11	9.32	2.3+	10.7	10.10	0.0
45	15.11	14.48	4.1-	53.20	53.20	0.0
46	6.91	5.98	13.4-	18.60	17.70	4.8-

was small usually. It was 4 lb. copper per ton in three samples, and 8, 9, 11 and 13 lb. in four samples. I think sampling should give better results than shown in the latter series, and the errors are especially important because they were made in sampling the original ore which is the only sample made usually. In the re-sampling the greatest difference was 3.5 lb., mills *B* and *C* running very much closer than *A* and *B*. Their highest variation was 3.5 per cent., which teaches us that extreme variations can be prevented. Mr. Mathewson would confer a favor on the profession if he would tell us what the differences of construction and operation of these three mills are.

It is remarkable that the silver should be altogether the most uniform, three out of five presenting no variation.

QUESTIONABLE PROGRESS

It cannot be denied that a difference of more than 10 per cent. in three samples out of 13 justifies my contention that the design and conduct of sampling mills need the careful attention of the profession. Such a discrepancy repeated so often can-

not be ascribed to assaying in works that are conducted with the skill of the Washoe management, and when we find three other samples varying by more than 4 per cent., we are justified in wondering how Brunton obtained his agreement to 0.25 per cent.¹ Brunton also says, "No errors in sampling have ever occurred, even upon the richest ores." With such a record 20 years ago, improvement seems to have gone backward!

I reiterate that I believe these errors are real, that those who think that sampling has been, or is now really accurate, have failed to scan their results with care, and that the errors are due to removable causes, which the enlightened study of engineers can remove. We owe to Mr. Mathewson and Paul Johnson a very great debt for the full records they have published. Seven of Johnson's ores carried from 34.7 to 58.0 per cent. of insoluble and lime, and four had 63.7 to 93

¹Trans. A. I. M. E. XIII (1884-5) p. 645.

be reduced to what will just pass the ore in a continuous stream. It is not my intention to continue this subject, but to point out that the selection and operation of each machine in the mill has an important effect upon accuracy.

JOHN A. CHURCH.

New York, Aug. 19, 1908.

NOTE—I notice that two lines were dropped from my article in the JOURNAL. On page 114 the sentence beginning on the fifteenth line below the table should read in full: "It contained 25.7 oz. in A and 26.4 oz. in B, a difference of 2.65 per cent. Four of the gold ores tallied. The mean of the remaining seven was 0.33 oz. and 0.31 oz., a difference of 6 per cent."

J. A. C.

Rocker for Washing Auriferous Gravel

A rocker for washing auriferous gravel should not be a difficult thing to construct, yet those that are made and are in use today are mostly constructed by practical men, and the dimensions that have been found by experience to be good as well as those that are bad are lost as far as others are concerned.

I once constructed a rocker and it was a failure. I have no doubt that if I had plenty of light lumber and several months' time in which to experiment and reconstruct I could eventually produce a satisfactory rocker, but this method has obvious disadvantages.

If among your readers there are some who have the dimensions of rockers that experience has shown to be efficient, I suggest that they make their knowledge public. The information will be sought, and if much variation is encountered between several designs an interesting investigation may follow.

A. R. TOWNSEND.

New York, Aug. 20, 1908.

Loading a Blast Hole

In view of the danger and annoyance caused by missed holes, it seems strange that more attention is not paid to the different methods of loading. Each machine-man seems to have a method of his own, differing more or less from any other in use. In the following I shall describe some of the different methods and try to point out some of the good and bad points of each.

The first thing to consider is the condition of the cap and fuse. The fuse should be cut square across, not slanting, and about an inch of the exposed end of the coil should be cut off for it is likely to have absorbed moisture. The cap should be crimped by means of a crimper which has a stop to prevent its being closed too far. For wet or damp holes, the fuse should be soaped from end to end with miner's tar soap and especially thoroughly where it enters the cap.

There is a great difference of opinion among miners as to the best way of put-

ting the cap in the powder. Probably the most common way is to make a hole in the end of the cartridge, and to push the cap in to about the middle of the powder, as shown in Fig. 1. This method has the advantage that the wrapping of the powder may be turned up around the fuse and tied, as shown in Fig. 2; if the fuse and wrapper are well soaped at this place there will be little danger of water getting to the cap. The disadvantage of this method is that neither the cartridge nor the one above it can be properly tamped without danger of breaking or kinking the fuse. If a slanting hole is made in the side of the cartridge and the cap inserted as shown in Fig. 3, the cartridge can be tamped without danger of injuring the fuse; but in this case the cap is, of course, not so well protected as it would be if inserted from the end.

In order to protect the fuse from being cut or pulled out by flying rocks, as much of it as possible should be in the hole; for

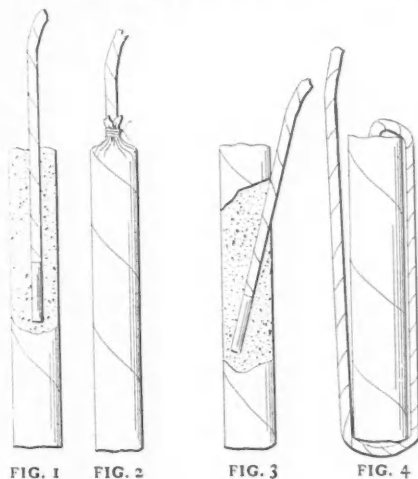


FIG. 1 FIG. 2 FIG. 3 FIG. 4
METHODS OF INSERTING THE FUSE

this reason the cartridge containing the cap should be placed near the bottom. In order to get a greater length of fuse in the hob, some miners wrap it around the end of the cartridge as shown in Fig. 4. This is not good practice for it seriously kinks the fuse and is liable to cause a miss-fire.

In tamping the powder should be pressed, not pounded into the hole, and tamping sticks of wood only should be used. Sometimes, pieces of iron pipe with wooden plugs in the ends are used for tamping rods. These are dangerous, because the plugs are likely to get broken and some miners are too careless to replace them.

Although the explosive gelatine now commonly used does not burn readily, it is probably best to throw a few handfuls of dirt on top of the powder to prevent sparks from getting at it, and also to exclude the air. If the dirt has been gathered from the bottom of the drift, it should not be tamped hard or it may injure the fuse.

H. L. TURNER.

Goldfield, Colo., July 24, 1908.

Over-balance Weight for Single Drum Hoist

Noticing the comments of John J. Smith in the JOURNAL of Aug. 1, and of Mr. Roelofs in the issue of August 15, I am impelled to add one or two remarks concerning the points discussed. The arrangement of two ropes on one drum, proposed by Mr. Smith, is useful only where the drum is large enough to carry the full length of rope in one winding across the face of the drum. The Findley rope, hoisting 1500 ft. makes $2\frac{1}{2}$ laps on the drum. As to the patent, my statement, "patent is now pending," was correct. While it would be absurd to attempt to patent broadly a simple counterbalance, the particular and special form of over-balance weight which I recommend, taking very little room in the manway and using guides in the best possible location in the manway, is, I think, patentable. I had in mind counterweights and overbalance weights in use in this and several other States, but to my knowledge, none of these had the special advantages for use in vertical shaft work that my arrangement shows. By referring to the JOURNAL of March 2, 1905, Mr. Smith will find drawings and description of an over-balance differential drum hoist, such as he suggests. This hoist was designed by me and is now in use at the Camp Bird mine, Ouray, Colo. I respectfully take issue with Mr. Roelofs on the point of the relative merits of long and short guide-shoes. While the long guide-shoe is a good mechanical construction which I use wherever the guides are straight, I yet insist that short shoes are much less likely to "hang up" than long ones, and I have found it necessary in more than one case to use short shoes on account of the crooked guides, on which long shoes would inevitably "hang up."

S. A. WORCESTER.

Victor, Colo., Aug. 19, 1908.

Phosphatic slags, according to R. McMurtrie (*Amer. Fertilizer*, June, 1908), are used in Europe to a considerable extent as fertilizers. By the Thomas Gilchrist process the slag from the basic converters can be made by proper regulation to contain about 17 per cent. phosphorus pentoxide. The phosphate in the slag is supposed to be a tetracalcic phosphate, insoluble in water, but slowly decomposed by air. To be used for fertilizer the slag must be ground so that 90 per cent. will pass a 100-mesh screen.

The Chilean mill, or *trapiche*, at Corocoro, Bolivia, has been developed to such a point that iron and sometimes chrome steel is used as a tire on the stone wheels.

Questions and Answers

Inquiries for information are answered in this department as promptly as possible, but more or less delay is often unavoidable. Many inquiries involve a good deal of investigation and these can be answered only when the general interest in the subject is conceived to justify the expenditure of the time required. Correspondents should refrain from asking for advice that ought to be obtained by professional consultation with an engineer. We will not answer questions pertaining to the value of specific mining enterprises. Inquiries should be framed concisely.

MARKET FOR GRAPHITE

Where can I dispose of flake graphite? How much of this material is imported yearly, and what is the average value per ton?

P. H. S.

Possible buyers of flake graphite are the Dixon Crucible Company, Jersey City, N. J., and Robt. Crooks & Co., 135 Front street, New York City. During 1907 there were imported into the United States 20,481 tons of unmanufactured graphite (plumbago), valued at \$1,777,389, or 4.34c. per pound.

LOCATING ON RAILROAD GROUND

I want to prospect and work a vein carrying copper and silver on ground which was granted to the Union Pacific Railroad 35 years ago. Must I negotiate with the railroad, or can I locate as on public land?

S. W. F.

We have received from A. H. Ricketts, the author of "Short Talks on Mining Law," the following answer to your question: "Assuming that your correspondent means by the use of the word 'granted' that the land in question lies within the limits of the grant by Congress in aid of the construction of the railroad, I will say that if such land has been patented to the Union Pacific Railroad, or its grantee (irrespective of its true character—that is, as agricultural land), it is not open to the prospector or locator as mineral land, and no rights can be acquired therein by either without the consent of the patentee. If the land is still unpatented it is subject to location under the mining laws, notwithstanding it is within the limits of the grant. Generally speaking, no land which has passed into private ownership is subject to mineral location."

MAGNESITE IN THE UNITED STATES

Is any of the magnesite produced in Greece imported into the United States? I should like to know the firms which handle these imports, the chemical composition of the magnesite and the price per ton f.o.b. cars New York. Is there no high-grade magnesite mined in the United States which could be used for magnesite cement instead of the imported magnesite?

T. B.

There are no workable deposits of magnesite in the United States except in Cali-

fornia, and this State consumes all of its own production. The material cannot be profitably shipped East on account of the high freight rates and because of competition from abroad. The market in the Eastern States is supplied largely from Austria and Greece. The crude magnesite may be considered as worth about \$3 per ton; the calcined is worth less than formerly, at the close of 1907 about \$12 per ton.

Dealers in both crude and ground magnesite are: H. J. Baker & Co., 100 William street; Hammill & Gillespie, 240 Front street; and Fuerst Bros. & Co., 2-4 Stone street, all of New York. The Harbison-Walker Refractories Company, of Pittsburg, uses a great quantity of the imported magnesite. The principal supplies of magnesite in the world are obtained from Austria-Hungary, Germany and Greece, the United States and India producing relatively small amounts. In 1906 Greece produced 64,424 metric tons of magnesite, a large part of which was exported to the United States.

We cannot give the average analysis of the Grecian product, but the following is an analysis obtained from an average of several shipments: Magnesia, 44.90 per cent.; carbonic acid, 44.56; silica, 0.52; iron oxide, 0.80; lime, 1.50.

POTASSIUM AND SODIUM CYANIDE

Is better extraction obtained on silver ores by using potassium cyanide than by using sodium cyanide?

A. T. C.

While C. W. Merrill, at the Homestake mill, Lead, S. D., has found that he obtained somewhat better extraction by using potassium instead of sodium cyanide, at Pachuca, Guanajuato and El Oro, Mexico, sodium cyanide is used at all the cyanide mills, and the metallurgists at those camps say that by experiment they have been unable to find any difference in extraction; consequently, as it is more economical, they use sodium cyanide.

CHEMICALS USED FOR GAS ANALYSIS

What chemicals are used in the Orsat apparatus for the determination of carbon dioxide and oxygen in a gas, and how are the solutions prepared?

B. K. C.

The chemicals used in an Orsat apparatus consist of a caustic potash solution (1.20 sp.gr.) for the absorption of CO₂ and an alkaline solution of pyrogallic acid for the absorption of oxygen. The potash solution should be made up as required and should contain 23 grams (1½ sticks) of pure KOH dissolved in 140 c.c. of distilled water.

The pyrogallic solution is made by dissolving 20 grams of pyrogallic acid in 150 c.c. of caustic potash solution such as is used for the determination of CO₂. This solution when cold is poured upon the pyrogallic acid.

In using the Orsat apparatus care should be taken not to allow the chemicals to become exhausted, so the solutions should be made up frequently and pure chemicals should be used.

MARKET FOR CRUDE PLATINUM

Who are the Eastern buyers and sellers of platinum? What form, or shape, of platinum is standard for price basis? What publication gives details of the platinum market?

F. A. V.

The names of the principal refiners of platinum will be found in the advertising pages of the JOURNAL. Crude platinum is commonly bought on the quotation for scrap platinum. The platinum market is reported weekly in THE ENGINEERING AND MINING JOURNAL.

FLORIDA PHOSPHATES

What grades of phosphate are mined in Florida, and in what districts are the different grades found? On what basis is the material sold with regard to content of bone phosphate of lime? What was the production and value of the output in 1906 and 1907?

W. A. C.

Florida phosphates are classed under three heads: Hard rock, land pebble, and river pebble. The hard-rock deposits are included within an area approximately 100 miles long and from 8 to 10 miles wide, beginning at Fort White and extending in a southerly direction to Bay City. Florida hard-rock phosphate is sold under a guarantee of a minimum of 77 per cent. bone phosphate of lime, and a maximum of 3 per cent. oxides of iron and alumina and 3 per cent. moisture. In 1906, Florida produced 561,370 long tons of hard rock, valued at \$3,312,083, as compared with 589,217 tons, valued at \$3,714,767, in 1907.

Land-pebble phosphate is found in Polk, De Soto and Hillsborough counties. It is sold under a guarantee of 68 per cent. bone phosphate of lime, and a maximum of 4 per cent. oxides of iron and alumina and 3 per cent. moisture. This variety represents the medium-grade phosphate which is well adapted chemically to the manufacture of fertilizers. Approximately 60 per cent. of this product is consumed in the United States, the remainder being exported. In 1906 Florida produced 603,382 long tons of land pebble, valued at \$1,810,146, as compared with 721,028 tons, valued at \$2,523,598, in 1907.

River-pebble phosphate occurs in De Soto county, on Peace river, and is commonly known as Peace river pebble. This variety is sold under a guarantee of 60 per cent. bone phosphate of lime, 3 per cent. oxides of iron and alumina, and 3 per cent. moisture. There has been a steady decrease in the production of this class of phosphate since 1905. In 1906 the production was 41,742 long tons, valued at \$116,878, as compared with 36,729 tons, valued at \$139,570, in 1907.

Patents Relating To Mining and Metallurgy

A Selected and Classified List of New Inventions Described during the Past Month in the Publications of the Patent Offices

UNITED STATES AND BRITISH PATENTS

A copy of the specifications of any of these patents issued by the United States Patent Office will be mailed by THE ENGINEERING AND MINING JOURNAL upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COAL AND COKE

COAL POCKET OR BIN. George W. Freeland, Moline, Ill., assignor to Williams, White & Co., a Corporation of Illinois. (U. S. No. 894,133; July 21, 1908.)

METHOD FOR COKING HYDROUS BITUMINOUS COMBUSTIBLES. Paul Hoering, Berlin, Germany, assignor to the firm of Torfkoks Gesellschaft mit beschränkter Haftung, Berlin, Germany. (U. S. No. 894,647; July 28, 1908.)

WEIGHING MECHANISM FOR COAL-POCKETS. George W. Freeland, Moline, Ill., assignor to Williams, White and Company, a Corporation of Illinois. (U. S. No. 894,132; July 21, 1908.)

COPPER

METHOD OF RECOVERING COPPER FROM ORES. William B. Potter, St. Louis, Mo., assignor to Esmeralda Copper Precipitating Company, Chicago, Ill., a Corporation of Arizona. (U. S. No. 894,902; August 4, 1908.)

GOLD AND SILVER

CYANIDE BRIQUETS—Improvements in the Manufacture of Hard Cyanide Briquets. James Y. Johnson, London, E. C., Eng. (Communicated from the Chemische Fabrik Schlempe, Frankfurt-on-Main, Germany). (Brit. No. 18,096 of 1907.)

GOLD-FILTERING MACHINE. Thorstein Thorson, Oakland, Cal. (U. S. No. 895,598; August 11, 1908.)

GOLD SEPARATOR AND AMALGAMATOR. Charles H. Hall and John Eldridge, Astoria, Oreg. (U. S. No. 894,632; July 28, 1908.)

IRON AND STEEL

IMPROVEMENTS IN the Process of, and Apparatus for, Directly Reducing Iron Ore and Subsequently Treating Same for the Manufacture of Wrought Iron and Steel. Montague Moore, Melbourne, and Thomas J. Heskett, Brunswick, Victoria, Australia. (Brit. No. 26,131 of 1907.)

PURIFYING CAST-IRON in the Manufacture of Basic Open-hearth Steel. William Muirhead, Shettleston, Scotland. (U. S. No. 894,779; August 4, 1908.)

TIN

IMPROVEMENTS in the Process of Treating Tin Ores or Tin Slag. Communicated from Hermann Mühlhnghaus, Wiesbaden, Germany. (Brit. No. 15,039 of 1907.)

ZINC

PROCESS OF REFINING ZINC. Richard Ziesing, Cleveland, Ohio, assignor of one-half to the Grasselli Chemical Company, Cleveland, Ohio, a Corporation of Ohio. (U. S. No. 893,415; July 14, 1908.)

APPARATUS FOR REFINING ZINC. Richard Ziesing, Cleveland, Ohio, assignor of one-half to the Grasselli Chemical Company, Cleveland, Ohio, a Corporation of Ohio. (U. S. No. 893,560; July 14, 1908.)

ORE DRESSING

APPARATUS for the Concentration of Ores, Minerals, etc. John C. Greenway, Coleraine, Minn. (U. S. No. 895,363; August 4, 1908.)

CRUSHER for Ore and Other Materials. Henry Eggers, Denver, Colo., assignor to the Samson Manufacturing Company, Denver, Colo., a Corporation of Colorado. (U. S. No. 893,713; July 21, 1908.)

CYANIDE-TANK. Ralph S. Browne, Alameda, Cal. (U. S. No. 894,245; July 28, 1908.)

GRAPHITE-SEPARATOR. William M. Fuller, Crown Point, N. Y., assignor to Walter C. Witherbee, Port Henry, N. Y., and one-third to Milo M. Winters, Crown Point, N. Y. (U. S. No. 894,879; August 4, 1908.)

GYRATORY CRUSHER. Charles L. Hathaway, Denver, Colo., assignor to the C. L. Hathaway Rock Crusher Company, Denver, Colo., a Corporation of Colorado. (U. S. Nos. 895,633, 895,634; August 11, 1908.)

HAMMER-CRUSHER. Joseph L. Hiller, Mattapoisett, Mass., and George W. Borton, Haddonfield, N. J. (U. S. No. 896,019; August 11, 1908.)

MAGNETIC SEPARATOR. Charles G. Buchanan, Brooklyn, N. Y. (U. S. No. 893,606; July 21, 1908.)

MECHANISM for Agitating and Handling Ore or Other Substances. Joseph Smith, Salt Lake City, Utah, assignor of one-half to Edward P. Lynch, Salt Lake City, Utah; Isaac Smith, administrator of said Joseph Smith, deceased. (U. S. No. 894,174; July 21, 1908.)

MECHANISM FOR SPLITTING, Breaking, or Pulverizing Rocks or Ores. Alvin Gerstenhauer, Los Angeles, Cal., assignor of one-third to John A. Spencer and one-third to George R. Tucker, Los Angeles, Cal. (U. S. No. 895,850; August 11, 1908.)

METHOD of and Apparatus for Purifying Middlings and Other Materials. Herbert S. Jewell, Buffalo, N. Y. (U. S. No. 894,009; July 21, 1908.)

IMPROVED METHOD of, and Apparatus for, Concentration of Metallic Ores. Dudley H. Norris, New York City. (Brit. No. 14,806 of 1907.)

IMPROVEMENTS IN, or Relating to, the Concentration of Ores Containing Wolfram. Marcus Ruthenberg, London, E. C. (Brit. No. 26,810 of 1907.)

ORE-CONCENTRATING TABLE. Emil Delster, Fort Wayne, Ind., assignor to the Delster Concentrator Company, a Corporation of Indiana. (U. S. No. 895,734; August 11, 1908.)

ORE-CONCENTRATOR. Emil Delster, Fort Wayne, Ind., assignor to the Delster Concentrator Company, a Corporation of Indiana. (U. S. Nos. 895,167; 895,168; 895,169; 895,170; August 4, 1908.)

ORE-CONCENTRATOR. Gilbert H. Davidson, Morenci, Ariz. (U. S. No. 893,985; July 21, 1908.)

ORE-JIGGER. Ephie Cohen, Joplin, Mo. (U. S. No. 894,604; July 28, 1908.)

ORE SEPARATING and Concentrating Machine. William P. Clifford, Moravia, Iowa. (U. S. No. 895,725; August 11, 1908.)

PROCESS of Extracting Precious Metals from Ores. Isidor Kitsee, Philadelphia, Penn. (U. S. No. 894,215; July 28, 1908.)

PROCESS OF SAVING the Values of Concentrates and Slimes. Stephen M. Smith, Boise, Idaho. (U. S. No. 895,509; August 11, 1908.)

PROCESS OF Treating Ore. James H. Reid, Cornwall, Ontario, Canada, assignor of one-half to Stephen Lemuel Tingley, Ottawa, Canada. (U. S. No. 895,196; August 4, 1908.)

PULP-CLASSIFIER. Alfred G. Kirby, Goldfield, Nev. (U. S. No. 895,092; August 4, 1908.)

TREATMENT OF ORES by Means of the Precipitation Process. Antoine H. Imbert, Grand-Montrouge, France, assignor to Imbert Process Company, New York, N. Y., a Corporation of New York. (U. S. No. 894,383; July 28, 1908.)

METALLURGY—GENERAL

APPARATUS for Charging Furnaces. Herman A. Prosser, Salt Lake City, Utah, and James B. Ladd, Ardmore, Penn. (U. S. No. 894,392; July 28, 1908.)

METHOD of Preparing Pyrites Fines for Desulphurization. Pierre de Peyster Ricketts and Tom C. King, New York, N. Y., assignors to National Metallurgical Company, Jersey City, N. J., a Corporation of New Jersey. (U. S. No. 894,799; July 28, 1908.)

METHOD of Treating Ores. Ralph Bag-galey, Pittsburg, Penn. (U. S. No. 895,939; August 11, 1908.)

PROCESS OF MAKING Pyrites Briquets. Pierre de Peyster Ricketts and Tom C. King, New York, N. Y., assignors to National Metallurgical Company, Jersey City, N. J., a Corporation of New Jersey. (U. S. No. 894,464; July 28, 1908.)

PROCESS OF Reducing Metallic Oxides. Edgar F. Price and Frederick M. Becket, Niagara Falls, N. Y., assignors, by mesne assignments, to Central Trust Company, of New York, trustee, a Corporation of New York. (U. S. No. 891,565; June 23, 1908.)

SMELTING PROCESS. James H. Boyd, Denver, Colo. (U. S. No. 894,111; July 21, 1908.)

MINING MACHINERY AND APPARATUS

CHAIN-LINK for Mining-Machines. David Buel, Columbus, Ohio. (U. S. No. 894,184; July 28, 1908.)

IMPROVED DEVICE for Igniting Miners' Safety Lamps and the Like. Carl Kock, Linden-on-the-Ruhr, Germany. (Brit. No. 8646 of 1908.)

IMPROVEMENTS IN Fluid-actuated Rock Drilling and Other Percussive Machines. Wilhelm Mauss, Brakpan, Transvaal. (Brit. Nos. 15,120; 15,121 of 1907.)

IMPROVEMENTS IN, or Connected with, Mine Hoists, or Hoisting Apparatus and the Like. Ernest Douglas, Highfield, Wigan, Eng. (Brit. No. 17,396 of 1907.)

IMPROVEMENTS IN, or Relating to Safety Electric Apparatus for Lighting Miners' Safety Lamps. John C. Bowie and John H. Phelps, Cardiff, Wales. (Brit. No. 16,145 of 1907.)

IMPROVEMENTS IN Detaching Devices for Mine Cars and the Like. Andrew Barna, Puritan, Penn. (Brit. No. 3895 of 1908.)

NEW OR IMPROVED Safety Appliance for Mine Cages, Lifts and the Like. Walter Buckeridge, Calne, Wiltshire, Eng. (Brit. No. 4825 of 1908.)

PNEUMATIC DRILL. Martin Hardsocg, Ottumwa, Iowa. (U. S. No. 890,978; June 16, 1908.)

COAL-DUMPING CAGE. Harvey O. Pearce, Linton, Ind. (U. S. No. 894,528; July 24, 1908.)

COAL-MINING MACHINE. John P. Gil-mour, Terre Haute, Ind. (U. S. No. 895,449; August 11, 1908.)

HOISTING-BUCKET. George Foeltz, Hoboken, N. J. (U. S. No. 894,128; July 21, 1908.)

MEANS FOR Ventilating and Expelling Water from Mines. Patrick H. Durack, El Paso, Tex. (U. S. No. 893,988; July 21, 1908.)

MINE-CAR WHEEL. James S. Woodcock, New Lexington, Ohio. (U. S. No. 895,826; August 11, 1908.)

MINER'S DRILL. Jacob Bleser, Springfield, Ill. (U. S. No. 894,808; August 4, 1908.)

ROCK-DRILL. Henry J. C. Keymer, Ger-leston, Great Yarmouth, England. (U. S. No. 894,213; July 28, 1908.)

ROCK-DRILL. Robert H. Anderson, Germiston, Transvaal. (U. S. No. 893,596; July 21, 1908.)

ROCK-DRILLING DEVICE. Eugene E. Messmore, Epworth, Iowa. (U. S. No. 895,877; August 11, 1908.)

METALLURGICAL MACHINERY AND APPARATUS

IMPROVEMENTS RELATING to Electric Furnaces. The Gröndal Kjellin Company, Ltd., and Johannes Hården, London, E. C. (Brit. No. 8445 of 1907.)

METALLURGICAL FURNACE. William N. Best, Los Angeles, Cal., assignor to John H. Best and Ezra Best, Quincy, Ill. (U. S. No. 894,107; July 21, 1908.)

Opening the California Desert

SPECIAL CORRESPONDENCE

The completion of 43 miles, or over one-third, of the new railroad from Moline, Kern county, California, to Keeler, Inyo county, has had already the effect of bringing in a lot of prospectors in search of the mineral wealth in the desert region which this line traverses. It is expected that shortly a number of mining camps and towns will spring up along the line of this road. Some 23 miles of the new road are being operated, and the balance of that just completed will be opened soon. The road has entered the section of heavier construction work in the mountains, but it is expected to be entirely completed by the end of the year. The region traversed has been an isolated inland country with few inhabitants except the nomadic prospector or miner. There are large areas which are virtually unprospected, as they are distant from even the small towns, and the whole section is absolutely desert in character, very hot in the summer months, and an unpleasant place to follow the prospector's occupation at any time. Notwithstanding this, however, there are plenty of men who have a strong belief in the richness of these desert regions. The veins carrying gold are usually small, but quite rich, so that money may be made quickly when they are found. It is this character of veins which are most sought for.

Of late it has been found that large veins carrying silver-lead ores, zinc ores, etc., occur in parts of the desert region. Until now they have been of very little use, but these new railways bring to them transportation facilities which permit the mining of shipping ores and the hauling in of machinery and supplies. Doubtless numbers of these mines will be found within the next few years, now that they are being sought for. Tungsten ores have also been found lately in the desert regions of Kern and San Bernardino counties and other deposits may be found elsewhere in similar places.

Transvaal Mining Notes

SPECIAL CORRESPONDENCE

The aggregate dividends declared by Transvaal gold mining companies for the half-year amount to \$20,080,000, of which the Rand contributes 97.4 per cent. The following table of progress, covering the period since the recommencement of operations on a big scale at the close of the war, shows that the dividends have lately increased more rapidly than outputs:

Period.	Yield.	Dividends.
1902.....	\$ 35,770,000	\$10,490,000
1903.....	61,870,000	16,470,000
1904.....	78,530,000	19,240,000
1905.....	102,160,000	23,799,000
1906.....	129,610,000	28,100,000
1907.....	134,300,000	34,940,000
1908 (6 mos.).....	70,760,000	20,080,000

The lack of advancement in the total distributions of the outside districts is a regrettable feature. The Nigel, which has paid 25 dividends since 1889, and which accounts for about a third of the outside aggregate, is, moreover, really a Rand mine inasmuch as it is located upon Main Reef, at the southern lip of the Syncline. For the rest, Lydenburg is alone able to distribute profits. The Transvaal Gold Mining Estates and Glynn's Lydenburg companies, under Eckstein control, still remain the only stable profit-makers dealing with gold reefs, other than "banket," in the country. The former company, drawing its ore from seven mines served by the two treatment plants, is shown by the annual report just issued to have been placed in a stronger position by the augmentation of ore reserves to over 315,000 tons, averaging \$17.61 over an average stoping width of 28 in. Owing to the wide distribution of the sources of yield and to the heavy transport rates ruling in the Lydenburg district, working costs (\$6 to \$6.50) are comparatively high. The Lydenburg gold-fields, almost the oldest in the Transvaal, are largely in the hands of big corporations, but the open sections have lately come in for attention from small syndicates and working parties, equipped with a few stamps. After Rhodesia, this district is now the most attractive to the "small man" of any in South Africa.

The appearance of the Luipaardsvlei Estate upon the list of Rand dividend-payers is notable for several reasons. This West Rand mine was equipped with dry crushing plant before the war, but profits for distribution have only been made available by the establishment of a wet mill of the highest efficiency. The property can now claim, indeed, the highest stamp duty on the field—over 9 tons per stamp per day. The mesh employed is 275 per square inch. On ore yielding less than \$6.50 per ton, a profit of \$2.50 is recorded; yet the mine stands on the comparatively small crushing basis of 60 stamps.

The performance of the Luipaardsvlei Estate, at which the economy of heavy stamps, large mesh screening and auxiliary grinding has been so strikingly exemplified, strengthens the promise of success in the now nearly-completed mill of the Simmer Deep & Jupiter, also under Consolidated Goldfields control. This great plant, designed to treat an initial tonnage of 72,000 tons per month with every facility for extension on any scale, is equipped with stamps of 1670 lb. Ten stamps—comprising the unit driven by an independent 40-h.p. motor and counter-shaft—have already been operated, but the whole plant will not be ready for service before September next. Excepting floors and bins (7000 tons capacity), this 300-stamp mill is chiefly constructed of steel. Mortar-box foundations, which require unusual strength, are simply of

concrete with easily accessible bolts, no anvil blocks being adopted. The magnitude of units is further illustrated in the cyanide works, where the sand-collecting vats are 50x8½ ft. and the treatment vats, 50x10 ft. The conical slime vats attain the dimensions, unequaled on the Rand, 70x12 ft. and 17½ ft. deep. Principles of general arrangement allow for ready extension in any section, without reorganization of the connecting system of belts and launders, and without any danger of cramped space. The probability that the Simmer Deep mill is now only in an initial stage of development is apparent when we consider the great reef-bearing area of 1500 claims it will be made to serve.

The report of J. S. Curtis, an engineer of long Rand experience, upon the Village Deep and Turf mines, in advocacy of their amalgamation, has been issued, and it appears certain that the new basis of consolidation evolved, will be accepted by shareholders. The delay of some years in the formulation of a scheme satisfactory to both companies has been essentially due to financial questions, the broad technical advantage of amalgamation having been mutually acknowledged. The greater part of the report deals with the relative valuation of assets, of interest to shareholders and to few else; but one section, discussing the oft debated question of impoverishment of Rand ore with depth, is of wide interest. In the light of the data now available from so many deep workings, up to 4000 ft. vertical and more, Mr. Curtis declares that, so far as he can judge, there does not seem to be at present enough evidence to prove that there is a general decrease in values as mines get deeper. The steady fall in yield of gold per ton crushed is, of course, demonstrated by the Chamber of Mines monthly analyses of output; Mr. Curtis apparently considers this to be fully accounted for by the policy of working poorer zones, made payable by cost reduction and by the greater employment of machine drills in stoping.

Lead Production in Germany

The production of lead in Germany in 1907 is reported as below by Julius Matton, in metric tons:

Company.	Tons.
Stollberger Gesellschaft.....	15,358
Rheinische-Nassauische Gesellschaft.....	15,206
Mechanischer Bergwerksverein.....	11,883
Bleihiitte Call, G. m. b. H.....	10,980
Gesellschaft der Emse Blei- und Silberwerke	4,730
Blei- und Silberhiitte Braubach.....	20,539
Walther-Croneck hiitte bei Rodzin (Gleiche's Erben).....	8,470
Königliche Huttenamt Friedrichshiitte, bei Tarnowitz.....	24,467
Herbergamt Clausthal, Oberharz.....	9,247
Herbergamt Clausthal, Unterharz.....	5,038
Königliche Oberhiittenamt Freiberg.....	5,563
Anhaltische Blei- und Silberwerke.....	2,182
Mansfelder Gewerkschaft (silver-lead).....	383
Total.....	134,136

The Rothenberger Hiitte in Siegerland and the Norddeutsche Affinerie in Hamburg reported no lead during the year.

Personal

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

Robert T. Hill, of New York, has gone west on professional business.

Walter Harvey Weed, New York, has gone to Arizona on professional business.

C. A. Hamilton, Jr., of Oaxaca, Mexico, has returned from a business trip to California.

Geo. L. Widney, of the Tennessee Coal, Iron and Railway Company, is in Mexico on business.

George W. Maynard, of New York, has gone to Idaho Springs, Colo., on professional business.

Edward K. Judd returned to New York last week from Colorado, and has gone to Newfoundland to examine a mine there.

F. M. Currie, of Broken Bow, Neb., is in the Balsas district of Guerrero, Mexico, in connection with his mining interests.

E. E. Carter, manager of the Gold Hill mine at Quartzburg, Idaho, has been examining the Lucky Boy mine near Hailey.

Prof. James F. Kemp, of Columbia University, New York, has been in Guanajuato, Mexico, accompanied by Kingman Gould.

G. H. Barber, a prominent mining engineer of Wellington, New Zealand, was in Toronto recently on his way to England.

J. P. Hutchins recently returned to New York from an examination of mines in British Columbia. He has left again, for Colorado.

D. M. Shanks, general manager of the Rio de Plata mines, in Chihuahua, Mexico, is back at the mines after a business trip to New York.

James Macnaughton, general manager of the Calumet & Hecla mine, has been in Boston attending the annual meeting of the stockholders.

Hugh F. Marriott, of London, has been in New York on his way to Quebec, to join the summer excursion of the Canadian Mining Institute.

Donald B. Gillies has returned to Chihuahua from El Paso, Texas, where he was operated upon for appendicitis; he is now recovering rapidly.

H. S. Washington, of Washington & Lewis, mining geologists, New York, has sailed for South America, where he will spend several months in the gold mining districts of Brazil.

W. C. Franz, of Charleston, W. Va., who has been appointed general manager of the Lake Superior Corporation, will shortly arrive at Sault Ste. Marie, Ont., to take charge.

C. H. Richardson, head of the department of geology at Syracuse University, Syracuse, N. Y., is in Canada, examining mines near Belleville, Ont. From there he expects to go to Colorado to examine some mines.

F. H. Dodge, head of the safety department of the Tennessee Coal, Iron and Railroad Company, who was shot in the recent encounter with striking miners at Blocton, Ala., is improving, and the physicians say that he will recover.

Charles McDermid, secretary of the Institution of Mining and Metallurgy, London, was in New York last week and left for Quebec. He is one of the delegates representing the Institution on the summer excursion of the Canadian Mining Institute.

Edward L. Dufourq has returned to New York after an absence in Mexico, which was prolonged a number of weeks by very severe illness and consequent operation for appendicitis in the American Hospital, in the city of Mexico. Mr. Dufourq has now fully recovered his health and strength.

J. Foster, an English authority on submarine mining, arrived at Halifax, N. S., recently. He has been engaged by the Dominion Coal Company to examine its submarine areas and advise as to the best methods of operation. He will be assisted by Hugh Fletcher of the Canadian Geological Survey.

Edmund B. Kirby, manager of the Federal Lead Company, Flat River, Mo., will retire on Oct. 15 next, and devote his time thereafter to consulting work, with headquarters at 701 Security building, St. Louis, Mo. His successor in the management is to be H. A. Guess, who is at present milling superintendent of the American Smelters Securities Company.

Obituary

Ralph Johnson, a well known mining engineer, was drowned July 8, while making some explorations in the northwestern part of British Columbia. He was 32 years of age, and was a graduate of the University of Minnesota.

John Kerr, the discoverer of the Tilbury oilfield and also of natural gas near Chatham, Ont., died at Detroit Aug. 17, at the age of 45 years. He sank the first oil well in the district on his own farm and though at first he was unsuccessful and encountered many difficulties, persevered until he attained success.

William A. Dennis, for many years prominent as a mining engineer in California, died suddenly in Los Angeles recently. He settled in California in 1855 and was well known throughout the State. For a number of years he was superintendent of the New Almaden quicksilver mines. He leaves four sons, three of them mining engineers.

Dr. Henry Youle Hind died at Windsor, Nova Scotia, Aug. 9, at the age of 85 years. He was born at Nottingham, England, and came to Canada at the age of 23. He held the position of professor of geology and chemistry at Trinity University, Toronto, for 13 years, during

which period he was engaged in important explorations in the Canadian West and the interior of Labrador. He resigned his professorship in 1864, and two years later removed to Windsor, N. S. Among the more important investigations which he conducted were an examination of the Nova Scotia gold districts, and an exploration of the mineral lands of northeastern Newfoundland and the adjoining coasts of Labrador in 1876. Dr. Hind gave important scientific assistance to the Fisheries Commission, organized under the provisions of the Treaty of Washington, and was a prolific writer on geological, chemical and geographical topics. In 1860 he was elected a Fellow of the Royal Geographical Society of England.

Societies and Technical Schools

Geological Survey of Oklahoma—The Oklahoma Geological Commission, consisting of the Governor of the State, the State superintendent of public instruction and the president of the State University, met for organization, July 24. Governor C. N. Haskell was elected president of the Commission; State superintendent E. D. Cameron secretary and A. Grant Evans, president of the State University, was elected executive officer. Dr. Chas. N. Gould, professor of geology at the State University of Oklahoma, was elected director of the Survey and instructed to begin, at once, the preparation of reports dealing with the geologic structure and mineral resources of the State.

Rocky Mountain Club of New York—This club has a membership of 500 and recently has had to secure larger quarters. It has leased the entire west wing of the 15th floor of the Waldorf-Astoria, where it has a large reception room in addition to a suite of 12 smaller rooms. The entertainment committee, of which Colvin B. Brown is chairman, announces that the regular Saturday night smokers will be resumed early in October and that upon each of these occasions the club will be addressed by a speaker familiar with some of the various sections of the West. Stereopticon views and moving pictures will be used to illustrate the lectures. Much interest in the West was created by this kind of entertainment given by the club last winter. After the lecture a lighter form of entertainment is provided for members and guests. The club was formed for the purpose of promoting good fellowship among its members and for furthering the interests of the West in the East and it is hoped that all Western commercial bodies will see to it that the club is supplied with all publications intended to call attention to the great country west of the Mississippi. John Hays Hammond is president of the club; A. J. Seligman, vice-president; W. B. Thompson, treasurer; James J. McEvilly, secretary.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at San Francisco, Salt Lake City, Denver, Goldfield, Butte and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

Aug. 17—The Superior Court of Yuba county has given judgment in favor of J. C. Campbell in his suit against Lang & Reams for possession of the Solano Wonder mine, near Brownsville. It was only a few months ago that the prospectors, Lang & Reams, located this mine and in a shaft only 18 ft. deep, came upon wonderfully rich ore. Not long after J. C. Campbell and wife, of Nevada City found that the mine was located on their patented ground, and they served an injunction prohibiting further work on the property. At that time some 60 sacks of ore were kept by the locators, supposed to be worth \$1000 per sack. The injunction prevented the sale of this ore, and under the decision rendered, it goes to Campbell and wife instead of to Lang & Reams who mined it. The Campbells are now re-opening the mine and will develop the property and install the necessary machinery to work it deeper. The locators supposed it to be on public land when they started work on the croppings.

In the desert regions of the southern portion of California, the heat this summer has been excessive, even for that hot region. Records of 120 deg. and even higher have been common. As a result numbers of prospectors and miners have been prostrated and some few deaths have occurred.

The capitalists who started the water and power project in the region of North San Juan, Nevada county, found some of the property owners willing to meet them on a fair basis, but others have held out for exorbitant prices, so little has been done of late.

Considerable ground must be acquired for lake and reservoir sites, as well as for rights of way. It is now thought that a few suits will be brought to determine property values in that section, after which it is expected that the original plans will be pushed to completion.

An exceptionally rich strike has been made in a new mine on the property of Wintering & Osgood, on the divide between Russian and Applesauce creeks in Siskiyou county. The group is composed of six claims and the orebody thus far found is wide and rich for a vein of the size. The property is very slightly developed, but already the owners have been offered large sums for it.

The Anti-Debris Association, through supervisors of certain valley counties, obtained an injunction against the Pennsylvania Dredging Company, of Oroville,

Butte county, recently, and stopped it from carrying on further operations. Since then the company has "landlocked" its dredger and prevented any material entering the river. Upon this showing being made, the Superior Court has suspended the injunction temporarily, to be revived at any time should the work not be done to the satisfaction of the Anti-Debris Association. That is to say, the Anti-Debris Association, a private organization of anti-mining people, is to pass upon the work of an incorporated dredging company, and say whether or not it is to continue operations.

San Diego has a new Chamber of Mines which is "booming" the mining interests of the county and it is now intended to have speakers address the public, twice a week, on the subject of the various county mining districts, to explain their merits. But what the county seems to need most is some good productive properties to attract attention to other claims needing capital. Since the stoppage of work at the mines at Hedges and the falling off of development work at Julian and Banner, the county seems to have come to depend on Escondido and Dulzura, the latter only a camp of a few months age, with its values mainly prospective.

At the Yellow Aster mine, Randsburg, Kern county, they are installing the most extensive cyanide plant in the State. There are upward of 1,000,000 tons of tailings to be handled by it. It is expected that this mine will before long have 500 stamps at its mill.

Goldfield, Nev.

Aug. 17—There are 161 mining camps in this State, of which about half have made or are making records, and it is conservatively estimated that since the discovery of ore in the State, Nevada has produced a billion dollars. The Comstock, which has turned out half a billion, will in another year have conditions adjusted so that the lower levels, now too hot for operating, will be fit for work, and the State production should be very largely increased. The camps of Goldfield and Tonopah have already produced more than \$30,000,000, and with the new mills now under construction in operation, the output of these two camps should be doubled.

Salt Lake City

Aug. 15—At the United States Smelting, Refining and Mining Company's lead

smelter four furnaces have been in operation under oxidized charges for the past two weeks, long enough to demonstrate the effectiveness of the company's new patented process for the condensation of fumes and elimination of the elements which deal death to vegetation. Although 800 tons of ore and fluxes are used up every day in these four furnaces scarcely a particle of smoke is seen to issue from the top of the high steel stack, so perfect is the process performing the work designed for it to do. At a distance the plant has every appearance of being idle. The roasting department will be in commission in a few days, when the company will take care of all the sulphide ore required to raise the daily capacity to 1600 tons. The lead mines of the United States company are supplying 200 tons per day, which is subjected to concentration in the mill near the smelter and which was placed in commission about Aug. 1.

The policy adopted by the mining companies controlled by Jesse Knight, of Provo, Utah, and associates, of issuing brief financial statements at the beginning of each month, is being faithfully carried out and the Aug. 1 statement, compared with the one issued July 1, makes the following exhibit:

	July.	August.
Colorado Mining—		
Cash on hand.....		\$18,294
Bills payable.....	\$38,369	
Indian Queen—		
Cash.....	\$ 6,620	\$ 6,789
Stock in treasury.....	188,950	158,650
East Tintic Con.—		
Cash.....	\$ 1,063	\$ 1,068
Stock in treasury.....	163,090	163,090
Mountain Lake—		
Cash.....	\$24,466	\$20,223
Stock in treasury.....	122,435	122,435
Utah Treas. Hill—		
Cash.....	\$ 416	\$ 1,023
Bills payable.....		8,500
Stock in treasury.....	8,500	8,500
Ibex Gold Mining—		
Cash.....	\$23,019	\$16,009
Stock in treasury.....	53,300	53,300
Mineral Flat—		
Cash.....	\$ 1,665	\$ 1,338
Stock in treasury.....	123,125	122,125
Crown Point—		
Cash.....	\$19,349	\$13,868
Stock in treasury.....	122,900	122,900
Iron Blossom—		
Cash.....	\$39,821	\$34,357
Stock in treasury.....	100,790	100,790
Black Jack Con.—		
Cash.....		\$ 2,622
Bills payable.....	\$21,129	
Beck Tunnel Con.—		
Cash.....		\$19,264
Bills payable.....	\$16,005	
Big Hill—		
Cash.....		\$ 1,121
Stock in treasury.....		38,231

Plans are maturing which will result in the erection of a 200-ton matte smelter at the Gold Hill mine of the Western Utah Copper Company, in the Deep Creek district. Practically all the equipment necessary will be purchased from either the Bingham Consolidated or Utah Consoli-

dated, each of which owns an idle smelter which will be dismantled sooner or later.

Wallace, Idaho

Aug. 17—A contract for 300 ft. of tunnel work has been let on the property of the Gold Crag Mining Company, owned by Colonel Fuller and others. A shipment of 25 tons of ore has been made from the property of the Gray Copper Company, at Osburn. This is the first shipment from the property and is of significance to the large number of prospects being worked in that particular vicinity. Several feet of galena ore, varying from a good grade of shipping ore to a low-grade milling ore, have been exposed in the raise being driven in the Black Bear Fraction mine at Black Bear and adjoining the Frisco. There are several feet of ore strung through the top and sides of the vein and scattered throughout the whole face. A strike of lead-silver ore has been made in the shaft being sunk on the Full Moon property. The shaft has been sunk about 50 ft. and practically the whole face is in carbonate ore carrying stringers of high-grade ore. The management has decided to run a long tunnel to tap the orebody at depth.

Butte

Aug. 20—The South Butte Mining Company has instituted action in the district court against Peter and Mary Kriser and Mattie Doyl, alleging unlawful detainer by defendants of certain portions of plaintiff's mining claims. The company asks that it be restored to possession and be awarded damages in the sum of \$500. Word has been received in Butte that the details of the reorganization of the Davis-Daly Estates Copper Company are about completed. A syndicate has been formed for the purpose of underwriting the stock and financing the company. The plan provides for the organization of a new company to be called the Davis-Daly Copper Company, with a capital of \$6,000,000 and shares of the par value of \$10. The new stock will be issued in exchange for the old upon payment of \$2 per share. With the fund thus expected to be raised, amounting to \$1,200,000, the company's debts will be liquidated and a working capital secured.

In the action of McIntyre et al. against the Montana Gold Mountain Mining Company et al., for the foreclosure of several mechanics' liens on the property of the company, situated in German gulch, south of Butte, a decision has been rendered, awarding the plaintiffs judgment for somewhat less than \$3000 and a foreclosure of the lien.

Denver

Aug. 22—Arguments in the million-dollar damage suit against the United Oil Company, the Inland Oil Company, and others, instituted by the minority stockholders of those concerns, are now being heard in the district court at Cañon City.

The plaintiffs allege manipulation of the output of the United in favor of the Inland company, and other mismanagement, and ask for the appointment of a receiver for both companies. Testimony in the case was taken a month ago, and the trial continued pending a meeting between the minority stockholders and the directors of the companies in an endeavor to settle the controversy; but as an agreement was not reached at this meeting, the trial in court has been taken up again.

Reports from Creede are to the effect that lessees operating the Creede-Quintell have recently cut a 4-ft. vein carrying 100 oz. silver per ton across its entire width, while assays taken from a narrow streak in the vein yield at the rate of 6000 oz. silver per ton.

The driving of the Cripple Creek deep drainage tunnel for the first 16 days of August amounted to 130 ft., making the total distance from portal to breast a trifle over 3000 ft.

A force of men is at work excavating for the experimental cyanide mill to be erected to test that process on the low-grade ores of the Portland Gold Mining Company's mines and dumps. Laboratory experiments with this process were successful, and the method of treatment is now to be tried on a commercial scale.

Indianapolis

Aug. 24—The return of Indiana miners to their work in the bituminous field after a strike of two weeks, is a victory for T. L. Lewis, president of the Miners' national organization. President Van Horn, of District No. 11, ordered the men out in violation of the agreement with the operators that no strike should occur pending an investigation of any grievance. President Lewis would not condone this act and said that the rules of the organization would be enforced and the charter taken away from the district organization unless the men returned to work at once.

The resumption in the coalfields a few weeks ago gave 3000 men work who had been idle all summer. At the time the men were called out upwards of 10,000 men were employed at the different mines in the district. It is now believed that the end of the strike will occasion a general opening up of the coal mines and the 16,000 men of the district will be at work from now on. Mr. Lewis says there is little hope for an immediate adjustment of the cause of the strike, but so long as the effort is being made the miners are bound by agreement to remain at work. As the operators are behind with orders and the demand for coal is increasing, it is expected that there will be no more slack periods this year.

London

Aug. 8—The Dunderland Iron Ore Company, Ltd., is passing through evil times. The mines in Norway are to be closed down temporarily, owing to the

small demand for iron ore and the low prices now ruling. Up to June 30 last the company produced 67,000 tons of briquettes, which were sold at prices ranging from \$6.55 to \$4.40 per ton. Some alterations to the plant were required, and the directors recommended the creation of further capital in the shape of £100,000 of pre-preference shares. Enormous sums have already been spent on this venture, but the directors are still sanguine that the company will pull through and reach the profit-earning stage.

At a meeting of the Central Mining and Investment Corporation, Ltd., held on July 31, Sir Julius Wernher, the chairman, made an interesting speech on the South African mining industry. Sir Julius spoke in an optimistic tone as regards the future of the goldfield, and said that, although a few of the older and smaller mines would disappear within the next 10 years, there were other mines coming on to take their place and that in his opinion the average production of gold for the next 20 years would, given normal conditions, be at least as good as, or better than the present annual output. Sir Julius gave a favorable review of the different factors that affect the situation, noticing in particular the friendly attitude of the Transvaal government toward the mining industry. As regards the labor problem, he stated that the supply of natives was at present sufficient for the wants of the mines, pointing out, however, at the same time, that, owing to the restriction of operations at the diamond mines and on public works, the supply was to some extent abnormal. He did not consider that the policy proposed by the majority of the Creswell commission of working the mines entirely by white labor a practical one. In order to make it so, it would be necessary for the white labor to become four times as efficient as it was at present and that, he thought, was asking too much. Sir Julius is not given to exaggeration and the hopeful view that he takes of the future ought to give confidence to Rand shareholders. The policy of amalgamating companies so as to reduce capital expenditure per claim, which has been a feature of recent years, is to be continued. With the reduction in working costs that such amalgamations are calculated to bring about, a larger tonnage, and consequently a longer life, will be obtained. While this policy of studying economy is to be commended, it is to be hoped that will be remembered that the profit earned is the main consideration and that to work low-grade ore and show low working costs is poor business, if there are no profits. The exact limit to which the grade of ore mined should be reduced is a nice point, and deserves greater attention that it seems to get. Big mills and low working costs, which are now the order of the day, do not necessarily mean good mining finance from a shareholder's point of view.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

JEFFERSON COUNTY

Tennessee Coal, Iron and Railroad Company—This company has decided to treat with preservatives all timbers used in its mines. A plant for this purpose will be erected near Birmingham. The Forest Service of the Government will cooperate with the company in the erection of the preserving station. The timbers will be treated with creosote, solutions of zinc chloride and common salt.

Arizona

YAVAPAI COUNTY

Congress Consolidated Mining Company—This company made a \$2000 shipment of bullion last week. Its mines are at Congress.

Derby—These mines, situated six miles west of Prescott, are being operated by George U. Young and associates. The mines have produced some very high-grade gold ore in the past but lack development.

McKinley Mining and Development Company—This company is taking shipping ore from its Peacock shaft near Iron Springs. Regular shipments of ore will be made in a short time. The shaft has reached a depth of 300 ft., and the ore-bodies are showing a continued improvement. Copper is the chief value in the ores.

Humboldt-Arizona Copper Company—This company owns a group of five claims near Humboldt. It is preparing plans for the installation of machinery, and the further development of the property. At present the deepest workings is an 80-ft. shaft.

Mazatzal—It is reported that this company has opened a large body of good-grade copper ore in its mines near Jerome and that it will soon be on the producing list.

Peterson—This group of mines, adjoining Octave mine on the east and covering the extension of the same vein, has been bonded to Eastern men by the owner, Andrew Peterson. About 2000 ft. of development work has been done, and some very promising bodies of ore await stoping.

YUMA COUNTY

Clara Consolidated Gold and Copper Company—Consolidation has been consummated of the following properties in the Santa Maria mining district: The Signal Copper Company, capital stock, \$5,000,000; Clara Gold and Copper Mining

Company, capital, \$2,000,000; Crown Princess Mining Company, capital, \$1,500,000; Crown Queen Mining Company, capital, \$1,000,000; also the Morro group of gold and copper-mining claims. The total properties comprising 132 full claims have been merged into the Clara Consolidated Gold and Copper Mining Company, which has a capital of \$3,000,000. The company has marketable ore on the dumps and considerable ore blocked out in the mines, one gasolene hoist in operation, another in course of construction, with an additional steam hoist and plant good for 2000 ft., ordered and shipped. Geo. Mitchell is general manager of the new company.

California

BUTTE COUNTY

United States Diamond Mining Company—At this property, near Oroville, where M. J. Cooney, manager, is prospecting for diamonds, a contract has been let to sink 100 ft. additional on the main shaft.

CALAVERAS COUNTY

Last Chance—This mine, near Murphy, now under bond to J. C. Spencer, has a new steam hoist and pump, and the shaft is being deepened.

Mountain King—Work has been resumed on this mine, near Hodson, and the 400-ft. shaft is to be sunk 500 ft. deeper. The mine has a 10-stamp mill, hoist, pumps, etc., and an air compressor is to be installed. W. R. Womble is superintendent.

HUMBOLDT COUNTY

Clover Flat—This mine has been compelled to close down for lack of water, the season being the shortest in years.

INYO COUNTY

Buckeye Mining Company—Unusually good ore has recently been found on one of the claims of this company at Fish Springs, which has caused something of a local mining excitement.

Skidoo Mines Company—This company at Skidoo is taking out high-grade ore daily, and is throwing some of the claims open to leasers. There are 50 men at work.

LAKE COUNTY

Helen—This quicksilver mine, owned by A. Rocca, near Middletown, is shipping about 75 flasks of quicksilver weekly of late.

MARIPOSA COUNTY

Exchequer—At this mine the shaft is now down 140 ft., and drifting will soon commence. There is still plenty of water to operate the power plant.

NEVADA COUNTY

Calvert & Sharp—This gravel mine on Canada Hill, Nevada City, has been bonded to Murphy & Hanaan, of San Francisco, who will extend the tunnel to the channel.

Cold Spring—At this property, Washington Ridge, Thomas Coan, superintendent, retimbering is being done and drifts will be run to crosscut the gravel channel.

PLACER COUNTY

Lost Emigrant—This mine at Summit, under bond to F. S. Morgan and George Hothersoll, is being reopened, and as soon as the shaft is unwatered, sinking will be carried on. There is a mill, hoisting works etc. on the property.

Columbia—This mine at Iowa Hill is now owned by M. J. Fitzpatrick and L. J. Pierson, who are developing it.

Pupiter—The channel recently opened in this mine is paying well; the gold found is coarse.

Parmalce—The Pacific company is putting compressors and other machinery in this mine at Last Chance.

Power Plant—W. S. Fletcher is putting in an electric plant in the North Fork of the Middle Fork to run the mill at the Homestake mine at Last Chance, the Paragon at Bath and the Dardanelles near Forest Hill.

PLUMAS COUNTY

Bonded—H. H. Hunter has bonded the Edward Braze mine near Butte Valley, and the Kitchen mine at Cariboo, and both properties are being opened.

Piazzoni—This quartz mine near Seneca has been bonded to D. M. Harvey, Reno, Nev., who will shortly put a mill on it.

SAN BENITO COUNTY

Bradford Quicksilver Mine—J. A. Stewart, superintendent of this mine, has arranged with Robert Scott to build a furnace; and it is expected that another of still larger capacity will follow.

Harbor Group—At this property on the east end of the Avawatz range the 175-ft. shaft is to be sunk to 500 ft., and a new hoist has been purchased.

Long Range District—In this district, 20 miles from Barstow, Ferand & Rumohr

have a Curtis dry-washing machine at work, and report it as being satisfactory.

Orange Blossom Extension Company—The new mill of this company, near Bagdad, has been completed and started in operation. J. A. Hodgman is manager.

SHASTA COUNTY

Black Tom—This company has commenced active operations on the Niagara mine at French Gulch, formerly a heavy producer. A new 10-stamp mill will be erected. K. H. Siebel is superintendent.

Mammoth Copper Company—This company now employs 350 underground miners and 125 surface men, exclusive of employees at the smelter. The new gravity tram is found satisfactory and carries 1000 tons of ore daily from the mine to the smelter. Supplies are all handled by it also. Mr. Robert Hanley is now superintendent of the mine.

SAN BERNARDINO COUNTY

Dewey—At this mine near Barstow, owned by Sharp Brothers of Philadelphia, they are putting up a 60-stamp mill with cyanide plant.

SAN DIEGO COUNTY

Cleveland Pacific—At this mine, Escondido, W. F. Spieth, manager, they are putting in new settling tanks and as soon as these are completed the mill is to be started up again.

SIERRA COUNTY

Steamboat—This mine at Balsam Flat has been bonded by F. A. De Lancey and others to a company of Sparks, Nevada. The Yankee tunnel will be used to gain access to the St. Elmo quartz ledge on the property.

Buttes Saddle—G. H. Chick and W. S. Aldrich have bonded this mine at Sierra City from Richard Phelan and have invited bids for 1000 ft. of tunnel. The tram and mill are to be put in order.

SISKIYOU COUNTY

Garden & Reed—This hydraulic mine cleaned up \$12,000 this season, and has closed down until some time in October.

Big Cliff—The new company which has bonded this mine from Wintering & Osgood has commenced operations with 12 men. The company is called the United States & British Columbia Mining Company of Boston, Mass. The mine is a new one but promising, the grade of ore being high.

Yellow Butte—Sufficient money has been raised by Manager L. D. Ball to further develop this copper mine near Weed by sinking the shaft 200 ft. deeper and running four levels to block out ore.

Colorado

CHAFFEE COUNTY

Florence—The first ore was taken away from the mine Aug. 17, and shipped to the smelter. Over 500 tons are on the dump.

Peerless—This mine, on Altman mountain, 18 miles from Salida, has begun to ship to the Salida smelter. The tunnel is now in 1000 ft., cutting the vein at a depth of 700 ft. H. F. Schuelke is president and manager of the company.

GARFIELD COUNTY

Elk Creek—Some mineral has been found at the head of Elk creek, 11 miles from the town of New Castle. Ore sent to Leadville for analysis gave returns of 3.45 oz. gold, 5 oz. silver and a trace of copper per ton. This ore was taken from a vein that is 4 ft. wide. The formation is quartzite and granite.

HINSDALE COUNTY

Wyoming—A new shaft on this mine, at a depth of 100 ft., has cut a vein running well in silver. The mine is on Engineer mountain, near the San Juan county line. E. W. Creel is superintendent.

LAKE COUNTY

Christensen—On this claim, between Twin Lakes and Granite, work near the surface has opened a vein that runs well in gold and silver with 70 per cent. lead. The vein is small.

Columbine Tunnel—A vein of ore has been opened at the breast of this tunnel, Mt. Elbert, 10 ft. wide, which carries streaks of high-grade gold ore. It is said that the whole 10 ft. will hold up to \$35 per ton. The vein was caught 100 ft. from the mouth of the bore.

Dinero Tunnel—The annual meeting of the stockholders of the company was held here recently and the old officers were re-elected. It is expected that the tunnel will cut the Dinero veins soon.

Tiger—In this mine, at the head of Iowa gulch, the strike made recently has widened out with development and the lessees have out another carload of ore.

Vinnie—On Breece hill, the Vinnie and the M. N. fraction are producing a heavy tonnage of sulphide ore and some silicious ore, all of which is passed through the Yak tunnel.

Yak Tunnel—During the last few days arrangements have been completed whereby this company has received the right of way from the breast of the tunnel through the intervening ground to the Dolly B claim in Big Evans gulch, a distance in a straight line of one mile. The tunnel is now in 15,000 ft. and the breast has cut the end-line of the New Year claim, South Evans, part of the Resurrection group. A lateral will be run from the tunnel to the Silent Friend, South Evans, several hundred feet, which will permit this property to be worked more successfully than at present. The breast of the tunnel is in granite and already several fissure veins have been cut that carry gold.

Empire Gulch—Lessees report a streak bearing silver in large quantities. In the

center of the group, and near the surface, a small leader was discovered, which when followed out, developed into a good-sized vein with indications of opening into a large orebody. A grab sample assayed 90 oz. of silver and a good percentage of lead.

Fanny Rawlins—This mine, which has been a steady producer for a long time, continues to look as well as at any time in the past. Present indications point to the opening of a high-grade mineralized area.

Huckleberry—One of the most promising claims in the outlying portions of the district is the Huckleberry, in St. Kevin. While shipments have not been heavy, all the ore sent to the smelter is exceptionally high grade, over \$20 per ton. The ore is chiefly gold, though it carries a small percentage of silver.

Margaret—A streak of telluride has been opened up in the Margaret, at a depth of 70 ft., which contains gold. Shipments are being made to a local smelter.

Progressive—Lessees operating on this mine have discovered a good body of ore, a carbonate, which besides carrying lead, also contains some silver. The shaft is now 300 ft. down.

Star of the West—This mine on Iron hill, which has been working all winter with heavy shipments of iron going to the local smelter, reports another strike. A vein of silver has been encountered which promises to develop into a large orebody. The ore carries lead.

SAN JUAN COUNTY

Shipments of ore from Silverton in July were 2575 tons concentrates and 1850 tons crude ore. The larger shipments of concentrates were 1475 tons from the Silver Lake, and 800 tons from the Hercules; of crude ore, 725 tons from the San Antonio and 400 tons from the Shenandoah-Dives.

Champion—A test run on ore from this mine is being made at the Contention mill, under charge of T. C. Woodworth. The object is to determine the best type of mill for the mine.

Iowa-Tiger Leasing Company—This company, formed by Henry Sherman and others, has taken a lease of the Iowa and Tiger mines, and is putting them in order for operation.

Shenandoah—This mine has been leased to Martin Honk and others, who have organized a leasing company. They will work the mine through the Trilby tunnel.

Idaho

SHOSHONE COUNTY

Ruby Mining Company—This company, which has just been formed at Wallace, with a capitalization of \$1,000,000, will operate the Ruby group of claims just across the line in Montana.

Stanley—Returns on the last shipment of concentrates show two grades of ore, ranging from \$85 to \$328 per ton and giving net receipts of \$3600. The mine has been closed until litigation in which it is involved is settled, after which a mill will be erected and the ore concentrated.

Montana Standard—At the last meeting of the directors held a short time ago it was decided to run a 700-ft. tunnel on the lead in order to determine the size of the orebody. If satisfactory results are obtained a mill will be erected next year.

Black Horse—The Black Horse Mining Company has just been organized at Wallace, with a capital of \$1,000,000, to work the Black Horse group near Murray.

Lucky Calumet—Sinking on a winze in the west drift has begun. High-grade galena ore was struck here a short time ago and after the drift had been pushed some distance beyond, it was determined to go down on the ore. The streak is small. If it proves large enough, a tunnel will be run from the foot of the hill to tap the orebody.

Indiana

Judge Francis E. Baker, of the Federal circuit court, has appointed John K. Siefert, of Terre Haute, general superintendent of the mines, receiver for the Indiana Southern Coal Company and the Southern Indiana Coal Company on complaint of the trustee for the bondholders. It was charged in the application for a receiver no interest had been paid on the bonds. The Southern Indiana Coal Company was the principal feeder for the Southern Indiana Railroad, which was placed in the hands of a receiver a few days ago. The action was brought in Indiana, as all the properties of the two coal companies are in this State. The coal companies' property consists of a dozen mines located along the line of the Southern Indiana Railroad.

GIBSON COUNTY

While drilling for oil near Oakland City on the farm of Charles Cromer, the drill passed through a vein of coal 6 ft. thick. The coal is overlaid by a formation resembling iron ore and by 40 ft. of rock. Arrangements are being made to develop the territory.

PARKE COUNTY

A vein of bituminous coal has been discovered a few miles southeast of Montezuma, on land recently purchased by the Wimmer Coal Company, which was recently organized. The vein was discovered at a depth of 125 ft. and is from 4 to 6 ft. thick. Machinery is now being installed for the opening of a new mine. The men backing this venture are Jesse Woods, John Wilhite, Harry White, Wallace Haworth and Robert Knox.

SULLIVAN COUNTY

Union Coal Mine—Fire broke out Aug.

22 in one of the levels of this mine and has continued to spread, despite efforts to check it.

VIGO COUNTY

A new geological survey of the coal-fields of this county was begun Aug. 13 under the supervision of State Geologist W. S. Blatchley. The field work will be under the direction of Dr. George H. Ashley, assisted by E. F. Lyons, both of the United States Geological Survey. The expense is being divided by the State and the United States surveys.

Michigan

COPPER

Ahmeek—The company has begun excavating on the site of the two new shafts. As the company does not own the outcrop of ore along all its property these shafts will start with a common collar and then diverge from that point to develop the lodes in the northern and central portions of its land. The shafts will have three compartments and will be sunk at an angle of 80 degrees until the lode is reached; then the pitch of the lode will be followed. It is calculated that it will be necessary to sink about 1200 ft. before the lode is cut. The two producing shafts of the company are shipping about 1200 tons of ore daily.

Osceola—The South Kearsarge property is shipping about 2300 tons of ore daily to the mills. No sinking is being done in either of the shafts, all work being concentrated in stoping and drifting.

Wyandot—Diamond-drill explorations for the Lake lode have begun. In the exploratory shaft a crosscut from a depth of 700 ft. is being driven toward the east.

BERY COUNTY

Robert Gage Coal Company—This company has sunk a new shaft at Auburn, cutting a new vein of coal, which is 7 ft. thick at the shaft.

HOPKINS COUNTY

Sunshine Coal Company—This company has been organized by W. D. Coil and G. R. Lynn, who recently bought the Royal coal mine at Madisonville. The property includes a mine in operation, and mineral rights over a large tract.

Missouri

LEAD-ZINC DISTRICT

Criterion—F. P. Allen and associates will erect a 200-ton mill on their 12-acre lease on the Criterion land. Two shafts have a 6-ft. face of sheet ore.

Gold Dust—This company has incorporated with a capital stock of \$15,000, equally divided between S. K. Ortt and A. L. Caulkins, of Webb City, and J. C. Hall, of Carthage.

J. C. Barr & Co.—This company has struck 14 ft. of sheet ore at 240 ft. on the

Troupe land south of Webb City. Another shaft will be sunk and a mill erected.

Little Velma Mining Company—This company has been incorporated with a capital stock of \$30,000 to buy and operate a lead and zinc mine located four miles southeast of Springfield. The stockholders are Richard Scharff, Hugo Mauch and W. A. Rathbun.

Sewickley—This company has been incorporated with a capital stock of \$100,000. The shareholders are Chas. A. Strasburg and Samuel Strasburg, of Criderville, O.; M. P. Myers, W. A. Myers and T. L. Myers, of Joplin.

Grand Duke Consolidated—This company has been incorporated with a capital stock of \$250,000. The shareholders are Sydney L. Wilkins, Frank S. Hamilton and W. F. Shannon, all of Joplin.

Illinois Zinc Company—This company, of La Salle, Ill., has filed papers of incorporation in Missouri with a capital stock of \$2,000,000. Under the new charter the company can operate mines and buy and sell mining lands. The company already owns 160 acres of mining land near Granby.

Kalitan—This company, which has been developing the old Crawfish mines on Turkey creek, has made its first turn-in.

Osyka—This company has been incorporated with a capital stock of \$150,000. The stockholders are F. A. Brown, R. K. Pitkin and John H. Robertson, all of Joplin.

Over Yonder Mining Company—This company has filed papers of incorporation with a capital stock of \$50,000. The incorporators are A. E. Bendelari and F. S. Cook of Joplin; E. E. Payne, Morrison Clark and J. W. Durby of Carthage. The company has sub-leased the land and the 250-ton mill of the Glass Mining Company, west of Webb City.

Porter Land—The water has finally been beaten in the Porter mine, near Carthage, with a large centrifugal pump, and the ground is now ready for work.

Portage Lead and Zinc Company—This company has been incorporated with a capital stock of \$150,000. The shareholders are J. L. Harris and Daniel Fisher of Houghton, Mich., and H. L. Culver of Joplin.

Montana

BUTTE DISTRICT

Tuolumne—The station has been completed on the 800-ft. level and it is stated that the same vein which was recently cut on the 1000 has been cut in the back of the 800 station. Development work is being pushed with all possible haste on both the 1000- and 800-ft. levels.

Butte & Superior—Some time ago a vein was cut south of the shaft on the 1000-ft. level, but the flow of water encountered compelled a halt in operations before the width of the lead was deter-

mined. Work on the crosscut has been resumed recently and the vein will be thoroughly explored. From the 1200-ft. station crosscuts have been started both north and south.

BEAVERHEAD COUNTY

New Departure—A lease has been given by the company to Fred. Randolph for the purpose of allowing him to locate a rich vein of gold supposed to exist in the mine.

FERGUS COUNTY

Cone Butte Company—The management states that work on the new mill of the company will be begun shortly. Some months ago an issue of bonds was authorized and enough of them have since been sold to provide funds for the erection of the new mill.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Production—This week's production amounted to 2544 tons, worth \$245,190, as follows: The Kinkead mill treated 60 tons of concentrates by the new process; the Combination mill treated 630 tons of Consolidated ores; the Western Ore Purchasing handled from the Van Riper dump 48 tons; Little Florence, 77 tons; Rogers Syndicate, 6 tons; Truax lease, 17 tons; Mohawk Jumbo, 696 tons; the Nevada Goldfield Reduction works treated from the Combination Fraction 342 tons; Consolidated Red Top, 155 tons; Engineers lease, 227 tons; Mohawk Jumbo, 55 tons; Daisy, 16 tons; Frances Mohawk, 105 tons; Rogers Syndicate, 12 tons; Little Florence, 48 tons; Mohawk Combination, 60 tons.

Great Bend—The new shaft is down 220 ft. and it is expected that connection with the old workings will be made within ten days, when ore shipments will begin.

Florence—President Lockhart, in his annual report to stockholders, states that the revenue from royalties on ore extracted by leasers has enabled the company to pay three dividends of 10c. per share, or a total of \$315,000, and also to pay for construction of the mill and the purchase and development of a water supply, which up to June 30, 1908, have cost \$255,691. The company has no debt of any kind. The water supply has been developed by a gravity pipe line to about 100,000 gal. per day, more than sufficient for the present milling plant.

Chicago Goldfield—The Gold Medal lease is making good headway in cross-cutting to get under the old Benedict shaft. This work has progressed 300 ft., with 60 more to go, when an upraise will be started.

Mohawk Ledge—Bids have been opened and contracts will be let in a day or two for sinking the shaft from the 475- to the 675-ft. level.

Oro—Captain Hooper, president of the

Oro, is in receipt of several requests for leases on this property, which is beyond the known northern ore zone.

Atlanta—Blocks Nos. 4, 5 and 6 on the Union Jack claim of the Atlanta have been leased to a New York company.

Laguna—The favorable developments in the Mushett lease have excited considerable interest in the adjoining ground, and it is reported that a bonus of \$40,000 has been offered for a lease in the No. 6 block of the Miss Jessie claim.

ESMERALDA COUNTY—CUPRITE

Sulphur Group—The group of claims at Cuprite known by this name have been sold to Los Angeles interests. Before the deal was consummated a shipment of sulphur from the property was made and the returns gave 93.7 per cent. sulphur. The sulphur deposit is 450 ft. wide and in places it protrudes above the ground in a well defined outcrop and in other places it is covered by rock. An 8-horse team and scraper will be put to work to uncover the deposit.

HUMBOLDT COUNTY—SEVEN TROUGHS DISTRICT

Mazuma Hills—Eighteen inches of shipping ore has been encountered in the face of the tunnel at a depth of 80 ft. in the Martin & Gourdiere lease. The strike occurs in a big parallel vein, 600 ft. west of the famous Mazuma Hills vein, in entirely new ground and it doubles the known ore zone which extends across Seven Troughs camp.

Kindergarten Mill—The mill treating ores from the Kindergarten mine realized \$18,000 from its July clean-up. During the month the mill ran only one shift in the 24 hours. The ore averaged around \$80. A large run will be made this month on Therien ore taken from the Wihuja lease adjoining the Kindergarten mine.

Mazuma Hills Mill—A clean-up of nearly \$18,000 was made from a 20-days' run. During the whole month of July the mill turned out \$30,000. The last 10 days of the month were devoted to the rich ores from the Reagan-Hayes lease.

LINCOLN COUNTY—SEARCHLIGHT

Quartette—The new 150-ton cyanide mill has been started up for the first time.

Philadelphia Searchlight—Work on the Philadelphia has been resumed with a large force of men.

LYON COUNTY—YERRINGTON

Nevada Douglas—Sixty tons of high-grade copper ore derived from development work are being shipped weekly to the Salt Lake smelters.

LYON COUNTY—RAMSEY

Ramsey Ophir—Machinery has been installed on the Faby lease on the Ramsey-Ophir ground and more development work is about to begin.

Queen—Near the 50-ft. level in the Ramsey Queen shaft sulphides have been encountered.

New Comstock—Work has been resumed on the New Comstock property after a shut-down of several weeks. A pump has been installed large enough to handle the water.

NYE COUNTY—BULLFROG

National Bank—The lessees on the Sixty-Six have made one of the most sensational strikes ever made in Bullfrog. A streak of ore 8 in. wide has been encountered which assays \$291.45. The vein itself is 4 ft. wide and this rich streak is near the hanging-wall side. The entire 4 ft. is shipping ore.

Pioneer—The 50-ton cyanide plant is expected to be ready to treat ore this week.

Homestake—The new Homestake King mill is treating 100 tons of ore per day and is working perfectly.

West Extension—A siding is being built to accommodate the West Extension, which has guaranteed a daily shipment of 30 tons to the new mill at Beatty. The west and south drifts are in milling ore running from \$10 to \$23 per ton.

Original Bullfrog—Arrangements have been made to ship a carload of ore from the Original Bullfrog to the Shoshone mill.

Tramp Consolidated—Sacking ore still goes on at the Tramp. It is expected that in a few days connection will be made between the tunnel and the shaft.

NYE COUNTY—MANHATTAN

Manhattan has four mills, with an aggregate capacity of 160 tons per day. Three of these mills are running full time, and the fourth, now being overhauled, will resume operations shortly. Since the settlement of the wage question, various companies now idle have been making preparations to resume operations.

A two-years' lease has been granted on the surface of the Big Chief, Toro Blanco, and Union Four properties to an Australian miner who has begun placing the old dumps. He has laid a pipe line from the Rose Nash shaft, has 12 men at work and his daily clean-up is averaging \$250.

Cañon Mill—This mill has installed a new pump for its presses and has resumed full shifts.

NYE COUNTY—RHYOLITE

Keane Wonder—This mine has this week shipped to the First National Bank of Rhyolite a gold brick weighing 700 oz. and worth \$16 per ounce.

NYE COUNTY—TONOPAH

Production—The output of Tonopah for the week ending Aug. 11 amounted

to 5995 tons worth \$153,025, as follows: Tonopah Extension, 90 tons; Tonopah Mining, 3800 tons; Belmont, 700 tons; Montana Tonopah, 1015 tons; MacNamara, 150 tons; West End, 90 tons; North Star, 50 tons.

Belmont—The big vein encountered in the new drift from the No. 4 south crosscut on the 1000-ft. level has been opened up for 200 ft. in the drift and the stopes show an average width of 14 ft. of milling ore. A winze down from this level 37 ft. is all in ore.

Tonopah Extension—The work of blocking out ore between the 550- and 600-ft. level continues in this property. Two raises have made connection between these two levels. The average width of the vein is 5 ft.

MacNamara—Since the settling of the apex litigation with the West End, the MacNamara company has been busy getting ready to work the east end of its property. A new compressor has been ordered and several more machine drills will be put to work.

Tonopah—The Mizpah shaft is now down 1086 ft. and will go to the 1300-ft. level before any more crosscutting will be done.

Oklahoma

OTTAWA COUNTY

An oil-pipe line is being laid from Miami to the mines where oil will be used for fuel.

Emma Gordon—This company is planning to install roasters to roast the ores. The ore has been running about 8 per cent. iron and 8 per cent. bitumen.

Miami-Yankee—This company, operating at Miami, has purchased a reduction of the royalty from 30 to 19 per cent.

Miami-Peoria Royalty Company—This company has been organized with a capital stock of \$100,000, equally divided among E. M. Chapman, H. P. Hall, A. L. McCawley, C. S. Bahney and W. C. Thomas, all of Carthage, Missouri.

Oregon

BAKER COUNTY

Blue Jacket—In this mine, near Sumpter, tunnel No. 2 has opened up a promising orebody. Prospecting work is to be continued by crosscuts from the tunnel.

Sandow Group—In this group, near Sumpter, a crosscut on the 240-ft. level has opened a vein running well in gold. The mine is worked by E. Shelton and associates.

Pennsylvania

ANTHRACITE COAL

Coalbrook—At this colliery of the Delaware & Hudson Company, the breaker is being rebuilt, and a steel conveyer put in to carry coal from the mine to the breaker.

Delaware, Lackawanna & Western—This company's great central power plant at Hampton, in the Keyser valley, is now completed and in operation. This plant has a capacity of 10,000 h.p., and furnishes power to 20 collieries owned by the company.

BITUMINOUS COAL

Jutte & Company—A suit has been brought to foreclose a mortgage for \$1,600,000 on coal lands owned by this company in Pike Run township, Washington county.

Ivory Hill—This mine, at Nant-y-glo, has been leased to Estep Brothers, of Ebsburg, Penn. The mine has a capacity of 100,000 tons a year.

Catsburg Colliery—Work is in progress on two new tipples at these mines of the Monongahela River Consolidated Coal and Coke Company, one of which will be for rail and the other for river shipments. The old river tipple has been in constant use, but the rail tipple has been out of service for some years, the company having exhausted all the coal adapted for rail shipment. New acreage adjacent has been acquired, and it is for the mining of this that the new tipple and other improvements are being made.

Emerald Coal Company—This new company has bought a tract of 5228 acres of coking coal in Greene county from J. V. Thompson, of Uniontown, and others. The price is said to have been about \$300 per acre. It is in Morgan township, and adjoins lands of the Bessemer Coke Company and the Pittsburg-Buffalo Coal Company. The land will be opened up, and an extension of the Pennsylvania railroad Marianna branch about 2½ miles will be built to reach it. The incorporators of the new company are Julian Kennedy and Reid Kennedy, Pittsburg; Thomas L. Daly, Bellevernon; R. C. Crawford and James Henderson, of McKeesport, Penn. The coal is said to average about 7 ft. thick, and to be a good coking coal.

South Dakota

LAWRENCE COUNTY

Golden Placer—The annual meeting will be held here Sept. 3, when it is planned to authorize the raising of \$30,000 for the further development of the property and equipment of the mill, the only one of its kind in the Black Hills.

Pennsylvania—Work will probably be resumed after the annual meeting in Williamsport, Penn., on Sept. 5. The property in Deadwood gulch contains phonolite ore that has not been worked for more than four years.

PENNINGTON COUNTY

Crown—A company has been organized by Rapid City men, capitalized at \$500,000, and work on the ledge which extends 1500

ft. along the property, will be commenced at once. A large mill is to be erected, as the ore is well developed.

North Star—Frank Caughron is developing a high-grade gold property near Rochford, from which he hopes to ship this fall. He is constructing a small treatment plant on the ground.

Tennessee

PUTNAM COUNTY

Georgia-Tennessee Phosphate Company—This company's offices have been moved from Baxter to Boma. This company has just placed an order for an air compressor and drills to be used in the operation of mine No. 1, one-half mile from Boma.

Texas

The statistics collected by the *Oil Investors' Journal* show that petroleum production in the Gulf Coast region in July averaged 41,080 bbls. a day, indicating a daily surplus of 3844 bbl. and an increase in stock amounting to 119,175 bbl. for the month. The estimated output for the month just closed was 21,000 bbl. less than the June record, being put at 1,273,500 bbl. Southeast Texas is credited with 817,200 bbl. gross production, a daily average of 26,361 bbl., as compared with a daily average of 26,720 bbl. in June.

Forty-one wells were completed in the Gulf Coast region in July; 28 being producers with initial output of 9,225 bbl. and 13 being dry. The June record was 71 completions, of which 45 were producers, 25 were dry, and one at Humble a gasser. On July 31 there were 101 wells drilling and 10 rigs up in the Gulf Coast region, as compared with 94 wells drilling and rigs at the end of June.

Utah

BEAVER COUNTY

King David—This company has ordered a large steam hoisting plant, capable of developing the mine to a depth of 2500 ft. A five-mile pipe-line is being laid to supply water. This company was organized about two weeks ago. It owns over 70 lode mining claims near the Horn Silver mine, and began active operations with \$50,000 in the treasury for development purposes.

Newhouse Mines and Smelters Company—The first ore found on the 900-ft. level of the Cactus mine assays 4 per cent. copper.

PIUTE COUNTY

Gold Development—Resumption of development work at the properties of this corporation, controlled by Philadelphians, has been ordered.

SALT LAKE COUNTY

Utah Apex—This company has closed a two-years' contract with the American Smelting and Refining Company, and is shipping 50 tons of lead ore per day.

Bingham Central Standard—Ore shipments are again being made from this property. One lot sold this week assayed 25 oz. silver, 4.5 per cent. copper and 30 per cent. lead. The indebtedness of the company will be paid off this month.

Emma—This famous old Alta producer has passed into the control of Jesse Knight and associates of Provo, Utah. Negotiations are being made to obtain adjoining ground.

Utah-Bingham—A new compressor is being installed at this property, which is controlled by an English syndicate. Engineers claim that there are 100,000 tons of ore blocked out in the mine.

SUMMIT COUNTY

Park City Ore Shipments—Last week the Daly-Judge shipped 245 tons; Silver King, 686; Daly-West, 575; total, 1506 tons.

Grasselli Chemical Company—The capacity of the mill for zinc ore will be immediately doubled; E. Nesbit will be the engineer in charge of construction. The present capacity of the mill is 150 tons per day.

Little Bell—Work has been resumed at this property. It is controlled by the Daly-West Mining Company.

Canada

ONTARIO-COBALT DISTRICT

Ore Shipments—Cobalt—Shipments of ore from Cobalt for the week ending Aug. 15 were as follows: Coniagas, 63,780 lb.; Cobalt Central, 46,170; Drummond, 185,480; La Rose, 339,170; McKinley-Darragh, 125,780; Nipissing, 174,360; O'Brien, 128,250; Silver Queen, 164,680; Hudson Bay, 194,500. Total, 1,422,170 pounds.

City of Cobalt—A vein of good ore has been discovered at a depth of 200 ft. in the drift being driven toward the main shaft from the bottom of the winze that has been sunk from the 143 ft.-level. This vein has already been developed on the 143 level, but where just cut it is richer and will assay about 4000 oz. silver per ton.

Little Nipissing—A vein of good ore, 13 in. wide, has been found on the 100-ft. level a few feet from the main shaft. In this vein free native silver and cobaltite occur along with calcite.

McKinley-Darragh—Work is being rushed on the new 20-stamp mill close to No. 1 shaft. It will have a daily capacity of from 60 to 75 tons. The company has on hand large dumps of low-grade ore ready for treatment. A crosscut, 150 ft. long, is being driven from the main workings through the right of way of the Temiskaming & Northern Ontario Railway and under Cobalt lake.

Muggley Concentrator—Last month the concentrator treated an average of 70 tons per day. The ore came from the dumps

of the Townsite and Silver Queen mines. An automatic sampler is being installed.

ONTARIO-CHIPPEWA

British Canadian Smelter Company—The smelter building, 60x140 ft., has been completed, and operations will begin shortly. The smelter will handle ore from Cobalt and also foundry and jeweler's waste.

ONTARIO-MANITOU LAKE DISTRICT

Paymaster—Preparations are being made for the installation of a 10-stamp mill at this gold mine. The machinery was freighted to the mine ten years ago by the Reliance company, now defunct, and was never erected.

ONTARIO-MONTREAL RIVER DISTRICT

Cartwright Location—R. A. Cartwright, who some time ago discovered a vein carrying niccolite and native silver at Bloom lake about 30 miles west of Elk lake on the Montreal river, has organized a syndicate, including A. E. Barlow, H. E. T. Haultain, Clifford Smith, J. W. Evans and others, for developing the property.

Mexico

CHIHUAHUA

Rio Plata—A recent shipment of 29 tons gave returns of more than 103,000 pesos. The concentrates ran 1212 oz. silver and the crude ore 2316 oz. silver to the ton. A late report of the mine superintendent states that there is 6 ft. of 212-oz. ore in the face of the tunnel in progress on the newly-opened orebody. The company's general manager, D. W. Shanks, accompanied by Mark R. Lamb, is at the mine superintending the installation of the Moore filter presses and other cyanide machinery.

Parral Production—The production of the Parral camp for the week ending August 8 amounted to 8150 tons, of which 5040 tons were treated at local milling plants and the balance sent to outside reduction works. This is an increase of about 1000 tons over the preceding week.

Almoloya—This company is carrying on extensive developments at its San Enrique property adjoining the Cigarrero mine in the vicinity of Baca. A three-compartment shaft is in progress to 1500-ft. depth. N. O. Bagge is the general manager and V. C. Joslyn is the superintendent in charge of mining operations.

Dios te Guie—The Earl Syndicate, of which Alexander Bonthron is general manager, is systematically developing this property in the Sierra Madre section. Installations of machinery are planned.

Providencia—This property, adjacent to the Refugio and La Luz mines, in the Parral section, has lately been equipped with heavier hoisting machinery and other improved surface works. Considerable orebodies have been exposed and plans are being formulated for a milling plant. W. W. Robinson, of Kansas City, is the owning operator.

GUANAJUATO

Production—Shipments from the Guanajuato district for the week ending Aug. 8 increased over the previous weeks. The output of bullion reached \$160,000. Concentrates amounted to \$89,000; total value of week's shipments, \$249,000. The market price of silver is now lower than at any other time during the past eight years and Guanajuato is maintaining a large output notwithstanding the light demand.

VERA CRUZ

Burning Oil Well—The Pearson company has been using four large centrifugal pumps throwing great volumes of water, sand and gravel into the mouth of the burning oil well at Dos Bocas, and two more have been ordered. According to late reports the fire in the crater still continues but it is thought the latest method for smothering the fire is gaining control. As soon as the well is securely capped another will be sunk near the old one, every precaution being taken to control the flow.

Central America

COSTA RICA

Aguacate Mines—This company is about to erect a 100-stamp mill, and the superintendent, A. M. Yonge, whose address is at San Mateo, Costa Rica, would like to receive catalogs from makers of mining machinery. The company's office is at 43 Exchange place, New York.

Europe

GERMANY

In an explosion of firedamp in the Dudweiler coal mine, at Saarbrucken, Rhenish Prussia, on August 11, 13 miners were killed and 30 injured. A number of the miners are also missing, and it is believed they are entombed in the workings, with little chance of their being rescued. The mine was one of the largest in Prussia, and the loss will be heavy.

Africa

WEST AFRICA

Gold production in July is reported by the South African Chamber of Mines at 24,587 oz. bullion. For the seven months ended July 31 the total was 169,359 oz. in 1907, and 174,206 oz. in 1908; an increase of 4847 oz. The bullion reported this year was equal to \$3,276,608, or 158,520 oz. fine gold.

New Caledonia

Exports of minerals from the colony for May and the five months ended May 31 are reported by the *Bulletin du Commerce*, of Noumea, as follows, in metric tons:

	May.	Four Mos.
Nickel ore.....	16,263	43,781
Cobalt ore.....	241	1,553
Chrome ore.....	10,603	16,548

Exports of nickel and chrome ore in May were unusually large.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Aug. 26—In the West the Indiana strike has been ended. The national authorities of the Mine Workers decided that the local officers had no right to order a strike, and that the miners must return to work, pending negotiations over the disputed clause in the agreement. The mines have started again, after a stoppage of two weeks. Otherwise the coal trade shows no change.

The strike in Alabama has developed much hard feeling and some violent outbreaks. The coal companies, however, continue firm in their refusal to treat with the union.

The Seaboard bituminous trade continues quiet, but there are signs of a better feeling. The Coastwise trade is improving. The anthracite trade remains dull.

The attorney-general of New York has brought suit against the anthracite railroads and their subsidiary coal companies, charging that, in violation of the so-called Donnelly anti-monopoly act they "have effected and are now carrying out an agreement which in effect constitutes a monopoly of the hard-coal business within the State, and that such an agreement restricts the production and regulates and fixes the prices at which coal can be sold in the State of New York." The court has issued an order directing the taking of testimony on the complaint, to begin Aug. 31, in Albany.

COAL TRAFFIC NOTES

Tonnage originating on Pennsylvania railroad lines east of Pittsburgh and Erie, year to Aug. 15, in short tons:

	1907.	1908.	Changes.
Anthracite.....	3,592,117	3,178,254	D. 353,863
Bituminous.....	23,969,254	20,162,724	D. 3,806,530
Coke.....	8,795,377	4,195,605	D. 4,599,772
Total.....	36,296,748	27,536,583	D. 8,760,165

Total decreases this year to date was 24.1 per cent.

Coastwise shipments of coal from Atlantic ports six months ended June 30, long tons:

	Anthracite.	Bitum.	Total.	PerCt.
New York....	7,946,823	4,899,875	12,846,698	64.1
Philadelphia	1,131,564	2,241,933	3,373,497	16.8
Baltimore....	131,560	1,773,658	1,905,218	9.5
Newp't News	.....	1,212,240	1,212,240	6.0
Norfolk.....	.....	715,686	715,686	3.6
Total.....	9,209,947	10,843,392	20,053,339	100.0
Total, 1907.	9,820,817	11,347,683	21,168,500	.....

Total decrease this year, 1,115,161 tons, or 5.3 per cent. New York includes all the New York harbor shipping ports.

Bituminous coal and coke shipments,

Pennsylvania and West Virginia, six months ended June 30, short tons:

	Coal.	Coke.	Total.
Balt. & Ohio.....	9,950,185	1,276,186	11,226,371
Buff., Roch. & Pitts.	2,602,411	178,216	2,780,627
Penn. lines, N. Y. C.	3,043,107	32,392	3,075,499
Pitts. & L. Erie.....	3,193,820	1,242,627	4,436,447
Norfolk & Western.	4,785,870	905,645	5,691,515
Total.....	23,575,398	3,635,066	27,210,469
Total, 1907.....	31,077,569	7,187,960	38,265,529

Decrease this year in coal, 24.1 per cent.; in coke, 49.4; total, 28.9 per cent. In addition to the above the Baltimore & Ohio carried 535,141 tons anthracite in 1907, and 397,656 in 1908; decrease, 137,485 tons.

New York

ANTHRACITE

Aug. 26—The local market continues dull, and the approach of September, when discounts will cease, seems to have no effect. Both prepared and steam sizes are in plentiful supply.

Quotations by the large dealers are as follows: Broken, \$4.65; egg, stove and chestnut, \$4.90; pea, \$3.25@3.50; buckwheat No. 1, \$2.35@2.50; buckwheat No. 2, or rice, \$1.60@2; barley, \$1.35@1.50; all f.o.b. New York harbor.

BITUMINOUS

There is some improvement in the Seaboard market, but it is of an uneven and spasmodic kind. Orders come from some quarters for a short time and then stop unexpectedly. Producers are working irregularly on this account, and it is difficult to gage the output. Car supply presents no difficulties; transportation from mines to tidewater is fair, cars taking about a week to come through.

In New York harbor business is still quiet. Ordinary grades of Clearfield are quoted about \$2.40, with the best grades at \$2.55.

Consumers in the shoalwater ports seem to have been taking advantage of low freight rates, and some of them have been putting in stock at an unusually early date. This will reduce the usual rush in October.

The Interstate Commerce Commission having upheld the claims of the producers, the Baltimore & Ohio has issued a new tariff, reducing the rate on "small-vein" Cumberland and George's Creek coal to tidewater 15c. below that charged on "big-vein" coal. This point has been in controversy some time. The reduction makes the rate on small-vein coal about the same as that on Clearfield to tidewater.

In the Coastwise trade, vessel rates are

hardening, chiefly owing to an increase in rates in the lumber trade. There has been no increase in quoted rates, but owners are making no concessions. Rates are, for large vessels, from Philadelphia: Boston, Salem and Portland, 50@55c.; Lynn, 60@65c.; Portsmouth, 55@60c.; Newburyport, Gardner and Bangor, 70@75c.; Bath, 65@75c.; Saco, 90c.; to the Sound, 50 cents.

Birmingham

Aug. 24—By degrees the coal production in Alabama is picking up and it will not belong before the new men, replacing the striking miners, will be sending out a steady supply. The military and deputies on duty throughout the mining district in Alabama have been vigilant of late and, barring bushwhacking and occasional throwing of dynamite, have held down conditions well. There is a heavy influx of new labor, but it will take some little time to get the men in shape for good results. All the larger corporations in the district have joined the Operators' Association and announce positively that there will be no recognition of the union. Some coal and coke is being brought into the Birmingham district and used at the furnaces.

Chicago

Aug. 24—There is little progress in the coal market. The increase in sales of Eastern coals is the only favorable sign. Steam consumption has not picked up generally yet.

The supply of light coals is small; of prepared sizes, heavy, compared with the demand.

Illinois and Indiana lump and egg are \$1.75@2.25; run-of-mine is \$1.60@1.75 and screenings \$1.35@1.55.

Of Eastern coals Hocking and smokeless are strong. Hocking sells for \$3.15; smokeless is at \$3.15 for run-of-mine and \$4.20@4.35 for lump and egg. Youghioheny is quiet at \$3.15@3.25 for ¾-in. lump.

Pittsburg

Aug. 25—Coal production in the Pittsburg district at the beginning of the week was at a rate of less than 60 per cent. It likely will drop to below 40 per cent. next week as the lake docks are congested with coal. The river coal mines are doing practically nothing, as almost every barge and coal boat in the pools is loaded. There was sufficient water to permit one or two

tows of "empties" to come in, but there will be no haste in loading them as there is a stock of over 20,000,000 bush. ready to go out as soon as the rivers are navigable. Prices are firmly maintained on the basis of \$1.15 for mine-run coal at mine. Slack continues to be a drug; and several sales were made during the week at 25c. a ton. Some operators are storing their slack and refuse to quote less than 75c. a ton.

Connellsville Coke—More ovens are being fired each week by the independents and the H. C. Frick Coke Company. While individual sales have not been large they aggregate over 30,000 tons. All coke sold on contract went at prices as follows: Furnace coke, \$1.65@1.75; foundry coke, \$2.10@2.25. For prompt shipment these prices can be shaded, a sale of 2000 tons of furnace coke being made at \$1.50. The *Courier* in its summary for the week gives the production in both regions at 193,492 tons. Shipments, 7784 cars as follows: To Pittsburg, 3126; to points west of Connellsville, 4236; to points east of Connellsville, 422 cars.

Foreign Coal Trade

United States Coal Exports—The coal supplied to vessels engaged in foreign trade at United States ports, six months ended June 30, was 2,835,547 tons in 1907, and 3,024,793 in 1908; increase, 189,246 tons. Adding the exports, previously reported, makes the total coal sold for consumption beyond the limits of the United States for the six months 8,503,789 tons in 1907, and 8,324,683 in 1908; decrease, 179,106 tons, or 2.1 per cent.

Nova Scotia Coal Shipments—Shipments by companies from Nova Scotia mines, seven months ended July 31, long tons:

	1907.	1908.	Changes
Dominion.....	1,745,195	1,898,467	I. 153,272
N. S. Steel.....	323,287	360,355	I. 37,068
Cumberland.....	213,413	222,865	I. 9,452
Acadia.....	172,974	187,355	I. 14,381
Intercolonial.....	155,816	153,769	D. 2,047
Inverness.....	130,997	152,666	I. 21,669
Total.....	2,741,682	2,975,477	I. 233,795

All the companies but one show gains this year, the total increase being 8.5 per cent.

Iron Trade Review

New York, Aug. 26—The markets, as a rule, show little change. More inquiries for pig iron are reported, but comparatively few sales. Prices are still low, and consumers are not ready to pay any advance. Southern iron seems to be in the strongest position just now, and makers are not inclined to make concessions.

In finished material rail orders continue to be small. Some bridge work is reported, and there are inquiries for more. Some good building contracts have been let, but most structural work seems to be held up for future developments. Specifications on contracts are coming in a

little more freely. On the whole, however, the volume of business seems to increase slowly.

Baltimore

Aug. 25—Exports from Baltimore for the week included 868,347 lb. scrap tin to Rotterdam; 1204 tons steel billets to Liverpool. Imports included 201 tons ferromanganese and 196 tons manganese ore from Rotterdam; 3400 tons cupriferous pyrites from Spain; 6200 tons iron ore from Cuba.

Birmingham

Aug. 24—Alabama manufacturers report the pig iron market still improving. There have been some inquiries received for immediate delivery iron and the \$13 quotation given. Some inquiries have been received for iron delivery during the first quarter of next year but as far as can be learned none of this business has been booked as yet. The make in the South is holding up well. The general price now for iron is around \$12.50 per ton, No. 2 foundry basis.

The feature of the past week was the resumption of operations at the rolling mills of the Tennessee Coal, Iron and Railroad Company at Bessemer. This plant rolls steel mostly and it is understood that 300 men will be given steady employment. The steel plant at Ensley is doing exceptionally well.

Nothing has been given out lately concerning the probable starting up of the plants of the Southern Steel Company.

Chicago

Aug. 24—The market for iron and steel continues to hold its own; little more can be said. In the pig-iron market there is a continued buying of small lots—a carload to 1000 tons—but no general advance to business for the future.

Southern No. 2 iron brings \$12.50@13 Birmingham, or \$16.85@17.35 Chicago. Northern iron of the same grade is obtainable at \$17@17.50, with the result that most of the buying is of Southern. The consumer will not endure the difference. Lake Superior charcoal is obtainable at \$19.50@20, with supplies scarce. These prices are on small lots for delivery in the last quarter of the year or sooner, the rule still obtaining that for early deliveries prices are light.

The average consumer, who makes the market, is still a bear. He will not buy more than he needs for quick consumption.

Coke is quiet, the supply being ample at \$4.90 for the best Connellsville.

Philadelphia

Aug. 26—A condensed view of the pig-iron market today is that so far as this territory is concerned there has been such a depletion of stocks, either by actual dealings or by selling for future delivery,

as to make it possible to do some business for fourth-quarter delivery at an advance of 50c. The tone of the market is stronger. A better feeling prevails. But the sagging factor is the large idle capacity. All buying is conservative and most of it for early delivery. The dull-est pig iron is forge. In basic pig, everything is talk. The foundry people show more activity, but their purchases are all for small lots. There is not a sign of speculative buying.

No. 2X is quoted at \$16.50; basic, \$15.50, and forge about the same.

Steel Billets—Inquiries are more numerous and some few orders were placed within a few days.

Bars—The only change in the situation is that there are more buyers snuffing around after fall iron.

Merchant Steel—Agents handling ordinary steel stocks are doing a fair business.

Nails—Hardware houses report an improved retail demand.

Wire Products—There has also developed quite a retail demand for wire products.

Pipes and Tubes—A larger amount of repair work into which tubes enter is coming along. In merchant pipe conditions are slightly better. In cast pipe the foundries are quite busy.

Plates—No large orders and the market is devoid of interest.

Structural Material—Present business is disappointing.

Scrap—Holders of heavy scrap have refused business this week. They want more money.

Pittsburg

Aug. 25—This week is a dull one as to new business, but there is no decline in the operation of the mills in the Pittsburg district. Specifications on old contracts are coming in freely. It is reported that the National Tube Company has taken an order for about 100 miles of line pipe, but the report was not confirmed. It was announced that business is improving and that about 60 per cent. of the capacity of the different plants is being turned out. The big Standard Oil Company contract has not been closed. The Spang-Chalfant Company is running its plant nearly to capacity and is reported to have a contract this week for 30 miles of line pipe. Merchant bars, wire products and sheets are the most important lines as to demand. The American Sheet and Tin Plate Company has added more sheet mills to its active list. The tinplate trade does not show any improvement. No change is noted in the plants of the Carnegie Steel Company in this district. It seems to be the impression here that there is considerable truth in the report that the railroads and the rail makers will get together some time next month and

during October a heavy tonnage of rails will be placed for 1909 delivery.

Pig Iron—The Standard Sanitary Manufacturing Company, as reported recently, bought 9600 tons of Northern, Southern and Virginia iron for September and October delivery. It has decided to cover for part of its November and December requirements and closed yesterday for 3500 tons of Northern iron in the Pittsburg district and from an outside furnace which takes a freight rate of 75c. While the price on this iron, No. 2 foundry, was \$15.40 at furnace, it is equivalent to a higher price at the Valley furnaces on account of the lower freight rate. Foundry iron continues strongest, being quoted this week at \$14.75@15, Valley furnaces. Bessemer iron is still declining, the lowest quotation, based on the last sale, being \$15.25, Valley. Basic and malleable bessemer are quoted at \$14.50@14.75 and gray forge at \$13.75@14 at furnace.

Steel—The market is dull; prices unchanged for billets at \$25, Pittsburg. Plates are quoted at 1.60c. and steel bars at 1.40c.

Sheets—The market continues to improve, and prices are firm at 2.50c. for black sheets and 3.55c. for galvanized, No. 28 gage.

Ferro-Manganese—Prices unchanged at \$45@46, Pittsburg.

Foreign Iron Trade

German Steel Syndicate—The report of the Steel Syndicate for the year ended March 31, 1908, shows the following shipments, in metric tons:

	Domestic.	Export.	Total.
Billets, blooms, etc...	1,187,121	269,324	1,456,445
Rails and fastenings.	1,624,473	744,185	2,368,658
Shapes, plates, etc...	1,176,136	425,769	1,601,905

Total..... 3,987,730 1,439,268 5,426,998

The total shipments for the previous year were 5,756,797 tons, showing a decrease last year of 329,799 tons, or 5.7 per cent. The decrease was chiefly in shapes and plates, and in billets (half-finished material); rails showed an increase.

Metal Market

Gold and Silver Exports and Imports

NEW YORK, Aug. 26.

At all U. S. Ports in July and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
July 1908..	\$ 4,845,272	\$ 2,916,408	Exp. \$ 1,928,864
" 1907..	7,478,366	3,410,782	" 4,067,584
Year 1908..	58,363,247	29,324,304	" 29,038,943
" 1907..	43,779,098	24,879,429	" 18,899,669
Silver:			
July 1908..	4,930,746	2,982,074	Exp. 1,948,672
" 1907..	5,955,042	3,387,225	" 2,567,817
Year 1908..	30,445,291	24,123,422	" 6,321,869
" 1907..	35,174,251	25,782,836	" 9,391,415

Exports of specie from New York, week ended Aug. 22: Gold, \$8000, to Haiti; silver, \$787,530, to London and Paris. Imports: Gold, \$306,674, from South America and Australia; silver, \$46,099, from the West Indies and Mexico.

Specie holdings of the leading banks of the world, Aug. 22, are reported, as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	\$331,266,700
England.....	\$191,436,295	.....	191,436,295
France.....	644,641,360	\$181,327,050	825,968,410
Germany.....	200,510,000	83,100,000	283,610,000
Spain.....	78,445,000	138,905,000	217,350,000
Netherlands....	38,525,500	20,870,500	59,396,000
Belgium.....	19,896,665	9,948,335	29,845,000
Italy.....	183,680,000	22,000,000	205,680,000
Russia.....	582,280,000	40,330,000	622,610,000
Aust.-Hungary..	235,285,000	66,180,000	301,465,000
Sweden.....	20,150,000	.....	20,150,000
Norway.....	8,800,000	.....	8,800,000
Switzerland....	23,080,000	.....	23,080,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

Silver Market

SILVER AND STERLING EXCHANGE.

August.	Sterling Exchange.	Silver.		August.	Sterling Exchange.	Silver.	
		New York, Cents.	London, Pence.			New York, Cents.	London, Pence.
20	4.8640	51 1/2	23 1/2	24	4.8605	51 1/2	23 1/2
21	4.8625	51 1/2	23 1/2	25	4.8580	51 1/2	23 1/2
22	4.8615	51 1/2	23 1/2	26	4.8580	51 1/2	23 1/2

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

The Indian bazaars are still buying only in a moderate way, and the price of silver continues to rule low, with present quotation about the lowest for five years. The market is fairly steady, however, at the present low figure.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Aug. 13:

	1907.	1908.	Changes.
India.....	£7,705,924	£5,313,753	D. £2,392,171
China.....	.....	516,400	I. 516,400
Straits.....	544,012	90,510	D. 453,502
Total.....	£8,249,936	£5,920,663	D. £2,329,273

Receipts for the week were £224,000 from New York. Exports, £2000 to Egypt, £128,000 coin to Singapore, and £138,200 to India; £268,200 in all.

Copper, Tin, Lead and Zinc

DAILY PRICES OF METALS.

August.	Copper.			Tin.	Lead.	Spelter.	
	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.			New York, Cts. per lb.	St. Louis, Cts. per lb.
20	13 1/2 @13 1/2	13 1/2 @13 1/2	59 1/2	29 1/2	4.57 1/2 @4.60	4.65 @4.70	4.50 @4.55
21	13 1/2 @13 1/2	13 1/2 @13 1/2	60	29 1/2	4.57 1/2 @4.60	4.65 @4.70	4.50 @4.55
22	13 1/2 @13 1/2	13 1/2 @13 1/2	.....	29 1/2	4.57 1/2 @4.60	4.65 @4.70	4.50 @4.55
24	13 1/2 @13 1/2	13 1/2 @13 1/2	60	29 1/2	4.57 1/2 @4.60	4.65 @4.70	4.50 @4.55
25	13 1/2 @13 1/2	13 1/2 @13 1/2	60	28 1/2	4.57 1/2 @4.60	4.65 @4.70	4.50 @4.55
26	13 1/2 @13 1/2	13 1/2 @13 1/2	60 1/2	29	4.57 1/2 @4.60	4.65 @4.70	4.50 @4.55

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 made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The activity of speculators, to which reference was made in our last issue, continued throughout this week, but they did not succeed in depressing prices further. Consumers have been picking up the lots which came on the market, and it is now anticipated that the market will soon be free of this influence, which would certainly improve the outlook for an early betterment of conditions. In the meanwhile these speculative transactions have produced some extraordinary variations. One considerable sale of electrolytic copper was made during the last week at 13 1/2c., while on the other hand a sale of several hundred thousand pounds of Lake copper for delivery late in September and in October was made at 13 7/8c. Neither of these transactions is representative of the real market, which has ruled about the same as in the previous week. The close is steady at 13 1/2@13 3/4c. for Lake copper; 13 3/8@13 1/2c. for electrolytic in ingots, cakes and wirebars; 13 1/8@13 1/4c. for casting copper.

The standard market in London moved within narrow limits throughout the week. It seems that prices have reached their natural level as compared with refined sorts, and the quotations are cabled at £60 7s. 6d. for spot, £60 2s. 6d. for three months.

Refined and manufactured sorts we quote: English tough, £63 10s.@64 10s.; best selected, £63 10s.@64 10s.; strong sheets, £75 10s.@76 10s.

Exports of copper for the week from New York and Philadelphia, 9514 long tons. Exports from Baltimore, reported by our special correspondent, 406 tons of copper.

Manufactured Copper—Sheets, cold-rolled, 19c.; hot-rolled, 18c. Wire, 15 1/4c. base.

Tin—The London market has remained without special feature, moving between the high, £133 5s. for spot, £134 for three months, and the low, £131 15s. for spot, £132 for three months. The close is cabled as strong as £132 10s. for spot, £133 5s. for three months.

The domestic market has been very narrow and the fluctuations were insignificant. Consumers have not shown any interest and the small business that was done was among traders. At the close spot and future tin can be bought at about 29 cents.

Lead—The market is quiet and unchanged at 4.57 1/2@4.60c. New York.

Large arrivals were pressed for sale in the London market and caused a rather weak tendency throughout the week, the close being lower at £13 6s. 3d. for Spanish lead, £13 8s. 9d. for English lead.

Spelter—This metal has been rather neglected, but in spite of the absence of a larger demand there is but little inclination on the part of smelters to meet even current prices, since the supply of ore is diminishing right along, and so is the margin between the ore and the refined metal. In fact, it is estimated that the present ore production is not adequate to supply the current requirements of spelter on the part of the consumers, and that the large accumulations which have been such a menace to the market, have been heavily drawn upon, so that they are now materially less than they were two months ago. The close is unchanged at 4.65@4.70c. New York, 4.50@4.55c. St. Louis.

The London market has declined further, quotations being cabled as £19 2s. 6d. per ton for good ordinaries, £19 7s. 6d. for specials.

Zinc Sheets—Base price is 7c. f.o.b. La Salle-Peru, Ill., less 8 per cent.

Other Metals

Antimony—The market has been very quiet abroad, and in New York only a retail business has been done. Prices are unchanged at 8¼c. for Cookson's, 8@8¼c. for Hallett's, 7¾@7¼c. for ordinary brands.

Aluminum—Ingots, American No. 1, in large quantities, 33c. per lb. Rods and wire, 38c. base; sheets, 40c. base.

Cadmium—In 100-lb. lots, \$1.25 per lb., at Cleveland, Ohio.

Nickel—According to size of lot and terms of sale, 45@50c., New York.

Quicksilver—New York price is \$43 per flask for large lots, higher for jobbing orders. San Francisco is nominal at \$42 for large orders, domestic delivery, and \$40@40.50 for export. London, £17 7s. 6d. per flask, with 1s. 3d. less quoted, from second hands.

Platinum—While the large interests are holding prices at \$20 per oz. for ordinary metal, and \$22 for hard, there are said to be considerable stocks of refined platinum in New York, and offers have been made at \$17.50@19 per oz. This price is the lowest reported in New York for nine years.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, seven months ended July 31, figures in long tons, except quicksilver, which is in pounds:

	Imports.	Exports.	Excess.
Copper.....	98,846	36,317	Imp. 62,529
Copper, 1907..	65,229	41,926	Imp. 23,303
Tin.....	26,839	23,784	Imp. 3,055
Tin, 1907.....	25,272	21,777	Imp. 3,495
Lead.....	134,778	32,664	Imp. 102,114
Lead, 1907.....	113,637	28,954	Imp. 84,683
Spelter.....	61,666	4,757	Imp. 56,909
Spelter, 1907..	64,594	3,125	Imp. 61,469
Quicksilver, lb.	3,021,528	926,701	Imp. 2,094,827
Quicksilver, '07	2,845,346	1,431,618	Imp. 1,413,728

Copper totals include metallic contents of ore and matte. Tin ore imports, not given above, 12,515 tons in 1907, and 15,559 in 1908. Imports of iron and copper pyrites, 459,289 tons in 1907, and 493,773 in 1908. Of the imports this year the United States furnished 3964 tons copper matte, 41,488 tons fine copper and 22,831 tons lead. Exports include re-exports of foreign material.

Missouri Ore Market

Joplin, Mo., Aug. 22—An apparent effort to lower the market early in the week was met by opposition from smelter agents, some of whom stepped in and took ore at prices current the previous week, causing the market to close firm on a base price of \$37 per ton of 60 per cent. zinc, ranging down to \$35. The highest price was \$40.50, and the average, all grades, was \$33.66. The highest bin price for lead was \$61, or \$61.50, delivered; medium grades sold at \$59@60.50, and the average, all grades, was \$60.48 per ton.

The shipment shows a net decrease of only 561 tons. The shipment approximates the output of the week, leaving the stock in bins about 5600 tons, over half of which is held for a material advance in price. The output has gradually increased until it is 1000 tons per week greater than six weeks ago. Following are the shipments of zinc and lead ore from the district for the week ending Aug. 22:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,801,190	580,540	\$84,225
Joplin.....	2,009,040	192,560	41,988
Badger.....	774,550	22,440	14,615
Oronogo.....	571,840	65,360	12,390
Galena.....	361,640	110,510	9,644
Prosperity.....	199,370	181,060	9,009
Duenweg.....	488,130	14,230	8,744
Alba-Neck.....	466,840	.....	8,402
Spurgeon.....	232,720	186,960	8,398
Granby.....	533,910	27,000	8,150
Miami.....	433,940	.....	5,641
Aurora.....	414,910	10,080	4,039
Zincite.....	153,660	3,700	2,723
Sarcocite.....	143,890	.....	2,592
Quapaw-Baxter.....	124,840	6,250	2,059
Carthage.....	60,840	.....	1,095
Carl Junction.....	30,960	5,590	723
Totals.....	10,802,270	1,406,220	\$224,437
34 weeks.....	318,463,910*	49,623,930	\$6,724,157
Zinc value, the week,	\$181,894;	34 weeks,	\$5,356,119
Lead value, the week,	42,543;	34 weeks,	1,368,038

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January...	45.84	35.56	January...	83.58	46.88
February...	47.11	34.92	February..	84.58	49.72
March.....	48.66	34.19	March.....	82.75	49.90
April.....	48.24	34.08	April.....	79.76	52.47
May.....	45.98	33.39	May.....	79.56	56.05
June.....	44.82	32.07	June.....	73.66	60.48
July.....	45.79	31.67	July.....	58.18	59.90
August.....	43.22	.....	August....	59.54	.....
September..	40.11	.....	September.	53.52	.....
October.....	39.85	.....	October....	51.40	.....
November..	35.19	.....	November..	43.40	.....
December..	30.87	.....	December..	37.71	.....
Year.....	43.68	.....	Year.....	68.90	.....

Wisconsin Ore Market

Platteville, Wis., Aug. 22—The highest price paid for zinc ore this week was \$38 on a basis of \$36@37 per ton of 60 per cent. zinc. For 80 per cent. lead ore \$60@61 per ton was paid. Shipments from the district, week ended Aug. 22:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton.....	898,560	48,640	.....
Platteville.....	441,580	.....	.....
Hazel Green.....	324,350	135,550	.....
Highland.....	220,600	.....	.....
Cuba City.....	170,000	58,800	.....
Galena.....	155,200	.....	.....
Linden.....	127,330	.....	.....
Livingston.....	94,000	.....	.....
Harker.....	30,000	.....	.....
Total.....	2,461,620	242,990	.....
Year to Aug. 22.....	59,435,381	7,051,595	1,262,014

Hazel Green shipped last week, not then reported, 468,300 lb. zinc ore. In addition to the above there was shipped to the electrostatic separator, at Platteville, 264,780 lb.; to the Joplin Separator Works, at Galena, 66,000 lb.; to the Enterprise roaster, at Platteville, 234,000 lb. zinc ore.

Chemicals

New York, Aug. 26—No material change can be reported in the market. Spot business is moderate only, and inquiries are not numerous. There have been few changes in prices; none of importance.

Copper Sulphate—Prices are unchanged and firm at \$4.65 per 100 lb. for carloads or over, and \$4.90 for smaller lots.

Nitrate of Soda—Trade is chiefly in small lots for early delivery. Prices are about 2.30cs. for spot, and 2.25@2.35c. for futures.

Mining Stocks

New York, Aug. 26—The general stock markets have been in an exceedingly confused and uncertain condition. On Saturday, Aug. 22, there was a wild market with heavy trading, on what is usually a light day. The conditions were so unusual and manipulation so strongly in evidence, that the governors of the Exchange have ordered an investigation. Since then trading has been light and the course of prices irregular.

On the Curb market copper stocks were strongly in evidence, with heavy buying and advancing prices. Nevada Consolidated was the leader. Cobalt stocks were also in demand, and showed large dealings, and prices will hold. The market closed rather dull.

Boston

Aug. 25—Happenings have been unimportant in this market the past week, and the trend of prices has been toward a slightly lower level. There has been no noticeable pressure, although profit-taking

has been quite general, especially in stocks that have had the greatest advance. This has been noticeable in Amalgamated, North Butte, Butte Coalition, Adventure and a few others. Two stocks that have been traded in on the curb were taken over into the unlisted department of the exchange last week, namely, Lake Mining and Miami Copper, the former a Michigan property and the latter in Arizona. Nevada Consolidated showed a degree of strength. Since Miami's listing, announcement has been made that the company intends to issue 100,000 shares of treasury stock at \$10 per share, thus bringing the total stock outstanding up to 600,000 shares. The issue has been underwritten. The declaration of a quarterly dividend of \$1 by the Quincy Mining Company, the same as three months ago, and \$1 by Calumet & Arizona, which is the same as the last payment, had a negative effect in both cases.

The late weakness in Mexico Consolidated is due to the fact that the company has had to borrow \$50,000 for four months at 6 per cent., giving in lieu thereof an option upon 10,000 shares of treasury stock for the same period at \$5 per share. The Davis-Daly reorganization plan has been modified. Instead of allowing an underwriting commission of 15 per cent., the \$2 assessment will be underwritten without commission.

At the annual meeting of the Calumet & Hecla Mining Company A. S. Bigelow was represented by counsel, who voted Mr. Bigelow's 23 shares in opposition to all the other voters.

STOCK QUOTATIONS

NEW YORK Aug. 25		BOSTON Aug. 25	
Name of Comp.	Cig.	Name of Comp.	Cig.
Alaska Mine.....	%	Adventure.....	10%
Amalgamated.....	77	Allouez.....	37
Anacnda.....	46%	Am. Zinc.....	27
Balaklala.....	2	Arcadian.....	3%
British Col. Cop.....	7%	Arizona Com.....	20%
Butte & London.....	14%	Bingham.....	60
Butte Coalition.....	26%	Boston Con.....	12%
Colonial Silver.....	%	Calumet & Ariz.....	118
Cum. Ely Mining.....	8%	Calumet & Hecla.....	3880
Davis Daly.....	2%	Centennial.....	33%
Dominion Cop.....	2%	Con. Mercur.....	43
Douglas Copper.....	4%	Copper Range.....	77%
El Bayo.....	3	Daly-West.....	9%
Florence.....	3%	Franklin.....	112
Foster Cobalt.....	44	Greene-Can.....	11%
Furnace Creek.....	17	Isle Royal.....	23
Giroux.....	4%	La Salle.....	14
Gold Hill.....	%	Mass.....	7%
Goldfield Con.....	6%	Michigan.....	13%
Granby.....	1102	Mohawk.....	64%
Greene Gold.....	%	Nevada.....	16%
Greene G. & S.....	1	North Butte.....	83
Greenw'r & D. Val.....	75	Old Colony.....	50
Guanajuato.....	2%	Old Dominion.....	140%
Guggen. Exp.....	177	Osecola.....	111
Hanapah.....	1.20	Parrot.....	26%
McKinley Dar.....	%	Quincy.....	96
Micmac.....	2%	Rhode Island.....	4
Mines Co. of Am.....	1%	Santa Fe.....	1%
Mitchell Mining.....	%	Shannon.....	14%
Mont. Sho.C.....	%	Superior.....	24
Nev. Utah M. & S.....	3%	Tamarack.....	70
Newhouse M. & S.....	6	Trinity.....	18
Nipissing Mines.....	9	United Cop., com.....	11%
Old Hundred.....	%	U. S. Oil.....	25%
Silver Queen.....	1.02	U. S. Smg. & Ref.....	41%
Stewart.....	1%	U.S.Sm. & Re.,pd.....	45%
Tennessee Cop'r.....	36%	Utah Con.....	46%
Tri-Bullion.....	1%	Victoria.....	5%
Union Copper.....	1%	Winona.....	6%
Utah Apex.....	4%	Wolverine.....	141
Utah Copper.....	14%	Wyandotte.....	2%
Yukon Gold.....	4%		

*Ex. Div. †Ex. Rights. ‡Last quotation.

N. Y. INDUSTRIAL

Am. Agri. Chem.....	24%
Am. Smelt. & Ref.....	94%
Am. Sm. & Ref., pf.....	107%
Bethlehem Steel.....	122
Colo. Fuel & Iron.....	33%
Federal M. & S., pf.....	187
Inter. Salt.....	18%
National Lead.....	83%
National Lead, pf.....	102
Pittsburg Coal.....	112
Republic I. & S.....	23
Republic I. & S., pf.....	77%
Sloss-Sheffield.....	163
Standard Oil.....	635%
U. S. Red. & Ref.....	115%
U. S. Steel.....	45%
U. S. Steel, pf.....	107%
Va. Car. Chem.....	26%

BOSTON CURB

Ahmeek.....	95
Black Mt.....	3%
East Butte.....	8
Hancock Con.....	16%
Keweenaw.....	6%
Majestic.....	.65
Raven.....	.98
Shawmut.....	1.30
Superior & Pitts.....	11%
Troy Man.....	.45

ST. LOUIS Aug. 22

N. of Com.	High.	Low.
Adams.....	.40	.30
Am. Nettie.....	.05	.03
Center Cr'k.....	2.25	1.75
Cent. C. & C.....	68.00	67.00
C.C. & C. pd.....	78.00	76.00
Cent. Oil.....	110.00	100.00
Columbia.....	4.00	3.00
Con. Coal.....	19.00	17.00
Doe Run.....	125.00	110.00
Gra. Bimet.....	.20	.18
St. Joe.....	15.00	13.00

LONDON Aug. 26

Name of Com.	Cig.
Dolores.....	£1 7s 0d
Stratton's Ind.....	0 1 0
Camp Bird.....	0 14 6
Esperanza.....	1 2 6
Tomboy.....	1 7 0
El Oro.....	0 8 6
Oroville.....	0 8 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Aug. 26.

Name of Comp.	Cig.	Name of Comp.	Cig.
COMSTOCK STOCKS		Silver Pick.....	.19
Belcher.....	.18	St. Ives.....	.32
Best & Belcher.....	.50	Triangle.....	.06
Caledonia.....	.20	BULLFROG STOCKS	
Chollar.....	.17	Bullfrog Mining.....	.03
Comstock.....	1.26	Bullfrog Nat. B.....	.04
Con. Cal. & Va.....	.81	Gibraltar.....	.05
Crown Point.....	.26	Gold Bar.....	.04
Exchequer.....	.25	Homestake King.....	.29
Gould & Curry.....	.12	Montgomery Mt.....	.08
Hale & Norcross.....	.22	Mont. Shoshone C.....	.81
Mexican.....	.73	Original Bullfrog.....	.01
Ophir.....	2.20	Tramp Cons.....	.17
Overman.....	.10	MANHATTAN STOCKS	
Potosi.....	.10	Manhattan Cons.....	.08
Savage.....	.31	Manhat'n Dexter.....	.04
Sierra Nevada.....	.29	Jumping Jack.....	.03
Union.....	.27	Stray Dog.....	.04
Utah.....	.05	MISCELLANEOUS	
Yellow Jacket.....	.54	Golden Boulder.....	.08
TONOPAH STOCKS		Bonnie Clare.....	.07
Belmont.....	1.12%	Lee Gold Grotto.....	.07
Extension.....	.70	Nevada Hills.....	1.50
Golden Anchor.....	.02	Nevada Smelting.....	1.12%
Jim Butler.....	.27	Pittsburgh S. Pk.....	1.08
MacNamara.....	.57	Round Mt. Sphinx.....	.15
Midway.....	.40		
Montana.....	1.40		
North Star.....	.08		
Tono'h Mine of N.....	7.31%		
West End Con.....	.62		

COLO. SPRINGS Aug. 26

Name of Comp.	Cig.
Acacia.....	6%
Black Bell.....	3%
Booth.....	3%
C. C. Con.....	3%
Columbia Mt.....	25
Dante.....	16%
Doctor Jack Pot.....	7
Elkton.....	59%
El Paso.....	36
Findlay.....	122
Gold Dollar.....	26%
Goldfield Belmont.....	33
Goldfield Daisy.....	35
Great Bend.....	47
Jumbo Extension.....	16
Katherine.....	2%
Kendall.....	2%
Lone Star.....	10
May Queen.....	06
Oro.....	14
Red Hill.....	30
Roanoke.....	3%
Sandstorm.....	26
Union Gold Mines.....	3%
Vindicator.....	84
Work.....	8

Assessments

Company.	Delinq.	Sale.	Amt.
Butler-Liberal, Utah.....	July 17	Aug. 6	\$0.02
Caledonia, Nev.....	Aug. 12	Sept. 2	0.05
Chollar, Nev.....	July 8	July 30	0.10
Exchequer, Nev.....	Aug. 11	Sept. 1	0.05
Helvetia, Ariz.....	.....	.....	0.50
Ingot, Utah.....	July 17	Aug. 5	0.01
Iowa Copper, Utah.....	July 13	July 30	0.05
Lead King, Utah.....	July 1	July 28	0.01
Little Chief, Utah.....	Aug. 1	Sept. 1	0.01
Lucky Calumet, Ida.....	July 3	Aug. 13	0.01
Maxfield, Utah.....	July 18	Aug. 17	0.02
Mexican, Nev.....	July 17	Aug. 17	0.10
Missoula Copper, Ida.....	July 25	Aug. 25	0.01
Oro Cobre, Cal.....	July 16	Aug. 3	0.02
Sierra Nevada.....	July 14	Aug. 4	0.10
Signet.....	Aug. 8	Oct. 6	0.01
Talisman, Utah.....	Aug. 1	Aug. 15	0.02
Tomahawk, Nev.....	July 10	Aug. 12	0.01
Wabash, Utah.....	July 10	Aug. 1	0.10
Wheeler, Utah.....	July 16	Aug. 6	0.01%

Monthly Average Prices of Metals

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January.....	68.673	55.678	31.769	25.738
February.....	68.835	56.000	31.852	25.855
March.....	67.519	55.365	31.325	25.570
April.....	65.462	54.505	30.253	25.133
May.....	65.971	52.795	30.471	24.377
June.....	67.090	53.663	30.893	24.760
July.....	68.144	53.115	31.366	24.514
August.....	68.745	.....	31.637	.....
September.....	67.792	.....	31.313	.....
October.....	62.435	.....	28.863	.....
November.....	58.677	.....	27.154	.....
December.....	54.565	.....	25.362	.....
Year.....	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

Month.	NEW YORK.		LONDON.	
	Electrolytic	Lake.	1907.	1908.
January.....	24.404	13.720	24.825	13.901
February.....	24.869	12.905	25.236	13.098
March.....	25.065	12.704	25.560	12.875
April.....	24.224	12.743	25.260	12.928
May.....	24.048	12.598	25.072	12.788
June.....	21.665	12.675	24.140	12.877
July.....	22.130	12.702	21.923	12.951
August.....	18.356	.....	19.255	.....
September.....	15.565	.....	16.047	.....
October.....	13.169	.....	13.551	.....
November.....	13.391	.....	13.870	.....
December.....	13.163	.....	13.393	.....
Year.....	20.004	.....	20.661	.....

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

TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January.....	41.548	27.380	July.....	41.091	29.207
February.....	42.102	28.978	August.....	37.667	.....
March.....	41.313	30.577	September.....	36.689	.....
April.....	40.938	31.702	October.....	32.620	.....
May.....	43.149	30.015	November.....	30.833	.....
June.....	42.120	28.024	December.....	27.925	.....
			Av. year.....	38.166	.....

Prices are in cents per pound.

LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January.....	6.000	3.691	19.828	14.469
February.....	6.000	3.725	19.531	14.250
March.....	6.000	3.838	19.703	13.975
April.....	6.000	3.993	19.975	13.469
May.....	6.000	4.253	19.688	12.938
June.....	5.760	4.406	20.188	12.600
July.....	5.288	4.447	20.350	13.000
August.....	5.250	.....	19.063	.....
September.....	4.813	.....	19.775	.....
October.....	4.750	.....	18.531	.....
November.....	4.376	.....	17.281	.....
December.....	3.658	.....	14.500	.....
Year.....	5.325	.....	19.034	.....

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

SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January.....	6.732	4.513	6.582	4.363	27.125	20.563
February.....	6.814	4.788	6.664	4.638	25.938	20.875
March.....	6.837	4.665	6.687	4.527	26.094	21.075
April.....	6.085	4.645	6.535	4.495	25.900	21.344
May.....	6.441	4.608	6.291	4.458	25.563	19.966
June.....	6.419	4.543	6.269	4.393	25.469	19.000
July.....	6.072	4.485	5.922	4.338	23.850	19.031
August.....	5.701	.....	5.551	.....	21.969	.....
September.....	5.236	.....	5.086	.....	21.050	.....
October.....	5.430	.....	5.			