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# Cyaniding a Furnace Product*

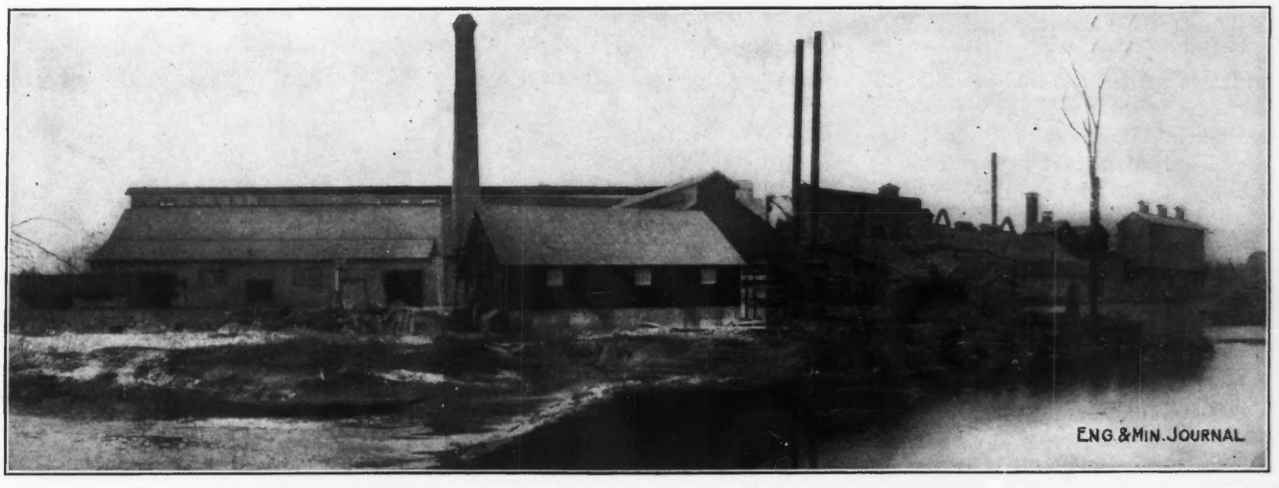
By Herbert A. Megraw

*SYNOPSIS—A plant in which the cyanide process fills a place in connection with furnace work, is unique. At the works of the Deloro Mining & Reduction Co., the ore is first smelted and the speiss produced is desulphurized, chloridized and cyanided. Silver chloride delivered to the cyanide plant is easily dissolved in exceedingly short time. Aluminum precipitation recovers the silver; probably the first instance of its practical use on any such scale. The plant also produces oxides of cobalt, nickel and arsenic for commercial use.*

When the cyanide process was first applied, not so many years ago, to some simple gold ores, there was little thought that it was of more than exceedingly limited application. The search was for clean ores without any cyanide-consuming properties, and strenuous efforts had to be made to secure positively successful results in even such cases. Later, when the treatment of silver ores was proposed by the process, serious doubts were expressed of the successful outcome. These doubts have long since disappeared. Within the last few years, we have seen the cyanide process applied to some of the most, seemingly, impossible problems, only to finally realize that the thing is possible. Perhaps the most revolutionary application, however, has been to the highly complex silver ores of the Cobalt district, of Ontario, Canada.

### Treatment of High-Grade Cobalt Ores

Having accustomed itself to the possibility of successfully treating the so called "rebellious" silver ores, the metallurgical world has another object lesson to study. That is the installation of a cyanide plant as an important unit of a smelting works, where it is expected to recover silver from high-grade, complex blast-furnace products. Such a unit is now part of the works of the Deloro Mining & Reduction Co., at Deloro, Ontario. The blast-furnace product that is so treated is speiss, a most unusual material to be subjected to cyanidation.




Plant of Deloro Mining & Reduction Co., Deloro, Ontario

The plant is working upon rich ore from the Gowganda and Cobalt districts of Ontario. It is not a large installation, but the high-grade ore treated insures a large production of material of great value. In the last year, the plant treated 2920 tons of rock from the districts mentioned, its average content being 2211 oz. Ag, 33% As, 3% Ni and 6% Co. Not only the silver is recovered, but all of the elements mentioned are produced in marketable form, hence the complicated processes followed and the complexity of the plant itself.

The ore is received in car lots from the mines, so that the operation of grinding is not continuous. Each car, as it is received, is sampled carefully. Some of the cars

*This is the twelfth of a second series of articles by Mr. Megraw. It deals with the comparative details of cyanide practice, discussing points of possible improvement. Preceding articles of this series appeared in the issues of Sept. 6, Oct. 4, Nov. 1, Nov. 15, Dec. 20, Jan. 31, Mar. 7, Mar. 21, Apr. 25, May 23 and June 20. The next article will deal with "Cyanide Development at Porcupine, Ontario," and will appear in the issue of Aug. 29, 1914.

have been previously sampled at the sampling plant at Cobalt, but this is the exception, most of them being sampled at Deloro, with a representative of the shipping company on hand.

The ore is first crushed to 10 mesh in a Krupp No. 5 ball mill, and the mill is thoroughly cleaned up after each sampling, and the metallics can be fully estimated at their value with respect to the entire shipment. The ground material is then passed through a Snyder sampling installation which cuts out a 14% sample. This is then mixed, again cut mechanically, then quartered and cut down by hand, the reject from the cutting being retained until agreement between the buyer and seller is final.

### Blast-Furnace Smelting

The ore is taken from the sampling plant to the blast furnace and smelted. Previously, the ore was cyanided before smelting, but with the development of the later process it has appeared to be better practice to smelt it first.

The blast furnace yields four products: volatiles which contain arsenic; silver, speiss and slag. The arsenic fumes are led through a series of flues and chambers to baghouses, where they are collected. Arsenic finally issues from the plant in the form of white arsenic. The silver from the furnace is refined and mixed with the silver from cyanide treatment in such proportions that none of it shall fall below the low limit of 996 fine. The cyanide bullion is 999 fine, or over, so that it will stand mixing with the furnace product, the ultimate product being a silver bar upon which no refining charges have to be paid.

The furnace slag is taken to the dump, except a certain quantity, that necessary to keep the furnace open, which is returned to the smeltery. The slag is kept clean and free from any of the elements which it is desired to recover. Should any of it contain any of these elements, it is included in that part returned to the furnace. The speiss is treated by cyanide.

### Cyaniding the Speiss

The speiss produced by the furnace is crushed in the Krupp ball mill to 40 mesh. It then begins a special treatment which finishes with cyanidation.

Speiss is a material which does not appear to be a good subject for cyanide treatment. The accompanying table shows its analysis:

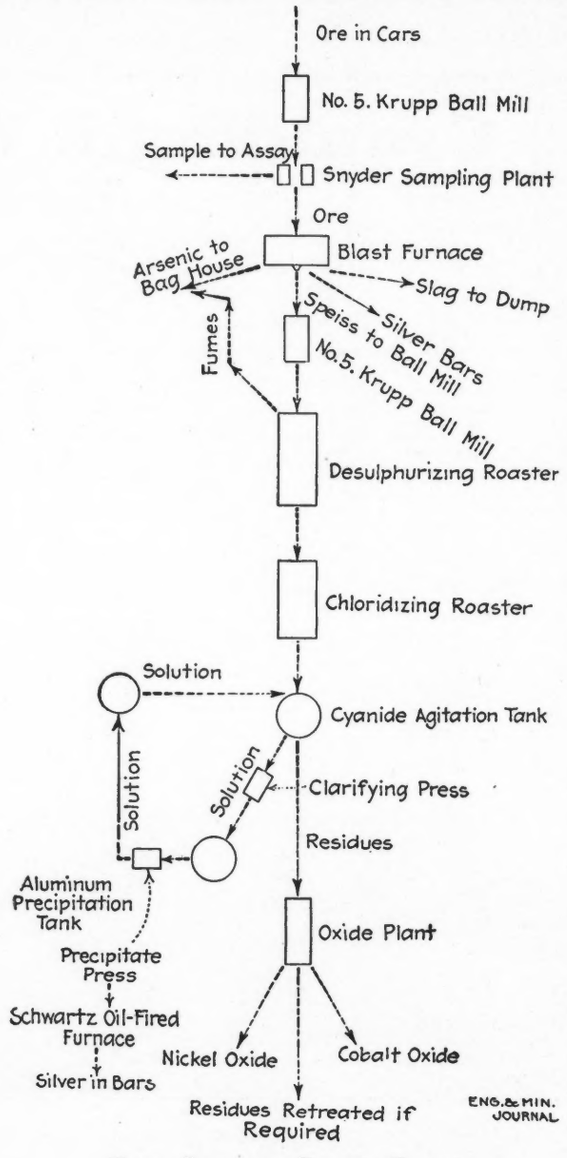
ANALYSIS OF DELORO SPEISS

| | |
|---|---|
| Silver | 1400 oz. |
| Arsenic | 25% |
| Cobalt | 20-25% |
| Nickel | 12-15% |
| Iron | 15-20% |
| Sulphur | 5-10% |
| Copper | 0.5-2% |

Much as this material appears to be unsuited to cyanide treatment, the problem is not so great, and it seems absurdly simple, when the methods have been explained. The first step is roasting, which is performed in mechanically rabbled furnaces, in order to remove the sulphur and arsenic. Sulphur is effectually driven off, but the elimination of the arsenic is not so simple. It is easy enough to reduce it to about 10 or 15%, but to get it materially below that point is a detail which has required much study and experiment. As a matter of fact, the arsenic content is reduced to 6 or 7%, a highly creditable result. That which remains is likely to be in combination with some of the metals as arsenates. Volatilized arsenic is collected in the chambers together with that portion which comes from the blast furnace.

### Chloridizing the Silver

Putting the silver in such form that the cyanide solution can act upon it is the step which follows. This is accomplished by roasting the ore again, this time with salt, so that the metal chlorides are formed. It will readily be seen that this operation is a rather delicate one, the




Flow Sheet of Deloro Plant

limits being on the one hand a sufficiently high heat to insure the chloridization of a sufficiently large proportion of the metal, and on the other, so keeping down the temperature that volatilization of the metal shall not take place. The operation has been so perfected that practically no volatilization loss is incurred, and of the 1500 or more ounces of silver in the desulphurized material, only 30 to 60 oz. is insoluble.

### Cyaniding the Ore

Silver in the ore has now been put into such form that it is readily soluble in cyanide solutions. Arsenic remains only as arsenate, and is not very soluble. The

little copper in the ore has been put, by careful roasting, in such form that it is only slightly soluble and it offers no difficulties in the treatment. Nor do the other elements go into solution readily. The problem, then, is simply the cyaniding of silver chloride, one of the easiest compounds to dissolve. Thus the real problem has been solved before the stage of cyanidation is begun.

Cyanide treatment is by agitation, there being no separation of sands and slimes. The whole of the material is put into an agitation tank and pulped at a ratio of about six of solution to one of solids. Sands and slimes are agitated together, the agitation being performed with a centrifugal pump.

### Agitation of the Pachuca Type

Agitation is performed in a tall tank of the Pachuca type, 11 ft. in diameter and 27 ft. 6 in. deep, including the cone bottom, which is 10 ft. from base to apex. From the apex a pipe connects with a 6-in. centrifugal pump. The pump delivers the pulp in the center of the top of the tank. Agitation is positive and there is little chance for any solids to settle out.

Agitation treatment is by charges consisting each of seven tons of ore with its quota of solution. Sodium cyanide is used, the strength being carried at about 1%. Caustic soda is used in quantity sufficient for the aluminum precipitation process, as set forth by Hamilton[1] and Kirkpatrick.[2] The use of lime is entirely avoided, since it introduces complications in the treatment. Of course, no lead salt is required under the circumstances. The agitation period of each charge is only six hours, during which time practically all the soluble silver is put into solution.

Settling is performed in the same tank in which agitation takes place. The solution is clarified before going to the precipitation department, where the silver is recovered as described in Kirkpatrick's article already referred to. The residues are filtered and washed and sent on to the next treatment.

### Precipitate Melted with Flux

Silver precipitate is lightly fluxed with small quantities of borax and soda and melted in a Schwartz oil-fired furnace. Fluxing is required to produce the highest possible quality of bullion, the furnace output averaging over 999 fine.

Precipitate from the aluminum process is different in appearance from that given when zinc is used. It is of grayish color, such that the operator accustomed to zinc precipitate would be likely to call it low grade. When a brownish or black precipitate is obtained, such as would be high-grade with zinc, it is of much less value. The aluminum product has also the property of amalgamating into metallic form when it is beaten or worked under friction. It is stated that in the tube mill this precipitate will agglomerate into masses of metallic silver. The centrifugal and plunger pumps handling the solution and precipitate become silver plated, and the packing in the centrifugal-pump gland acquires a coating of metallic silver.

Consumption of aluminum dust amounts to 8.9 lb. per 1000 oz. of silver recovered, and of soda, 29.8 lb. per 1000 oz. The cyanide used amounts to about 11 lb. per ton of speiss treated. A much greater quantity, of course, is used in dissolving the great quantity of silver present, but precipitation with aluminum dust allows the regeneration of most of it.

### Treatment of Cyanide Residues

Residues from cyanide treatment are sent to the oxide plant, which occupies a special department at the Deloro works. Here the cobalt and nickel are dissolved, separated from the remainder and precipitated separately as oxides. The cobalt oxide made is the black $Co_3O_4$, used as a coloring in ceramic and enameling arts. In producing the black cobalt oxide, great care has to be exercised to avoid the production of the gray oxide, which has a different composition, the reason being not the higher or lower percentage of cobalt, but the fact that in producing colors, the artisans use weight formulas, and if the color-producing element were not absolutely uniform, the product would vary in shade. The black oxide contains about 71% cobalt, and the gray 76%. Both the cobalt and nickel oxides produced are of first grade.

The Deloro plant is a good example of the modern tendency to turn every possible element to good account, and where many difficulties have had to be surmounted to accomplish that end.

For the opportunity to examine the Deloro plant and publish this account of their system of treatment, thanks are due to Prof. F. S. Kirkpatrick, of Queens College, Kingston, Ont., consulting engineer for the company, and to S. B. Wright, manager in charge.

[1] "Aluminum Precipitation at Nipissing," "Eng. and Min. Journ.," May 10, 1913.

[2] "Aluminum Precipitation," "Eng. and Min. Journ.," June 28, 1913.

## Mineral Production of New Zealand in 1912

The mineral production of New Zealand, for 1912, as officially reported, was as follows, the items being arranged in order of descending value: Gold, 343,163 oz.; coal, 2,177,615 tons; kauri gum, 7908 tons; silver, 801,165 oz.; other minerals (stone, greenstone, pumice, scheelite and pyrites), to the value of £20,571. The total value of the mineral production was £3,042,224. The total number of miners employed in the gold mines was 5162, compared with 7365 in 1911. The production of gold and silver was less than that of the preceding year, while coal and kauri gum showed a small increase.

## Barytes in 1913

The production of crude barytes in the United States in 1913, according to the U. S. Geological Survey, was 45,298 tons, compared with 37,478 tons in 1912. The total quantity of refined barytes reported as sold by mills in 1913 was 37,033 tons, valued at $525,300.

The greater part of the barytes produced in the United States is used as a pigment in the manufacture of mixed paints. It is also used in the manufacture of lithopone, a white pigment. Wall-paper manufacturers are said to use some barytes for giving weight to their products. Other uses for the mineral are in the manufacture of rubber, asbestos cement, and poker chips and in tanning leather.

**Important Extensions to the Joachimsthal Radium Works** are being made, says "l'Echo des Mines," with the intention of increasing the output from five grams to 10 grams per year.

# Chiksan Mines, Chosen--I

By Clarence L. Larson*

*SYNOPSIS—This American-controlled concession is just beginning to take its place as a productive property, along with the Oriental and Seoul companies. The mines are near Tsunpo Bay of the Yellow Sea, at slight elevation. Scarcity of timber is a leading feature. Transportation is difficult, and use is made of men, bull carts and pack bulls. A motor truck has been tried without much success. Korean, Japanese and Chinese labor is used, the rate of wages being low; the average from 30 to 37c. per day. Graft is widespread and must be reckoned with.*

Among names familiar to those interested in mining, are two in Chosen, the Oriental Consolidated Mines and the Suan Mine of the Seoul Mining Co., these two having successfully operated for several years. They are the only foreign-owned and managed properties in Korea that have proved profitable up to this time. During the past six months the results obtained on the French concession indicate the beginning of a successful period for that property.

The Chiksan mines, although an old concession, had not been developed in proportion to its size until two years ago, when it fell into the hands of the present company. This property is more conveniently situated than any other in Korea, being but 9 miles from the Saikwan station of the Seoul-Fusan Ry., and but 50 miles south of Seoul. Thus it is afforded quick rail and ferry connection to Japanese markets and direct rail connection to Chemulpo for supplies by steamer from Japan, America and England.

The concession has had a long and a varied history. having been originally granted in 1900 to Baron E. Shibusawa and S. Asano, by the old Korean government. This partnership was allowed two years in which to select and survey the ground. Their work resulted in the present concession limits, approximately a rectangle, 20 miles long and 13 miles wide, inclosing about 270 square miles. The concession grant was for mining rights only.

After several years of rather unsuccessful operations, negotiations with an American group of capitalists were opened and the Korean Exploration Co. assumed charge of operations in 1907, 50% of the stock being allotted to the Shibusawa-Asano partnership and the remainder to the American group.

A two-stamp Nissen mill was operated for a time, and then a lack of funds resulted in the cessation of operations until 1909, when two additional Nissen stamps were purchased and installed. Operations with the four stamps from May, 1909, to December, 1910, yielded $148,000 of gold bullion and concentrates. During this time, some 500 acres of placer ground had been drilled and declared worth dredging. The total showing of quartz and placers influenced the formation of the present Chiksan Mining Co., American in control, the new company receiving 52% of the $1,000,000 capitalization and full concession rights in consideration of $500,000 cash to be invested in development operations. The remaining 48% of the stock was halved between the Shibusawa-Asano partnership and the Korean Exploration Co. The present company thus obtained control late in 1911, and since then have pushed operations as rapidly as possible. Thirty-five additional stamps, in batteries of five, were installed and put in operation Nov. 1, 1912.

*Box 24, Moscow, Idaho.

## Geography and Character

The principal mines lie but 15 miles from the Tsunpo Bay of the Yellow Sea, and hence the altitude is not great, varying from 300 to 2000 ft. above sea level. The hills are low and much eroded, although one range, which contains the main vein system, is high and rugged. This range strikes approximately northeast and southwest, and practically all the known ledges are to be found on the north slopes of this range, and the placers in the main valleys below.


The Jiggie Man or Korean Porter

The hills are barren of timber, except for the recently started reforestation of pine, and vegetation is scarce. This is due to the lack of foresight and indifference of generations of Koreans who have stripped the hills of vegetation, using it for fuel. No better argument for the conservation of natural resources can be found than the treeless plains and hills of southern Korea. The Japanese authorities are endeavoring to remedy the situation, enforcing the setting out of trees and guarding them carefully while growing. A certain worm is destructive to these small pines, and is fought in this way—a tax of

a certain measure, usually an empty oil-can, is assessed per unit-sized house, and each Korean family is forced to go out upon the hills and collect its measure of these worms and bring them in to the gendarmes. The valleys are used almost entirely for the raising of rice with occasional small patches of truck, such as corn, beans, greens, tobacco and peppers. Farming and mining are the two industries of the Chiksan district.

### Transportation Methods

The main camp, Yangdei, is approximately 10 miles from the railway station and is composed of the general offices, residences, mill and the Korean villages, attendant upon the mill and office. The mines are scattered in every direction from this central point.

The main road to the station has been placed in good condition and is almost without grade for the greater part of the distance. There is but one hill of consequence which has about a mile rise on one side at a 3 or 4% grade and a quarter-mile rise on the other side at about 7%. Aside from this hill, but few grades are encountered. The important mines and prospects are also connected by good roads with Yangdei, and by short-cut pack-animal paths with the main road to the station.

There are five modes of transportation—the jiggie-man; horse and mule wagons; bull-carts; pack bulls and motor truck. Accompanying photographs show the jiggies, carts and pack-animals. Jiggies are employed principally on short hauls and are paid in proportion to the distance and load carried. Rates are based on about a 20c. per day scale. A coolie will carry loads remarkable both in volume and weight, once they have been placed on his jiggie, but he is almost worthless for lifting. This type of freighting is important where roads are absent and trails are steep; also in construction work where materials must be carried short distances. When employed by the day, 17½c. is the wage.

Two- and four-wheeled bull carts and four-wheeled mule and horse wagons carry the bulk of the freight between the railway and Yangdei camp, although pack bulls carry much coal and practically all the timber used. The rate paid on all miscellaneous freight and on coal, is $1.20 per ton to the main camp, a distance of 10 miles, making a cost per ton-mile of 12c. The rates to the different mines are proportioned to the distances and grades involved. Timber is hauled at an arranged price per piece.

Pack cows carry 350 to 450 lb. of coal or ore, and bulls from 400 to 600 lb. Thus a good bull and driver nets 30 to 35c. per load, making one load in a long day's work. Wagons carry 2000 to 2200 lb. per load and also make but one trip per day. Return freight is paid for at the rate of $1 per ton.

Most of the transportation noted above is by contract, and the company maintains but a small stable used on odd jobs and for saddle animals.

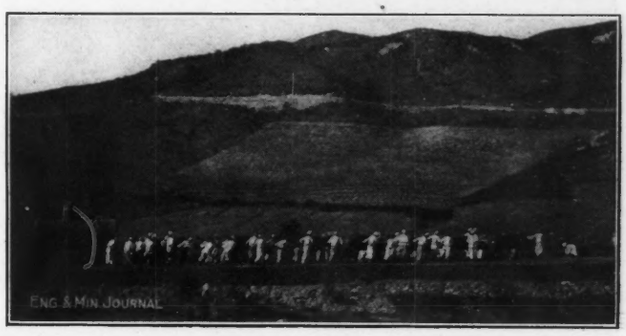
Ore from prospects is brought to the mill principally by pack-bulls and is paid for by the ton, rated to equal 30 to 35c. per day in wages. Each delivery point, therefore, requires a scale and a native weigher. At the mill a large platform scale is now available, and the mines are provided with small 1000-lb. scales. Each freighter's load is weighed in carrying boxes and credited on his invoice; the invoice is presented to the Yangdei office for payment. The native weighers are fairly honest, of necessity, since partiality toward any particular freighters would be soon noticed and reported by the less favored ones. A weigher receives from 35 to 45c. per day, but usually has other duties to perform.

A Garford 3-ton motor truck has been used, though not steadily, due to difficulties with the gendarmes as to the width of the road, to road troubles, to bad weather, etc. The Japanese driver received $25 per month. Early tests were rather disappointing as it seems that the engine is not sufficiently powerful to handle the load on the big hill. This made the trip a slow one and the gasoline consumption was high and did not compete successfully with the native freighting cost. The accompanying table shows costs and earnings for the truck.

MOTOR-TRUCK DATA

| | Per Day | |
|---|---|---|
| | Two Trips | Three Trips |
| Gasoline—8½ gal. per trip | $5.10 | $7.65 |
| Driver—$25 per month | 0.59 | 0.59 |
| Interest—$4858.50 @ 6% | 0.795 | 0.795 |
| Depreciation—20% | 2.655 | 2.655 |
| Operating cost per day | 9.14 | 11.69 |
| Earnings @ $1.20 per ton—3-ton trip | 7.20 | 10.80 |

This shows, on a two-trip day, a loss of $1.94 plus repairs, and on a three-trip day, a loss of $0.89, plus the repair cost. Although the record shown in this table has been




Transporting a Boiler with Natives and Bulls

slightly bettered as far as gasoline consumption is concerned, two-trip days are a loss and three-trip days scarcely break even, when the repair and tire costs are considered. The difficulty of competing with the native freighting is shown. However, one credit must be given the truck; although not in constant use, it enables the company to hold a whip hand over the natives; the cost per ton of freighting was reduced 5c. immediately upon the arrival of the truck.

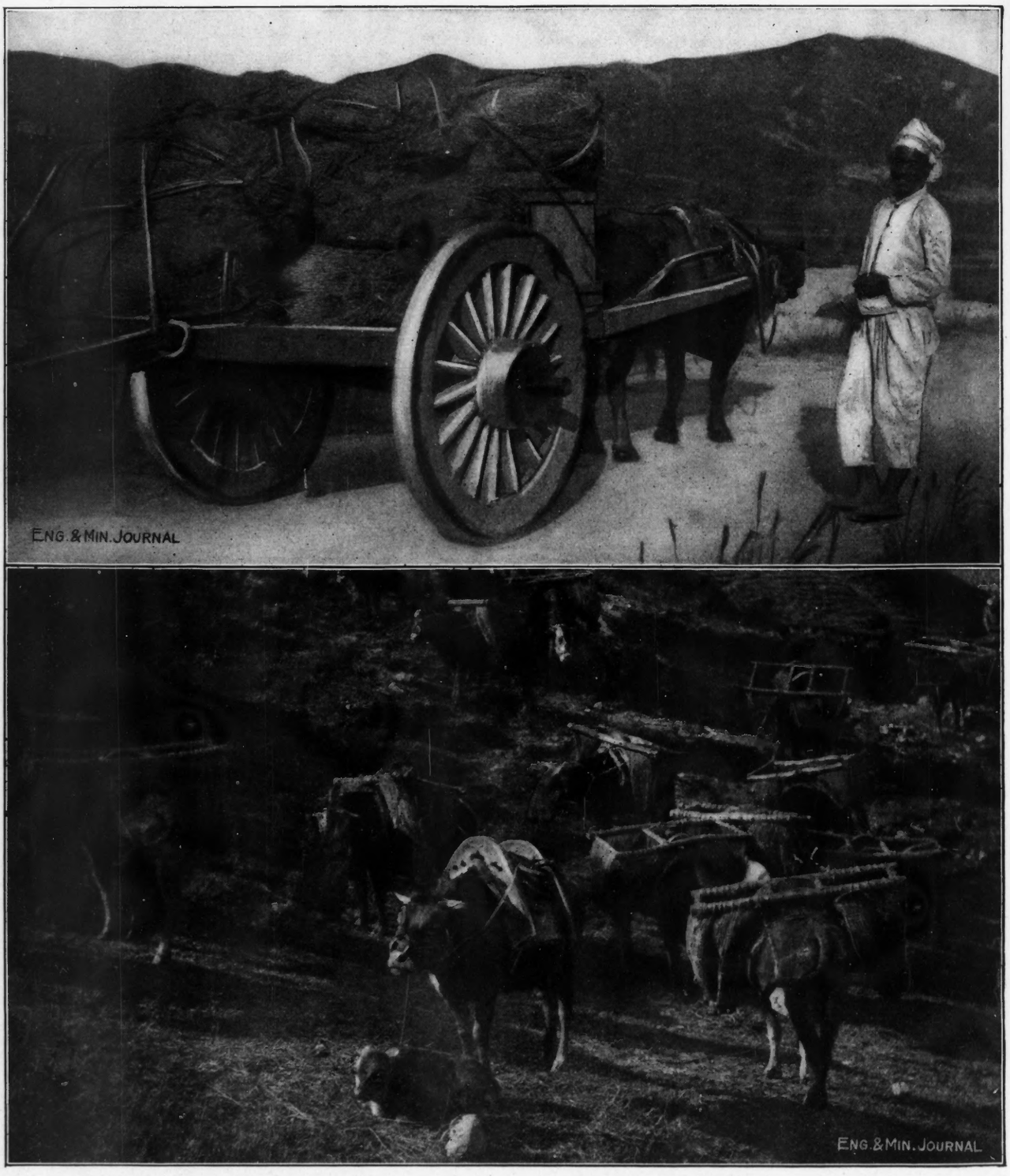
Large pieces of machinery to be brought in from the station are loaded on wagons and hauled by means of bulls and coolies. It is better to contract such work, preferably to Japanese freighters. The boiler shown in the accompanying photograph was transported over the main road, described above, 10 miles, and then an added mile and one-half up a steady 2% grade having many turns in it. The total cost was $95. The cost of bringing in four mortars for 5-stamp batteries, each mortar weighing nearly 3½ tons, was $280.50, or about $2 per ton-mile. This was company day's-pay work. Two boxed compressors weighing 3½ tons each, traversed the same road as the boiler, for $30 each, or $0.745 per ton-mile. This was contract work, and about indicates a proper comparison of the two methods when considered with the previous figure. (However, part of the trouble or high cost of bringing in the mortars was due to the poor choice of a carrying wagon.)

### Labor and Its Peculiarities

Three kinds of native labor are employed: Korean, Chinese and Japanese. Korean labor preponderates, of course, and is used in all branches of the work. At the mines but a single Japanese is employed, a skilled blacksmith-mechanic, who receives 90c. per day. At the Yangdei mill, Japanese carpenters are employed at 87½c. daily. Chinese carpenters of equal ability are available at from 75 to 87½c. Japanese blacksmiths and mechanics are also used at the mill and in the machine shop, receiving from 80c. to $1 per day.

Masonry and concrete work is all done by Chinese who are capable and do good work under foreign direction and inspection. Nearly all of this work is done by contract: day's-pay wages are set at 40c. for good men and 25 to 30c. for helpers. No Chinese or Japanese are employed in the milling department.

At the mines, both Korean and Chinese labor is em-




Transportation Methods in Chosen. Bull Cart and Pack Bulls and Cows

ployed, the scale of wages being the same for both. The Chinese are but a small minority of the total number of mine workers. The scale of wages is shown in the accompanying table.

WAGE SCALE OF NATIVE AND FOREIGN LABOR

| | |
|---|---|
| Mine foremen | $0.625 |
| Shift bosses, all Korean | 0.45 to 0.50 |
| Mine storekeeper, interpreter | 0.62½ |
| Hoisting engineers | 0.37½ |
| Compressor engineers | 0.32½ to 0.40 |
| Firemen | 0.30 |
| Watchmen—Chinese | 0.32½ |
| Weighers, interpreters, clerks | 0.35 to 0.45 |
| Korean timber framers | 0.32½ |
| Hand drill-steel sharpeners | 0.30 |
| Machine-steel dressers | 0.35 to 0.40 |
| Timbermen | 0.30 to 0.40 |
| Hand miners, single and doublehand | 0.25 |
| Shaft hand miners | 0.30 |
| Waugh machine miners | 0.30 |
| Piston-machine miners | 0.37½ to 0.40 |
| Muckers, car men | 0.20 |
| Skip tenders | 0.25 |
| Pump men | 0.30 |
| Surface coolies, ore-sorters | 0.17½ |

A Korean mechanic who has had eight years of experience under foreigners and who is capable of handling almost any work around boilers, pumps, engines, compressors, etc., receives 90c. per day. His No. 1 helper receives 50c. Hoisting engineers and practically all development hand miners work 8-hr. shifts. Stoping miners, machine miners, and all men such as firemen, watchmen, car men, etc., work 10-hr. shifts.

Successful handling of this native labor requires much study. Contract work is done wherever possible and is based upon the wage scale already given, but is varied slightly to suit conditions which change from time to time, such as scarcity of labor in crop times, and to suit underground conditions, such as wetness, and hardness of rock. Holiday seasons require watching also as the Koreans have customs peculiar to themselves.

Brotherhoods exist among them, some good and some bad, each usually containing but a small number of members. These must be watched so that they become not too powerful in any one department. Thus one avoids the small difficulties due to strikes and quarrels with nonmembers securing positions.

The average Korean laborer seems to be endowed with a shiftless tendency; he never plans much beyond the day at hand. To him debt is not a discouragement but rather an e.m.f., inciting him to move to other fields. Upon securing employment he rarely works steadily more than a month or two, in that time borrowing as much money as he can at 12 to 15% interest per month. Then after all is gone and the interest cannot be met by the amount of his wages he quietly leaves for parts as unknown as possible. Lately, the Japanese gendarme service is becoming efficient enough to trace them and bring them back to trial, and is gradually stamping out the evil. It affects the mines only as it provides a roaming class of labor, which is not as efficient as a more permanent class. "Squeeze" (graft) is the greatest thing that must be contended with and is prevalent, to be eternally so, as some think, among Japanese, Korean and Chinese alike. It is directed not only at employers but at each other, even in their very own families. No system will ever be found to stamp it out. The best that can be done is to regulate it. When readers stop to think that 17½ to 30c. per day is the range of wages for 90% of the workmen, it will be realized that a few cents amounts to a high percentage of squeeze. Half a candle a day is a 3% gain, so where in America the shift going off is searched for high grade, in Korea it is searched for candles, inch pieces of powder, short lengths of steel, etc. Another instance: in weighing, a squeeze increase of 20 lb. on a bull-load of coal means 5 per cent.

Drill steel and all the supplies used by a contractor are charged out to him. On the first of each month, inventory of his material is taken and he is credited on the finished month with the invoice and debited the same amount on the new month. Every possible precaution is thus taken to insure against the removal of any supplies from the mine, and to make any such removal chargeable directly to the contractor.

Laborers are given numbered checks, brass and aluminum in alternate months, which they must present each day in order to be marked present upon the timebooks. On the monthly payday, these same checks are presented for payment.

The question of the efficiency of these laborers comes next. It is difficult to compare them with those available in the United States. Korean and Chinese single- and double-hand miners, timbermen, mechanics, hoisting engine men, Chinese carpenters, are all efficient, and especially so considering the wage paid. Car men, firemen, and blacksmiths are not highly efficient at routine work, as they lack pride in it. Native machine men do not compare with U. S. laborers. One American miner can do more work with a small piston machine than three of these natives. Still, for the price paid all the workmen, the native labor should be considered fairly efficient, much more so than the average Spanish or Mexican labor.

Coal is used entirely for fuel, both at the mill and at the mine power plants. Laid down ready for use, it costs $5.50 per ton. The grade in use is known as Fushun coal, coming from the Japanese mines of that name in Manchuria, and is probably the most generally used coal in the northern part of the Orient.

### Timber Brought from a Distance

As has been stated, the concession is barren of mature timber. The company recently purchased rights to a forest a considerable distance away. Timber from this forest is cut and delivered to the various mines by a Korean contractor. Another native contractor brings in timber from his own forest. All of this timber is transported by pack bulls, the length of haul being about 25 or 30 miles. Most of it is round timber running from 5 to 10 in. in diameter and from 6 to 10 ft. in length. The transportation costs in all cases amount to more than 75% of the total cost of the timber. Costs of the various sizes as laid down at the mines are as shown in the accompanying table.

COST OF TIMBER

| | |
|---|---|
| 1-in. boards—5 ft. long. | 1c. per in. of width |
| 2-in. boards—5 ft. long. | 2c. per in. of width |
| 2x4-in., 10 ft.— | $0.16 per piece |
| 4x4-in., 10 ft.— | 0.30 per piece |
| 4x6-in., 3½ ft.— | $0.10½ per piece |
| 6x6-in., 6 ft.— | $0.22½ per piece |
| 6x6-in., 10 ft.— | 0.40 per piece |
| 8x8-in., 6 ft.— | 0.55 per piece |
| 6-in. round, 7 ft. long | $0.22½ per piece, increasing 2½c. per ft. length |
| 7-in. round, 7 ft. long | 0.30 per piece, increasing 2½c. per ft. length |
| 8-in. round, 7 ft. long | 0.32½ per piece, increasing 2½c. per ft. length |
| 9-in. round, 7 ft. long | 0.35 per piece, increasing 2½c. per ft. length |
| 10-in. round, 7 ft. long | 0.37½ per piece, increasing 2½c. per ft. length |

Sawed 8-in.x8-in.x10-ft. timbers have been secured in lots of 1000 pieces from a point on the railroad some 150 miles to the north, landed at the mines at a total cost of $1.10 each. Wedges are made by a contractor, hewn out by hand from waste pieces from framing sets. The rate paid is 15c. per 100 wedges. A workman turns

out about 200 in a 10-hr. day. Ladders are also made by contract at 7½c. per ladder. They are 10 ft. long, the stays being of 2x4-in. stuff, and rungs 2x2-in., 15 in. wide, placed 15 in. apart. The cost of such a ladder is as follows:

| | | |
|---|---|---|
| 2 pieces | 2x4-in., 10 ft. | $0.32 |
| 12 ft. | 2x2-in. | 0.08 |
| 20 | 4-in. nails | 0.03½ |
| | Labor | 0.07½ |
| Total | | $0.51 |

Native timber framers are employed, receiving $0.32½ per day. Two men are employed at each of the two largest mines, on day shift only, and handle all the framing, posts, caps, winze sets, raise sets, and shaft sets alike, framing from either round or square timber.

### Water-Supply

Sufficient water is at all times produced from the mines by ordinary pumping, to supply their steam plants, and as there are no reservoirs at hand, the mine water is used almost entirely. The rains come usually within two short periods, one in early spring and the other in latter July or August. The watershed is away from the mines and is rapid. The other seasons are dry.

COST OF PRINCIPAL SUPPLIES

| | | | |
|---|---|---|---|
| 4-lb. hammers | $0.62½ | 1-in. unions, each | 0.14 |
| 4-lb. hammer handles | 0.10 | 1-in. tees, each | 0.06 |
| 8-lb. hammers | 0.75 | 1-in. nipples, each | 0.12 |
| 8-lb. hammer handles | 0.10 | Front skip wheels | 2.00 |
| Picks | 0.50 | Rear skip wheels | 2.50 |
| Shovels | 0.75 | 12-lb. track spikes, each | 0.00¾ |
| Handsaws | 1.50 | bolts | 0.01¼ |
| 8-in. monkey wrench | 0.87½ | fish-plates | 0.03¼ |
| 10-in. monkey wrench | 1.25 | rail, per ft. | 0.11 |
| 12-in. Stilson wrench | 1.12½ | 25-lb. track spikes | 0.02½ |
| 14-in. Stilson wrench | 1.50 | bolts | 0.02 |
| 18-in. Stilson wrench | 2.12½ | fish-plates | 0.05 |
| Round, square and strap iron, lb. | 0.03½ | rail, per ft. | 0.27 |
| Angle iron, per ft. | 0.06½ | Tar, gal. | 0.20 |
| Corrugated roofing | 0.50 | White lead, lb. | 0.55 |
| Hand drill steel—¾, ⅞ lb. | 0.07 | Brown lead | 0.65 |
| Machine drill steel | 0.09 | Red lead | 0.45 |
| Rivets, per lb. | 0.07½ | Lime—sack | 0.45 |
| Compressor oil, gal. | 0.40 | Fire-clay (Denver) lb. | 0.01 |
| Engine oil | 0.25 | Cement—Manchuria portland, per bag | 3.00 |
| Cylinder oil | 0.50 | Rubber packing, lb. | 1.00 |
| Kerosene | 0.20½ | Victor packing | 1.12 |
| Hard oil | 0.10 | ¾-in. wire cable, ft. | 0.02 |
| 1-in. pipe, ft. | 0.07½ | ¼ steel cable | .04½ |
| 1-in. glove valves, each | 2.25 | ½ steel cable | 0.16½ |
| 1-in. elbows, each | 0.05 | | |

Candles, Balloon brand—1¼c. each—15-oz. candle
Caps, Nobel-Glasgow, 6A—$0.0065 each
Fuse, Nobel-Glasgow, special—White, waterproof, ½c. per ft.
Powder, Nobel Gelignite, 60%—22c. per lb.

The mill has received its supply from a small creek which has been dammed at the mill site. From this reservoir, 60 or 80 ft. of pumping is necessary. During the past few months, dams on two separate forks leading into this main creek were built. Water thus caught is led in flumes, partly natural earth ditches and partly constructed of wood, to the mill tanks. This saves pumping and eliminates losses of water during rains by providing excess reservoir capacity in addition to the original dam. This arrangement together with settling ponds has solved what at first threatened to be a serious problem during the dryest seasons. Tailings are run into stock piles and the drained off water led into the settling ponds, thus removing the slimes, which then become available for cyanidation. The water is ultimately passed through a large settling box, or spitzkasten, and pumped back to the mill tanks and used as battery water. This is done only in the dry seasons.

Water for domestic purposes is available from numerous springs. For the use of the foreign residents, it is usually boiled or distilled.

In order to make all cost figures and general statements complete, the cost of the principal supplies are shown in the accompanying tables printed above, the figures representing the total cost of the articles delivered at the mines.

## The Diamond Outlook and the Premier Diamond Mine

JOHANNESBURG CORRESPONDENCE

The number of loads of 16 cu.ft. each of blue ground treated was 10,435,000 in 1913, compared with 9,707,000 in 1912. The total number of loads hauled was 11,028,738, which included tailings and waste rock, an average of 919,000 loads per month and an average per day of 35,461. The highest number of loads hauled per day was 47,098. A load of blue ground of high specific gravity weighs about $\frac{9}{10}$ ton, so that the tonnage dealt with amounted to about 44,000 tons. The only other mine approaching this output is the porphyry copper at Bingham, Utah, U. S. A., which dealt with 30,000 tons. The total yield of diamonds was 2,107,983 carats, or an average of 0.202 carats per load. The average cost per load treated was 2s. 3.545d., and cost per carat 11s. 4.35d. Maintenance charges equaled 6.803d. per load. Hammer drills are being introduced for drilling in the benches and 200 natives have been displaced and the cost per load of recent months reduced to 2s. 1.54d. The 310-ft. level of the open cut has now been attacked and above that level there are 25,000,000 loads available.

The average depth of the workings was 209 ft. Recruiting natives cost £60,552 for 21,886 natives. The daily average of natives employed was 14,548. Natives earned 3s. per day, finding their own food. The death rate fell from 31.75 to 17.66 per 1000 per annum, due largely to decrease of pneumonia, due to inoculation with prophylactic vaccine. There were 879 white employees earning in wages £261,816. Sixteen electrically driven air compressors are situated in various parts of the mine to supply air to the hammer drills.

The price per carat obtained was 22s. 2d. A profit of £1,003,098 was made after paying £84,826 toward the workers' provident and benefit fund. Of this sum the shareholders received £400,000 and the government £600,000.

The chairman of the committee, who represents the interests of Messrs. Barnato Bros., who are largely interested in De Beers mines, stated that the prospects of a steady gradual improvement in the demand for diamonds was good. The value of diamonds won in South Africa in 1913 probably equaled £1,200,000. He practically announced that at last a diamond combine had been formed to regulate production. I am pleased to state that the big producers have not only practically recognized the principle of adjusting the production to the demand, but they also recognize the importance of maintaining prices; both our government and the German government must realize the importance and the advantage of an effective combination. It is thus apparent that the conflict between the Premier Co. backed by the Transvaal government and De Beers Proprietary is now at an end. At the same time, the fact remains, that should the world be unable to continue to absorb £1,200,000 worth of diamonds per year indefinitely, and of this there must be some doubt, in the struggle for existence among producers the Premier mine can maintain its position only by a large production as the margin of profit is small.

# Mine Sampling at El Tigre

By Charles M. Heron*

*SYNOPSIS—Description of the samples taken and records kept, and how these records are used in distributing costs, in a mine where the stoping width averages 3½ ft. The vein is vertical. High-grade ore is sorted for shipment and milling ore is stamped, concentrated and the tailings cyanided.*

The method of sampling at the El Tigre mine, Sonora, Mexico, although probably not radically different from systems employed elsewhere, having been evolved to meet the existing needs and conditions, may be of interest to others. Briefly stated, the conditions are: The orebody, in rhyolite, is a nearly vertical vein, carrying gold and silver associated chiefly with lead sulphides. It ranges in width from 1½ to 8 or 10 ft., but for sake of uniformity the stope width has been assumed to be 3½ ft., and when samples are taken their assays are reduced to this standard. For the most part, overhead stoping is used; the high-grade ore is sorted in the stopes, and the second-class, or milling ore, is left as filling, to be drawn through the chutes as needed. Nearly all stoping is done by hand drilling, Mexicans there being fairly proficient at this kind of labor. Little cobbing is done in the stopes, but before being shipped all high-grade ore is carefully sorted on the surface. The second-class ore passes over a sorting belt at the head of the mill, where once more high-grade and waste are removed. The ore is crushed by stamps, concentrated, and the tailings cyanided. In general, therefore, in sampling three objects are to be kept in mind; first, the determination of what shall be shipped without further treatment, what milled, and what sent to the dump; second, the determination of what portions of the vein can be mined profitably; third, the estimation of the value of ore reserves.

## Development Samples

The samples might be classed somewhat arbitrarily under three heads; development, stope and record. Development samples are taken every day or as required, to show the grade of the ore exposed in prospecting and developing. The samplers cut grooves across the vein at the face, taking a uniform cut. When the vein is in distinct seams, each one is sampled. For example, the usual cut consists of a seam of high-grade, bounded on each side by second-class ore, and often with these there is a seam of quartz or vein breccia, cemented by siliceous material. An example of a report of these samples will show how they are reduced to the stoping width, 42 in. Assume the vein to be 3½ ft. wide, of which 6 in. is high-grade sulphides, assaying 210 oz. of silver, 30 in. more or less siliceous breccia or gouge, averaging 28 oz., and 6 in. of low-grade assaying 6 oz.; then the assay at this point would be, $(^{6}/_{42} \times 210) + (^{30}/_{42} \times 28) + (^{6}/_{42} \times 6) = 50.97$ oz. The object of this sort of sample is to show what is developed, and what is to be done with the broken rock; hence the report of these samples concerns chiefly the mine superintendent.

## Stope Samples

Stope samples, as the term is used at El Tigre, includes samples of muck and cut samples of high grade. These are taken at the end of each week, at 10-ft. intervals, measuring from the center of the manways, and are numbered consecutively. For instance, the sample tag labeled "No. 4 level, 65-70 stope, No. 10" would refer to the sample of muck taken 100 ft. from manway No. 65 toward 70, on No. 4 level. The samplers record the widths of the vein and of the high grade, putting down zero when no high grade occurs, so that when the average width of high grade is computed for the area, each measurement may be given its due proportion. The muck samples are taken straight across the stope, fragments being picked up indiscriminately. Assays are made twice monthly of samples taken from the same place, those of the first two weeks being combined, and those of the last two or three, as the case may be. All high-grade samples for each interval are combined, and the assay made once for the month. These bimonthly and monthly assays, together with the widths which they represent, are recorded by the samplers for use in monthly reports. The objects of stope sampling are: First, to determine the efficiency of the stope, to know whether it is being worked at a profit or loss; and second, to have a record of the grade of broken ore in the stopes in order that what is sent to the mill may be kept at a uniform standard, ore being drawn from the high-grade stopes to raise the average of ore of lower grade.

FIG. 1—STOPE SHEET

Level..... Month of.....19....

| Dist. from Chute | Stope Width | | | | | | Sq.Ft. Broken | Tons Broken | Assay | | | | | | Contents | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 1st-2nd Wks. | | 3rd-4th-&5th Wks | | Ave. | | Tons × Ave. | |
| | 1 | 2 | 3 | 4 | 5 | Ave. | | | Au | Ag | Au | Ag | Au | Ag | Au | Ag |
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*Mining engineer, care Tigre Mining Co., Esqueda, Sonora, Mexico.

### Recording of Stope Samples

Supplementary to this sampling is the measurement of stopes. During the last two days of the month a profile is made of each stope and plotted for permanent record on the stope map. The area of the rock broken is then measured graphically. From this information and that supplied by the samplers, the volume, tonnage and assay are computed by the following simple calculation. The product of the average width and the number of square feet, divided by 12, or the number of cubic feet per ton, gives the tonnage, or "Tons Broken" (see Stope Sheet, Fig. 1). In the columns next to this are recorded the bi-monthly assays; their average is entered under "Average Assays." The product of the tonnage and the average assay equals the metal content, or "Contents." This same computation is made for each 10-ft. interval. The total contents of the stope being then summed up and divided by the total tonnage, the average assay of the stope is determined. In this way each 10 ft. is automatically weighed.

The "Stope Statement," Fig. 2, is next made out. The first four columns are taken directly from the preceding stope sheet. The column marked "Tons," under the section "Ore Broken," is obtained by subtracting from the total tons broken in each stope the waste from each stope. The record of waste, kept by the shift bosses, and turned into the engineering office at the end of each shift, includes an itemized account of waste sorted from each of the working stopes, entered under "Tons of Waste." In the section "Sorted High Grade (Calculated)," under columns "Area" and "Width," are given, respectively, the area recorded in the first section of the sheet, and the average of the high-grade widths in inches as reported by the samplers. From these the volume and tonnage are calculated as before. The calculated total is invariably much greater than the amount of sorted high grade actually shipped, because of the careful sorting and cobbing done at the *planilla,* sorting floor. The section marked "Sorted High Grade (Actual)" is obtained as follows: The actual total of high grade shipped being known, it is divided among the various stopes proportionally to the calculated tonnage. For instance, if the calculated tonnage is 175 and the actual tonnage shipped is 100, and the calculated tonnage in a certain stope is 7 tons, then the actual tonnage in that stope is $^{100}/_{175} \times 7$ tons $= 4$ tons. In the same manner from the calculated and actual total the contents of each stope is obtained.

The foreman of the *planilla* keeps an account of the cars of second class taken from the sorting floor to the mill, and takes a composite sample for the month. From his report and that of the assay, the total tonnage and contents are obtained and divided among the various stopes proportionally to the high grade taken from each. The section marked "Total Second Class" is the sum of the second class broken in stopes and the *planilla* second class. The section "Total Rock Broken" is the sum of the total second class and actual high grade from each stope, the values of which are recorded opposite them in the next column. This completes the stope statement. Its purpose is to afford the cost clerk definite information as to the value of the shipping ore and the second class taken from each stope.

FIG. 2. STOPE STATEMENT, MONTHLY REPORT ON

Month of.....19..

| Level | Stope | Ore Broken | | | | Fill | | | | | Planilla Second Class | | | Total Second Class | | | | | $ U.S. Currency Gross Value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dimensions | | | | | Assay | | Contents | | | Contents | | | Assay | | Contents | | |
| | | Area | Width | Cu.Ft. | Tons | Tons | Au. | Ag. | Au. | Ag. | Tons | Au | Ag | Tons | Au | Ag | Au | Ag | |
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Mexican Currency
Tons at 2000 Lb.

FIG. 3. FINANCIAL

| Level | Stope | Tons Ore Broken | Shipping Ore | | | | | | | Mill Ore | | Labor Costs (Boletas) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Tons | Gross Value | Sorting Cost | Marketing $59 per Ton | Loss, Taxes 13% | Total Deductions | Profit | Tons | Gross Value | Miners | Air Drills | Timber-men | Miners | Air Drills |
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The foreman of the *planilla* keeps an account of the cars of second class taken from the sorting floor to the mill, and takes a composite sample for the month. From his report and that of the assay, the total tonnage and contents are obtained and divided among the various stopes proportionally to the high grade taken from each. The section marked "Total Second Class" is the sum of the second class broken in stopes and the *planilla* second class. The section "Total Rock Broken" is the sum of the total second class and actual high grade from each stope, the values of which are recorded opposite them in the next column. This completes the stope statement. Its purpose is to afford the cost clerk definite information as to the value of the shipping ore and the second class taken from each stope.

### Financial Statement of Stopes

From the preceding statement and from records kept in the general office is worked out the financial statement of the stopes, Fig. 3. The first three items "Level," "Stope" and "Tons of Ore Broken," are taken directly from the stope statement, as are also the first two columns "Tons" and "Gross Value," under the section "Shipping Ore." The next three columns are taken from data kept by the cost clerk. The total "Sorting Cost" is divided among the stopes proportionally to the tonnage of shipping ore taken from each. Transportation, treatment charge and commissions, which make up the "Marketing Cost," vary so little from month to month that they are considered as a fixed deduction per ton. In like manner losses and taxes, varying but slightly, are taken at a constant fixed percentage. Subtracting these three costs from the gross value gives the total profit on shipping ore for each stope.

The section headed "Mill Ore" is taken directly from the stope statement. The data under "Labor Costs" are obtained from the time slips, upon which is entered by the shiftbosses the location, class of work and price paid, and which, being segregated by the time clerk, first as to location and secondly as to class of labor, i.e., "Miners," "Air Drills" and "Timbering" include the cost of labor to wages, which is entered directly upon the financial sheet. The cost clerk furnishes all information under the section "Mining Costs." The three columns "Miners," "Air Drills" and "Timbermen" include the cost of labor given in the previous section and also that of explosives, lights, etc., which additional cost is allotted proportionally to the labor cost. The column "Miners and Air Drills" is the sum of the two columns "Miners" and "Air Drills," and is merely the basis of distribution of the costs of the following column, "Blacksmith, Nippers, Superintendent, Sampling," etc. The hoisting and pumping costs, which are small, the mine being fairly dry and entered by tunnels, are distributed at the discretion of the mine superintendent. The product of the tons of milling ore broken in each stope and the cost of general tramming, divided by the total tonnage sent to the mill, for the month, gives the cost of tramming charged to each stope. The sum of the last five costs, including "General" gives the "Total Mining Cost." Finally come "Sundry Costs," including "Tramming to Mill," "Concentrating," "Cyaniding," "Loss and Marketing," and "General Costs," which are obtained by use of the following simple formulas:

Tramming cost per stope = tonnage broken in each stope multiplied by cost per ton of tramming to mill.

Concentrating cost per stope = total concentration costs divided by tonnage of ore sent to the mill, multiplied by tonnage broken in the stope.

Cyaniding costs per stope = average monthly cost of cyaniding one ton of ore multiplied by 96% of monthly tonnage broken in the stopes. (4% of the total ore milled is removed by concentrating before the tailings are cyanided.)

Loss and marketing cost have been found, after two years' observation, to equal practically 27% of the gross value of milling ore.

General cost = tonnage multiplied by general cost per ton.

The total deductions equal the sum of mining, transportation, milling, marketing and general costs. The

MINE TONNAGE AND ASSAY

| Tons of Waste | Shipping Ore | | | | | | | | | | | | | | Ore Broken | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sorted High Grade (Calculated) | | | | | | | | Sorted High Grade (Actual) | | | | | | | Assay | | Contents | |
| | Dimensions | | | | Assay | | Contents | | | Assay | | Contents | | $ U.S. Currency Gross Value | | | | | |
| | Area | Width | Cu.Ft. | Tons | Au | Ag | Au | Ag | Tons | Au | Ag | Au | Ag | | Tons | Au | Ag | Au | Ag |
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STATEMENT OF STOPES Month of.....19....

| Mining Costs | | | | | | Sundry Costs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Miners and Air Drills | Blacksmith, Nippers, Superintend., Samplers, etc. | Timbering | Hoisting and Pumping | General Tramming | Total Mining Cost | Tramming to Mill | Concentrating | Cyaniding | Loss and Marketing Cost 27% | General Costs | Total Deductions Mill Ore | Profit or Loss on Mill Ore | Total Profit or Loss | Profit or Loss Per Ton |
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profit or loss on milling ore equals gross value of milling ore broken in each stope, minus the total costs charged to the stope. The total profit or loss equals profit or loss on shipping ore plus profit or loss on milling.

From this somewhat detailed financial statement a brief summary, including the location, the total gross profit or loss, and the profit or loss per ton of each stope, is tabulated for the use of the mine superintendent and all others whom it concerns. This is the main object of this statement, but there is another advantage, in that from the record upon the stope sheets, Fig. 1, of the contents of each 10 ft. of area, at the end of the year, the contents of the broken ore in the stopes can be approximated with a fair degree of accuracy.

### Assay Records

Among the records kept in the engineering office is the assay map, a projection upon the plane of the vein of all the workings of the mine. Upon this are plotted all assays of which it is desirable that a permanent record be kept. All development work in drifts, raises and winzes is carefully sampled at definite intervals, usually 5 ft., and the assays are there recorded. Thus, as the ore is blocked out, the general trend of the grade may be seen at a glance, and the desirability of prospect raises and winzes easily determined. Toward the end of the year when careful estimates of the ore reserves are made, cut samples are taken in all stopes pertinent to the calculation, and the assays recorded on the map, the position of the roof of each stope being indicated by a dotted line. From this map, when the ore reserves are estimated, the assays surrounding a block of ore are used to calculate the value of that particular block. This approximation of ore in place has proved consistent with the actual contents when mined. It is apparent that there are certain parts of this system which are essential to every mine. Other parts not absolutely essential, but requiring little extra labor, are at the same time wholly consistent with the possible accuracy of sampling and of cost distribution, and possess distinct advantages and ultimately of value.

## Administration of the Calumet & Hecla

The system of administration and supervision of the Calumet & Hecla company was described by the manager, James McNaughton, before the Congressional Committee investigating the recent strike.

There is a board of five directors which selects a president. One of the directors is Mr. McNaughton, himself, who is also second vice-president and general manager, in charge of all the operations of mines, mills and smelting and refining plants. Under him is John Knox, as general superintendent. Each of the mines has a superintendent under the general superintendent and each also has a head mining captain. The mining captain has full charge of all underground operations at his property. At the Calumet & Hecla proper there is a head mining captain on the conglomerate lode and another on the amygdaloid lode. Each of these lodes is again divided into sections called branches. There are three of these on the conglomerate, namely, the Calumet & Hecla, the South Hecla and the Red Jacket shaft. The amygdaloid is divided into north and south branches. Each of these five branches itself has a head mining captain and under him there is a shaft mining captain on each shift. Under the shaft captain there is a shift boss on each shift, a trammer boss on each shift and timber bosses. This is the arrangement at the Calumet & Hecla, but the same general arrangement is followed at the subsidiary properties. There is, furthermore, a railroad superintendent, a stamp-mill superintendent and smelting-plant superintendents.

The branch mining captains hire the men for their departments, but the shaft captain can discharge men with the approval of the branch captain. The trammer boss, who will have supervision of the trammers on from three to six levels, is known among the men as the "$5-boss."

The total number of bosses in the employ of the company and its subsidiaries is about 750 to 800, and the total number of men is something over 8000.

## Electro-Thermic Iron-Ore Smelting in Norway

Christiania Correspondence

Professors H. L. Vogt and P. Farup, of the Norwegian electrometallurgical commission, reported on the causes of the economic failure of the Elektrometal smelter at the Hardanger Iron & Steel Works in Norway as follows:

> The type of smelter used at Hardanger (the Elektrometal) has, with charcoal as a reducing material, proved a success at several Swedish works.
>
> It has been ascertained at the Hardanger works that it is also adapted to coke. The results obtained after a few hours' trial with coke in Sweden—from which it was stated that coke was unemployable—have not been confirmed after many months' working at Hardanger. The latter has obtained good results, notwithstanding that the Hardanger furnace's dimensions were less suitable than those of the Swedish smelter used at Trollhättan, and despite the fact that in the Hardanger smelter considerably finer charges were treated.
>
> It was found at the Hardanger works that, with coke, an excellent quality of pig iron can be produced. The consumption of carbon is the same whether charcoal or coke is employed. The consumption of electric energy has shown itself to be that originally computed by us, both for poor and rich ores. While the operations at Hardanger proved to be not economical the cause should be attributed partly to the nature of the ores treated and partly to their low iron content, conjointly with the unsatisfactory condition of the agglomerating roasting oven, and several parts of the electrical equipment; in other words, conditions which neither bear on the electric iron-ore smeltery nor the smelter type used.

Engineer Gustaf Oedquist, on the other hand, in his statement before the Christiania Polyteknik Forening, says:

> The committee is of opinion that the type of smelter used did not conduce to the unfavorable results at Hardanger. I am of a different opinion. The reason why it is not adapted to coke consists in the greater variation in the electric resistance in the furnace itself by the use of coke, owing to which the average load as well as the production is diminished. To which must be added that the larger quantity of limestone thereby necessitated contributes to a lesser production of pig iron per horsepower-year

He attributes to an oversight in the installation of the electrical plant the fact that only two-thirds of the available energy was a benefit to the smelter. This brought down the pig-iron results per horsepower-year, and, owing to the difficulty in obtaining the necessary heat, the "scrap" went up as high as 25%. As regards the ores, he considers the Sydvaranger briquettes and Rödsand slig suitable for the process, but not the Klodeberg and Persberg ores. He describes the pig-iron product as varying widely in quality. He concludes:

The causes of the unsatisfactory result of Hardanger were many, but the type of smelter used bears a large share, which must not be overlooked. On the other hand, these results must not be made to apply to electric iron-ore smelting with coke generally. On the contrary, efforts should be made to arrive at a type of smelter which by the use of a cheap reducing material will produce an excellent article at a price which can defy the sharpest competition.

Engineer Lindemann, in dealing with the operations at Hardanger, says:

In the second working period, from July 10, 1912, to Feb. 20, 1913, Sydvaranger briquettes were treated in the smelter with a little addition of Rödsand slig, or Klodeberg ore. This was so far favorable that it gave between 50 and 51% pig iron; but it was found that the condition of the briquettes in the smelter caused as great trouble as did the Klodeberg ore. It was found that the briquettes, owing to the action of the hot carbonic oxide, fell completely to powder and made gas circulation impossible. The briquette question was, in itself, of great moment for Norway. If ores are to be smelted with comparatively much slag and at high temperatures they must be low in phosphorus. Now, it is generally known that if one uses Norwegian ores the latter must be in the form of briquettes. These briquettes, in themselves an excellent ore (containing from 64 to 65% Fe and well suited for electric smelting), have the peculiarity, as stated, that in contact with hot carbonic oxide the latter separated by catalytic action in such a way that the carbon is deposited and the briquettes increase in bulk. The Swedish experiments have shown that when sufficient gas is conducted over the briquettes the latter increase three or four times in volume. It is, therefore, clear enough that an electric high shaft furnace could be closed up so effectually as to preclude all gas circulation.

During the third working period, from Mar. 2, 1913, to May, 1913, the Swedish Persberg ore and the Norwegian Rödsand slig were treated. As a result of the high percentage of silica in the Persberg ore it was necessary to add so large a quantity of limestone that the iron content went down to 42% Fe. This was sufficient of itself to render impossible any economical result from the operations. As in the first working period the charges proved too poor to give economical results. In that period the smelter worked satisfactorily, in spite of the large quantity of fine-grained ore (Rödsand slig), which was treated, and the energy results obtained agreed with the calculations previously made by the electrometallurgical commission.

From the foregoing Herr Lindman concluded that the Hardanger works had never treated charges which would have made economical results possible. Generally speaking, there were two causes for this: the crumbling of the briquettes in the smelter, and the inadequacy of the agglomerating roaster used for the Rödsand slig.

When, eventually, this slig on which the whole of the working was based, was obtainable, and the roaster brought into use, it was found that while it expelled the sulphur satisfactorily it lacked the main quality predicted for it. It did not agglomerate. It produced a fine powder. And when a shaft furnace 8 m. high is filled up with fine powder it is not difficult to understand that anything that may be termed gas circulation is out of the question.

### The Bie-Lorentzen Smelting Works

Full constructional details of the "Bie-Lorentzen" smelter in operation at the Tinnfos, and quite recently at the Ulefos Iron Works in Telemarken, Norway, have not hitherto been available. It differs, however, essentially from the Elektrometal type used at Hardanger in that two separate shafts come into the smelting chamber with connecting arches. The electrodes pass through these arches into the charge and the current passes through it to the lower electrodes and the bottom of the furnace. This obviates the overheating and destruction of the arches, which are protected, as it were, by the electrodes. No gas circulation is used at Tinnfos, and the two shafts are rather high to produce a good draft for the ascending gases.

General Olssön, a director of the Tinnfos company, in a paper read before the Polyteknik Forening, states that the ores located at Tinnfos are all low-grade (45 to 48% Fe) and are of three kinds: the Klodeberg, Grevinde Wedel, and Fru Anker ores.

There are at present four furnaces completed, of which the last is a modification of the original design. In the meanwhile, as two of the smelters had been in continual use from 10 to 11 weeks without any of the difficulties mentioned in connection with Hardanger, the result may be considered as being satisfactory. These runs were with Klodeberg and Grevinde Wedel ores, which are both basic, and there were no additions of lime. It had been sought to blend the ores in such a manner that the least possible addition of lime might be necessary.

Apart from unfavorable results, when the smelting had to be discontinued, the average during several weeks has been 3100, 3000, 2900, 2800, 2700, and, in one week, only 2600 kw.-hr. per ton of iron. It is estimated that to get a result as good as that obtained by the Trollhättan smelter no more than 2800 kw.-hr. per ton of iron should be necessary.

There have not been the same heavy expenses entailed in the production as were apparent at Hardanger, where, from some acounts, they had gone up as high as $25.66 per ton of pig iron, and more than that the goods can scarcely have fetched in Germany. On this point, however, nothing can be stated with certainty.

It is the intention, later, of the Bie-Lorentzen Works to go over to steel production taking the pig iron in its molten state direct to the electric steel furnace. At present it is usual first to treat the pig iron in a Siemens-Martin or bessemer furnace, finally dealing with it in an electric steel furnace. But when the pig iron is so pure as that at Tinnfos, with so little phosphorus and sulphur, and with power so cheap, it can be dealt with directly in the electric furnace. It has been tried with a pig iron much higher in silica, phosphorus and sulphur than that produced at Tinnfos.

It had been said that the Klodeberg ore had a zinc content of about 0.3%, and that this had been a disturbing effect on smelting operations with the Elektrometal system at Hardanger, owing to the smallness of the pipes through which the gas passed, and the deposition of zinc oxide in lumps on the walls and iron connections. At Tinnfos a case did occur which caused some trouble, but, generally speaking, the zinc has not proved particularly disturbing. There is, besides, no gas circulation at Tinnfos, nor has the gas available hitherto been used, and the furnace has an open top. The zinc caused no difficulties during the smelting operations at the old iron works at Nes.

### The Modified Bie-Lorentzen, at Ulefos

A smeltery has decently been established at Ulefos, in Telemarken, Norway, for the electrothermic treatment of iron ores by a modified type of the original "Bie-Lorentzen" installed at Tinnfos. In the power station three turbines have been placed: a double 1400-hp. turbine coupled to a single-phase generator for operating the electric smelter, a 500-hp. turbine driving a three-phase generator for delivering power to the mines at Faehn, and a 150-hp. turbine coupled to a direct-current generator for electric lighting. The turbines, which were supplied by the Kvaerner iron foundry in Christiania, receive their power from the recently constructed intake at Ulefos.

The electric equipment was furnished by Siemens-Schuchert. The power from the station is conducted a distance of only 75 m. to the smelting house.

The Ulefos iron works was started in 1650 to treat the hematite ores from the then recently discovered Faehn deposits.

Originally intended for wrought-iron production the works, in 1842, went over entirely to foundry iron. Charcoal was used in the furnaces; but as the cost of timber kept going up conjointly with the falling of iron prices, owing to the adoption of improved smelting methods with coke in foreign countries, the Ulefos works was closed in 1877 and the blast furnace pulled down. Foundry work was, in the meanwhile continued, for which purpose only pig iron from England was used.

The Faehn mines, which were shut down in the beginning of the '80s, were again operated in 1900, and the ore mainly exported. Up to the present time about 500,000 tons have been shipped. With the possibilities of electro-thermic smelting in view, the owner of the mines, Herr Cappelen, decided to supplement the export by electrically treating the ore at Ulefos. The Eidsfoss and Vrangfoss falls were acquired by him in 1907, and a small electrothermic smelter was constructed in 1910. The latter has been replaced by the present smelter, for which the recently built power station supplies an energy of 1400 e.hp. The pig-iron product is to be used for foundry purposes.

Ulefos is the first Norwegian proposition which produces a marketable pig iron from its own mines, by the electrothermic method. The ore reserves of the Faehn mines were stated by Professor Vogt (in 1909) at a certain 500,000 tons, a probable 750,000 tons, and, under favorable conditions, 1,000,000 tons; and the ore content was given as 50% Fe, 0.4 to 0.7% P, and 0.2% S.

### The Helfenstein Smelter

Dr. A. Helfenstein, the Austrian inventor of the Helfenstein smelter, addressed the Polyteknik Forening in Christiania on Feb. 3, 1914, on the subject of large electric furnaces in their relation to pig-iron production, and the advantages which, in his opinion, the large closed furnaces have over the ordinary shaft furnaces. He made special reference to the large Helfenstein smelter, installed at Domnarfvet in Sweden, and pointed out that among the points in its favor were the minimum of labor arrived at—it had been reduced to five men for each shift—great reduction in cost of construction, facility of operation, and, what was of importance, the possibility of treating considerable quantities of slig. Although charcoal was used in Sweden he was still of opinion that coke as a reducing material was the main problem yet to be solved in connection with iron-ore smelting. It was a problem, moreover, which especially concerned Norway, where only coke can be used with advantage. By the employment of coke a valuable product of first rank, carbonic-oxide gas, is secured, and it was Dr. Helfenstein's opinion that this gas would constitute a chief element in future pig-iron production. Its importance would be realized when it was known that by its aid such products as synthetic sugar, phosphates, soaps, carbide and nitrates could be produced. He pointed out that peat coke was also admirably adapted for electric iron-ore smelting, peat gas having also, as is known, its uses. His particular furnaces were designed for 10,000 to 12,000 hp. On the whole, he was in favor of large aggregates, and he laid special stress on the fact that whereas his furnaces could also be operated with a lower load—down to 4000 hp.—small furnaces are not efficient. The high shaft furnace—his own was a Diesel furnace—was not suited for coke on account of the danger of explosion. His furnace was 6 m. high, but it could develop an effective power up to 12,000 hp.

In conclusion, Dr. Helfenstein, "as a neutral foreigner," expressed his astonishment at the foreign concession policy of the Norwegian government. He described how, in other countries, the state aided industries, and pointed out that here, in Norway, it should be remembered that they had to compete with countries old in industrial experience. His point was that foreign capital should, as in other lands, be welcomed when it came to stay. "No country is so independent, in that respect, that it can afford to leave others out of consideration. They all lived in the great World-Society, where international capital was indispensable."

The above conclusory remarks appeared to be resented by a section of the audience, and Engineer Höy, in the course of the discussion which followed, pointed out that the policy of the Norwegian government was to preserve the country's water-power resources from overwhelming foreign influences. "We are glad to see foreigners in this country; but, in return, they must respect us" (applause). While duly acknowledging the advantages of Dr. Helfenstein's system of furnace he wished to point out that a patent method resembling it had been in favorable operation for several years at Meraker, in Norway.

General Olssön disagreed with Dr. Helfenstein on the respective merits of the closed and the shaft furnaces. He considered the principle of the shaft furnace the best principle. The process was even and effective, and one got the best iron product from it. From his experiences at Tinnfos he did not believe there was any danger of explosion when coke is used in a high shaft furnace.

## British Mineral Output

Mineral output of the British Isles in 1913 is summarized in the general report for mines and quarries by the chief inspector of mines. The accompanying table summarizes the statistics:

MINERAL OUTPUT OF THE BRITISH ISLES

| Mineral | 1913 Long Tons | Mineral | 1913 Long Tons |
|---|---|---|---|
| Alum shale | 8,741 | Limestone (other than chalk) | 12,740,664 |
| Arsenic | 1,695 | Manganese ore | 5,393 |
| Arsenical pyrites | 35 | Mica | 32,986 |
| Barium (compounds) | 50,045 | Natural gas | Cu.ft. 87,450 |
| Bauxite | 6,055 | Ochre, umber, etc. | 14,935 |
| Bog ore | 3,835 | Oil shale | 3,280,143 |
| Chalk | 4,858,126 | Rock salt | 214,573 |
| Chert, flint, etc. | 74,858 | Salt from brine | 2,033,185 |
| Clays and shale | 13,859,821 | Sandstone | 3,977,303 |
| Coal | 287,430,473 | Slate and slate slabs | 370,756 |
| Copper ore and copper precipitate | 2,732 | Soapstone | 40 |
| Diatomite | 154 | Sulphate of strontia | 18,425 |
| Fluorspar | 53,663 | Tin ore (dressed) | 8,355 |
| Gold ore | 4 | Uranium ore | 95 |
| Gravel and sand | 2,409,152 | Wolfram | 182 |
| Gypsum | 285,338 | Zinc ore | 17,294 |
| Igneous rocks | 7,098,493 | | |
| Iron ore | 15,997,328 | Total, tons | 354,890,667 |
| Iron pyrites | 11,427 | | Cu.ft. 87,450 |
| Lead ore | 24,282 | | |
| Lignite | 81 | | |

**California Mineral Products in 1914** will probably exceed $100,000,000 in value, according to the estimate by F. McN. Hamilton, state mineralogist. The total is derived as follows: Petroleum, $50,000,000; gold, $20,000,000; all other mineral products, $30,000,000. The increase in total value of petroleum is based on larger output and higher prices than last year.

# Details of Practical Mining

## Otis Elevator Mine Hoist

By L. E. Ives

The Naumkeag Copper Co. is doing exploratory work on a large tract of land, about a mile west of the village of Houghton, Mich., in the heart of the Lake Superior copper country. After having done a large amount of geological cross-sectioning with the diamond drill, exploratory work was started some months ago with an adit, the mouth of which is about on the same level with and approximately 75 ft. from the wagon road that skirts Portage Lake in that vicinity. Because of the lack of elevation and the proximity of the road, dump room at the mouth of the adit is at a premium. The difficulty has been overcome, for the time being at least, in a rather novel and effectual manner.

The accompanying illustration shows an artificial single-compartment shaft, constructed by the Otis Elevator Co., New York, and built over the adit at its


A Peculiar Mine Shaft

mouth. The framework of the shaft is built up of flat, rough boards, approximately 7½ in. wide and 1¾ in. thick. Five of these, laid flat sides together and standing on end constitute each corner post, these being about 8¼ in. thick. The sides are divided in panels by horizontal members of similar construction, and each panel is properly braced diagonally. This framework is inclosed by matched, planed boards 8x¾ in., the whole making up the boxed-in shaft, 9x10 ft. 7 in. outside dimensions, shown in the illustrations. The lift from the floor of the tunnel to the level of the dump is 30 ft.

The elevator car is nothing more than an ordinary freight-elevator platform with a 2-ft. gage track running across it and two sides boarded to a height of 5 ft., the car itself being 8 ft. long. The hoisting is done by an Otis Elevator Co., 10-hp., alternating-current, 230-volt, 2-phase, 60-cycle motor, placed in a separate compartment over the sheaves at the top of the shaft. Two ¾-in. steel hoisting cables are used and the hoisting speed is 40 ft. per minute. The tram car in use holds 30 cu.ft., and the hoist is capable of lifting 4000 lb., in addition to the elevator car, at the speed and through the distance given. The entire installation is operated by a hand cable, and stopping is automatic at both top and bottom.

Power for operating this hoist is obtained from the service wires of the Houghton County Electric Light Co., which parallel the road, not over 100 ft. away. Since being installed, about 600 tons of rock per month have been hoisted, and this has been done with a power consumption of about 58 kilowatt-hours per month, at a total cost of $1.80. This figures out about 6c. per day for hoisting expense, or 0.3c. per ton hoisted. No hoist men are required. Two trammers push the car out to the shaft and on the platform, pull the cable, go up with the load, dump it and return to the muck pile again. Power is not being wasted when no hoisting is going on, and three safety stops guard against the possibility of overwinding. One cannot help wondering why this same idea —an automatic, electric, freight elevator—should not find favor in many mining districts, both for exploratory and for permanent purposes, and especially where the deposits are comparatively shallow and flat.

## Spotting Railroad Cars with Water-Driven Winch

By Frank M. Leland*

At the Empire Copper Co. works, we ship on an average two 50-ton cars daily over the tracks of the Oregon Short Line and we bring the ore down from the mine over our narrow-gage road, using a Shay locomotive to pull a train of 10 four-wheeled bottom-dump cars, each car containing about seven tons; it takes eight of these to fill a 50-ton car.

We run our train on an old trestle in the smelting plant and we have a Short Line track at the bottom of the trestle. We then dump the small cars in a chute which delivers the ore into the Short Line car. The latter requires moving eight times during loading; it used to take two men with pinch bars to move the car; hard work and expensive.

I figured it carefully and found that if we could move the cars with power, it would save approximately $150 per month, besides being quicker. I investigated several patent winches, both hand and power, but every one called for a man down below to operate it, so I finally hit upon the following: We have an old hoist in the plant which was hardly good enough to use at the mine, but would work if run slowly. I set this up at the end of the track and connected it up to our high-pressure water line which gave 200 ft. of vertical head. I ran the connecting pipe up to the level of the top track and placed the con-

*President, Empire Copper Co., Mackay, Idaho.

trolling throttle there. In operating now, we hook the cable to two railroad cars coupled together and move them 16 times before unhooking the cable. We set the brake slightly on one car so as to make it stop the moment the throttle is closed. When the two cars are loaded, we take them out with the Shay locomotive and put in two more, throw out the clutch on the hoist, pull out the rope and proceed as before.

After we had tried out the hoist and found that it gave us such good results, we took a small timber hoist which we were not using at the mine and installed it at the top of the trestle to handle the narrow-gage cars. When we are running at full capacity, our engine sets the loaded train of small cars, takes the empties and goes back to the mine immediately, leaving the loaded cars on the trestle. One man, by using the hoists, unloads the 70 tons of ore all alone in less than an hour, and as the water costs nothing, the cost of transferring the ore is only $^3/_7$c. per ton.

The large hoist, which pulls the two 50-ton cars along, is a double-cylinder nonreversible engine with a friction clutch and a brake, although we do not use the brake. The cylinders are 6 in. in diameter with an 8-in. stroke, the crankshaft geared to the drum shaft with a ratio of 5 : 1; the diameter of the drum is 30 in.

When we first turned in the water, the hoist would make only part of a revolution and come up all standing. I made a little wooden model of the valve and valve seats and figured it out that while steam or air would compress, water would not; so I cut out ¼ in. on each side of the exhaust cavity in the valve and the engine worked perfectly. It runs slowly, but is just the thing to pull the cars and actually saves us $120 per month.

When one can take an old hoist, which otherwise would have netted perhaps $20 for scrap, and some water which costs nothing, and get a revenue of $120 per month at a total cost of installation of, say $200, it appears to me it is a profitable operation.

**Detachable Bits for Rock Drills** have engaged the attention of Rand miners for some time. The "South African Mining Journal," quoting R. W. Shumacher, states that hammer drills seem to make the detachable-bit problem easier of solution, and that undoubtedly a successful detachable bit will eventually be devised. Its advantages from the point of view of steel distribution are manifest.

## Drifting with a Jackhamer

By I. A. Chapman*

Three men, leasing a mine in Butte, are drifting and doing all their drilling with a jackhamer. They are Dick and Harry Cloke and Harry Andrews, each one of whom had considerable experience with jackhamers, while operating a lease on the Bullwhacker property. In the mine which they are working at present, they are driving a 7x7-ft. drift on a vein varying from 18 in. to 7 ft. in width and dipping 35°. The wall rock is so solid that little timbering is necessary. The rock is the easily drilled quartz monzonite of the Butte district, altered principally by the formation of chlorite. The men preferred the jackhamer, although they had the choice of any other machine.

An important item of equipment is the wooden trough in which they seat their drill. This is about 6 ft. long with inner side boards to hold the drill as steady as possible. It is laid up against the breast in line with the hole to be drilled, the machine is placed in the trough and the drilling commenced. In order to hold the machine up to its work, it is urged forward by a lever consisting of a short piece of steel, which fits into holes drilled in the base of the trough. Six 5-ft. holes are generally drilled to the round. In harder rock it is sometimes necessary to drill back holes almost flat. This is done by wedging a small stull across the drift 4 ft. from the face at the desired height and spiking the rear end of the trough to the top of the stull.


Use of Lever in Trough for Hole Inclined Upward


Putting in a Lifter

The average time for drilling a 5-ft. round of six holes is 2 to 2½ hr.; the men relieve each other and keep drilling steadily during that time. A special feature of the steel used is a hole 4 in. back of the bit slanting backward and connecting with the center hole of the steel. This extra hole aids in the blowing out of drill cuttings. I believe that this is an idea of Oscar Rohn's, or at least, that he was the first to use it in Butte.

Twenty-four to 26 cars of rock are broken per round. The cars are trammed an average of 300 ft. to the shaft.

*Box 1375, Butte, Mont.

In order to make the handling of the cars easier, the drift was widened in two places, and switches put in. It was necessary to timber the drift in one place for a distance of 30 ft., where two turns were made. With the exception of running the hoisting engine and compressor and doing a small part of the drill sharpening, the three men do the work, including dumping the cars on the surface. At the end of 25 shifts they had made a progress of 94½ feet.

## New Type of Copper Queen Change House

Prior to 1913, the change houses or drys for miners of the Copper Queen Consolidated Mining Co. were all of one type, similar in equipment and construction to others in the Southwest. They were usually two-story wooden buildings, with corrugated-iron roofs and walls. They had wash rooms and shower baths, and lockers for clothing. The lockers were ventilated and had steam pipes beneath. Each change house had its own heating plant for warming the building and heating water. Exhaust steam was not available, as all power was generated at a central station and distributed by electricity or compressed air.

When new buildings were designed, an attempt was made to improve on the older construction, particularly


FIG. 1. THE NEW CHANGE HOUSE AT SACRAMENTO SHAFT

in the directions of sanitation and reduction of maintenance costs. In the old buildings, the wooden floors wore rapidly, and gradually became saturated with wash water, etc. Although the lockers were ventilated at top and bottom, wet clothes were packed too closely to allow free circulation of air. It was necessary to keep the rooms uncomfortably hot in order that the clothes might be dried.

The Uncle Sam change room was built in the winter of 1912-13. It was followed by one at the West Atlanta shaft and later by a larger building at the Sacramento shaft. These are all single-story buildings, with cement floors. Small lockers are used for such articles as might be lost or stolen, but all clothing is hung from the ceiling. The wet clothes are thus spread out to favor drying by free ventilation, rather than by the heat of steam pipes. Each change room has a wash room and shower baths, accommodations for foreman, bosses and timekeeper, and a small storeroom.

Fig. 1 gives a view of the outside of the Sacramento building, and Fig. 2 a view of the interior. For one end of the building a cut in the ground was necessary, while the other was built on fill. The building was surrounded by shallow concrete foundation walls and the fill was settled by water. The cement floor was laid on the ground, with the exception of the wash room, which was supported by iron posts and laid on Berger plate. The skeleton of the building is of timber, plastered within and without on Hy-rib. Fig. 3 is a plan of the change house.

The heating plant, separated from the change room to cut down the fire risk, is situated below the building, so


FIG. 2. INSIDE OF CHANGE HOUSE, SHOWING SMALL LOCKERS AND CLOTHES SUSPENDED FROM HOOKS

that condensed water drains back to the boiler. The heater is an "Ideal" steam boiler of the American Radiator Co., 36-9 section. For heating the main room 650 sq.ft. of radiating surface is provided, and 70 more for the office and the bosses' change room. The steam pipes are laid around the walls above the benches, and protection from burns is given by wooden gratings.

The floor of the building is clear for washing with a hose; nothing but the iron supports of the benches interfere.

In Arizona, during a large part of the year, the air is so dry that clothes may be dried without heat if there is a free circulation of air. To furnish this, ventilators are spaced at 10 ft. intervals in a row down the center of the building. The room is exceedingly wide, and it may be desirable to provide additional ventilators. It would be even better to leave out the flat ceiling, which would allow the air to pass still more freely through the clothes. Thin sheets of galvanized iron separate the surface and mining clothes, but they appear to be unnecessary.

Miners work eight hours in the Warren district, and clothes have at least 14 hr. in which to dry. As soon as the morning shift has changed, the fire is banked and all windows opened. Little fire is necessary until an hour or an hour and a half before the shift comes up, when the windows are closed and the fire freshened to warm the room and heat water for bathing. The men on

the night shift go down an hour and a half after the day shift comes up, and the building is still warm for them while they change their clothes. The fire is again allowed to die down and is started up to warm the room for men coming off shift at 1:30 a.m. and for the morning shift which goes on at 7:30.

The cost of the building was as follows:

| | |
|---|---|
| Excavation | $303 |
| Concrete foundation walls, and floor | 1,589 |
| Building | 10,490 |
| Heating plant, etc. | 3,056 |
| Total | $15,438 |

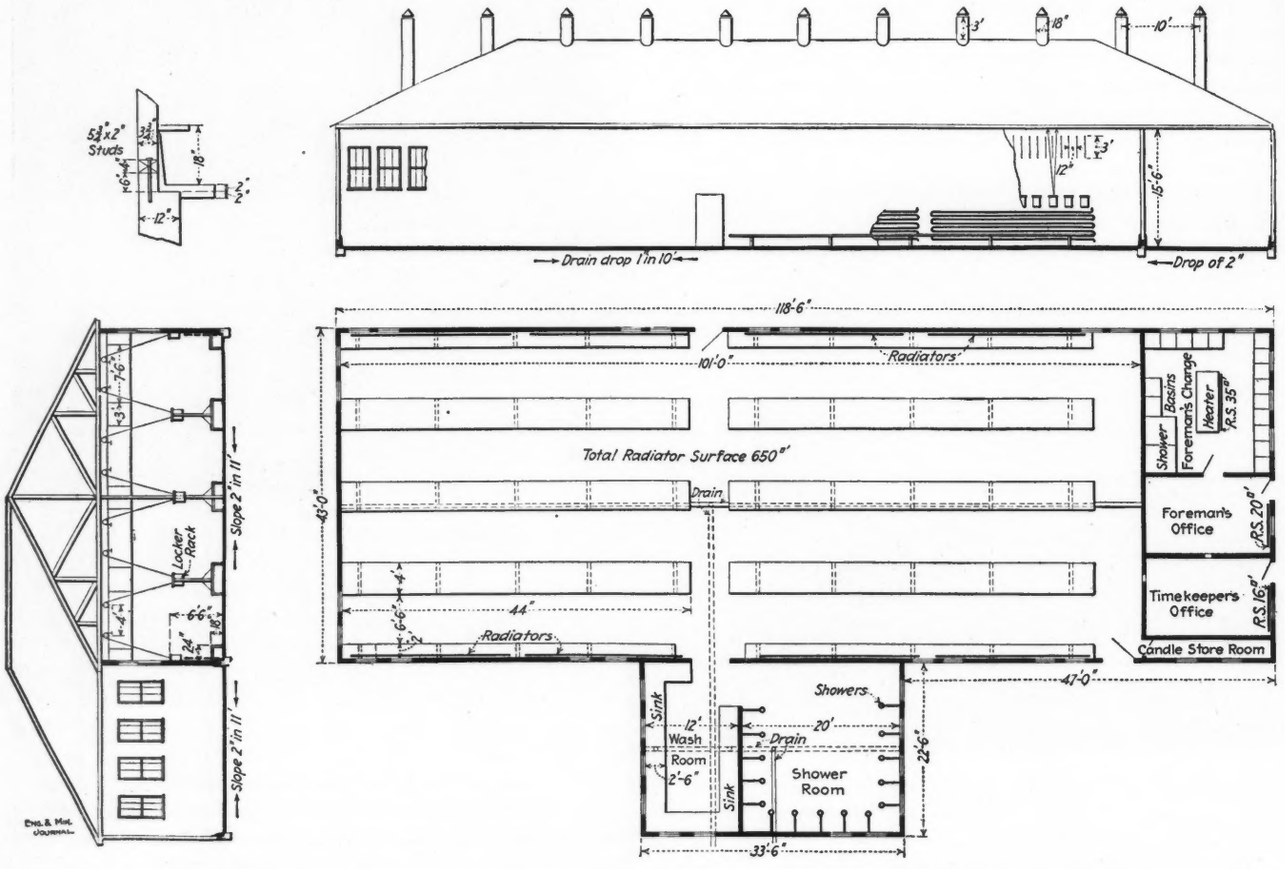
The building is large enough for 500 men, but only 383 lockers are provided. The cost of extra lockers would be about $250 more, making the cost per man $31.37.

## Vacuum Bailing Tank

A novel device, described by the *South African Mining Journal* of May 23, 1914, has been installed at the Daggafontein Gold Mining Co.'s property on the extreme southeastern Rand, where sinking is proceeding.

A large amount of water was encountered in the shaft, and to handle this a bailing tank was built in which a vacuum is created at the time of filling, so that the water flows in more readily and in greater quantity. An air pump is installed about 300 ft. above the shaft bottom, and 4-in. pipes are carried to a point 40 ft. from the bottom, where a 40-ft. length of flexible hose is attached. On the end of this hose and on the side of the tank are the halves of a vacuum-brake connection coupling.

When the tank arrives at the bottom of the shaft, connection is made between the flexible hose and the tank, and a stop-cock is opened so that the air is allowed to be drawn from the tank. The tank is then allowed to fill through a valve at the bottom, the stop-cock is shut off when the gage-glass on the side indicates that the tank is full, the vacuum couplings are detached and the tank is ready for hoisting. The tank fills in 15 sec. after the water valve at the bottom is open. An air tap 1 in. in diameter is fixed in the top of the tank to admit air at atmospheric pressure when it becomes time to discharge. Other details are added to make the device practicable in operation.




ARRANGEMENT OF A COPPER QUEEN CHANGE HOUSE OF THE DESIGN RECENTLY ADOPTED

The buildings have not been constructed long enough to give a fair average for cost of maintenance. The expense for fuel is more uniform, and a shorter time is sufficient to give dependable costs. We found that in the new change rooms the cost of fuel per man for a period of nine months ended not long ago was only 72% of that of the older type. None of the new change rooms is used to its full capacity, while the older buildings are crowded. The saving in fuel per man would be even greater if they also were filled.

It may be safely assumed that these buildings will cost less for repairs than the earlier type, and there will be an important saving in fuel. There is also a great improvement in sanitation. The usual rather unpleasant smell of drying clothes is not present.

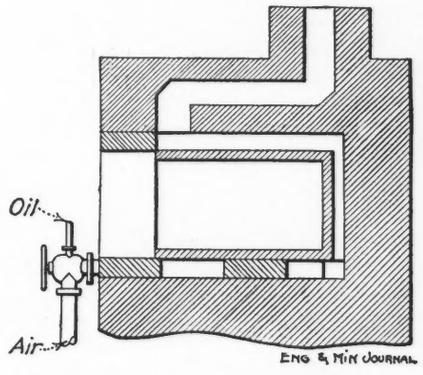
# Details of Milling and Smelting

## Refining Practice at Colburn-Ajax Mill

By Ralph H. Shaw*

In refining zinc precipitate from a cyanide plant, it is a serious problem to make high-grade bullion economically. The precipitate usually contains many metals, making refining difficult and expensive. The precipitate at the Colburn-Ajax mill, Victor, Colo., contains, besides gold and silver, a large amount of silica and zinc and small amounts of lead, iron and copper. For this mixture complex treatment is required.

Zinc-dust precipitation is used in this plant. When the press pressure reaches 35 or 40 lb., the flow of solution is cut off, and air is blown through the cake for several minutes to dry it out. This reduces the moisture to about 30%. Iron pans are then placed under the press, it is opened, and the precipitate is scraped off of the filter cloths. It is broken up into small pieces, ¼-in. cubes or smaller, and a sample is taken as the precipitate is broken up. A rough analysis is made to determine the amount of zinc present. To remove zinc, 1 lb. of concentrated commercial sulphuric acid is added for every pound of zinc present, which removes most of the zinc. Enough water is added to make about a 10% solution of acid, then the acid is put in. The entire mixture is then steam-heated nearly to boiling, during which time, and for several hours after, the mixture is air-agitated. After all action has ceased, the precipitate is settled and the liquor taken off through a filter press. The precipitate is water washed repeatedly until the discharge from the press gives only a slight cloudiness upon adding a few drops of $BaCl_2$ solution. Usually eight or 10 washings are sufficient to give the desired result. The reason for using a smaller amount of acid than is theoretically necessary is to preserve the presses, since dilute sulphuric acid attacks them rapidly.




Section of Cupelling Furnace

After washing is completed, the precipitate is washed out of the tank into an air receiver and thence forced into the press. The press is dried out and cleaned as before. Two days are usually required to cut down and wash the precipitate from one cleanup. The pans containing the precipitate are almost completely dried, electrically.

The melting is done in an oil-fired tilting furnace with low-pressure burner. The crucibles are Dixon's No. 275 and hold about 175 lb. of precipitate and flux when melted. Fuel consumption is about 0.1 to 0.15 gal. per pound of precipitate treated. From 200 to 250 lb. of precipitate can be melted per day of 8 hr. The life of each crucible is 4 or 5 days, or from 800 to 1000 lb. of precipitate.

Before fluxing the precipitate, it is broken up into small pieces, the flux added and the whole mixed well. The flux is slightly changed nearly every melt, as the percentage of silica in the precipitate varies. An average flux used is, in terms of percentage of weight of precipitate: Soda, 40%; borax, 10%; potash, 5%; coke, 0.5 to 1%, and slag, 20%. It was found that by adding a little coke to each charge, the life of the crucible was greatly lengthened, but that the grade of bullion from the furnace was lowered, due to the reduction of zinc and iron salts in the precipitate. This reduction of base metals is of no great consequence, however, because of the later treatment of the bullion. Slag added is the portion nearest to the bottom in the mold, and usually contains much metal. The contents of the crucible, after fusion, are poured into a mold and allowed to cool. About two pourings can be made per day. The slag from this process is saved and at intervals is shipped. Its average contents are about 35 or 40 oz. gold per ton. No matte is made, except occasionally when for some reason the washing is poor. If a little matte is formed it is broken up and ground and put back in with the next charge. The bullion produced is about 250 fine in gold and 50 to 75 fine in silver.

For a long time no satisfactory method of making a better-grade bullion was found. Making a heavy matte was tried and gave somewhat better results. It was unsatisfactory, however, as the results were erratic, and there was also the matte to ship and have refined, which was expensive, and to treat it was costly as well as difficult. It gave a low-grade bullion also, which had to be shipped separately from the first bullion. After some experiments, cupellation was decided upon. The furnace, as built, resembles, in a degree, the assay furnace described in the Journal of Dec. 6, 1913. It is oil fired, and the muffle is much higher than an ordinary assay muffle, though not so long. The openings in the back are near the top. The muffle is supported by firebricks, so placed as to form baffles, which deflect the flame around the muffle at the sides and back. A space of 2½ in. is left all around the muffle to give free passage of the gases to the stack. The relative positions of the muffle, burner and supports are shown in the accompanying sketch.

Cupels used are made of two parts of bone ash to one of cement. Each one weighs about 12 lb. when dry. They are 8 in. in diameter and about 6 in. high, with

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a depression 2 in. deep. They are made in a device similar to the ordinary hand cupel mold, the pressure necessary being applied by means of an ordinary jack-screw. Before using, each cupel is thoroughly dried and gradually heated to redness. If any cracks show, it is rejected. A cupel will hold about 15 lb. of base bullion and enough lead to make a good cupellation. About 3 to 4 hr. is required for each operation, and the fuel consumption is 10 or 12 gal. of oil per day of eight hours.

After cupellation, the gold button is melted in a small graphite crucible and run into a mold. The bars average about 750 fine in gold and 200 fine in silver. The cupel, after using, is ground up and mixed in with the precipitate and flux going to the melting furnace. By so doing, any cupel absorption is regained and also the litharge in the cupel is reduced to metallic lead, supplying part of that necessary for the next cupellation.

Several mixtures of bone ash and cement were tried for cupels, but with either more or less cement the results were unsatisfactory. If less cement were used the cupel was too soft and would not stand the weight of the button, while if more were used, the expansion of the cupel on heating would cause it to crack around the top. With a mixture of two parts bone ash and one of cement, a cupel either breaks on drying or while heating to redness, but never after the button is placed in it.

By this system of treatment of cyanide precipitate, high-grade bullion is made at reasonable cost. Only two products are made, the low-grade slag from the furnace and the bullion. The system has proved an economical success at this plant. Some skill and considerable practice are required to operate the two furnaces and get good results, but one man can do all the work if he arranges it systematically.

## Some Screen Analyses from Tonopah

By Percy E. Barbour*

The accompanying screen analyses of pulp from a Tonopah mill show some interesting facts regarding the results of the product of running a Dorr classifier at different speeds.

They also show the difference in the slime product from the tube mills with different types of lining. The

VARIATION OF PULP GRADE

| | On 60 | On 100 | On 150 | On 200 | Through 200 |
|---|---|---|---|---|---|
| Battery splash: | | | | | |
| From launders..... | 36.1 | 14.2 | 3.0 | 5.5 | 41.2 |
| From splash..... | 44.5 | 12.7 | 2.9 | 5.1 | 34.8 |
| From splash..... | 47.9 | 17.1 | 3.5 | 7.6 | 23.9 |
| Dorr-classifier overflow: | | | | | |
| At 20 strokes..... | 0.0 | 1.2 | 1.4 | 11.4 | 86.0 |
| At 12½ strokes.... | 0.0 | 0.125 | 0.8 | 5.45 | 93.62 |
| Tube-mill feed: | | | | | |
| Dorr running 20... | 42.9 | 29.2 | 17.2 | 2.7 | 8.0 |
| Dorr running 12½. | 42.9 | 25.0 | 6.9 | 12.2 | 13.0 |
| Tube-mill discharge: | | | | | |
| Smooth liners..... | 0.64 | 6.58 | 19.34 | 1.34 | 72.60 |
| El Oro liners..... | 0.7 | 10.0 | 30.8 | 1.08 | 57.42 |
| Smooth liners..... | 0.4 | 6.8 | 19.5 | 6.1 | 67.2 |
| El Oro liners..... | 1.0 | 14.6 | 27.7 | 6.9 | 49.8 |

mill has 30 stamps weighing 1100 lb. each and crushes through a 12-mesh screen on four batteries and a 4-mesh screen on the fifth battery, this having been shown by experience to give a grade of material on which the tube mills run with highest efficiency. There are two 5x18-ft. tube mills, which when equipped with smooth liners give 12 to 20% more efficiency than with the El Oro type, but the wear of the former is considerably greater and a compromise type has been adopted.

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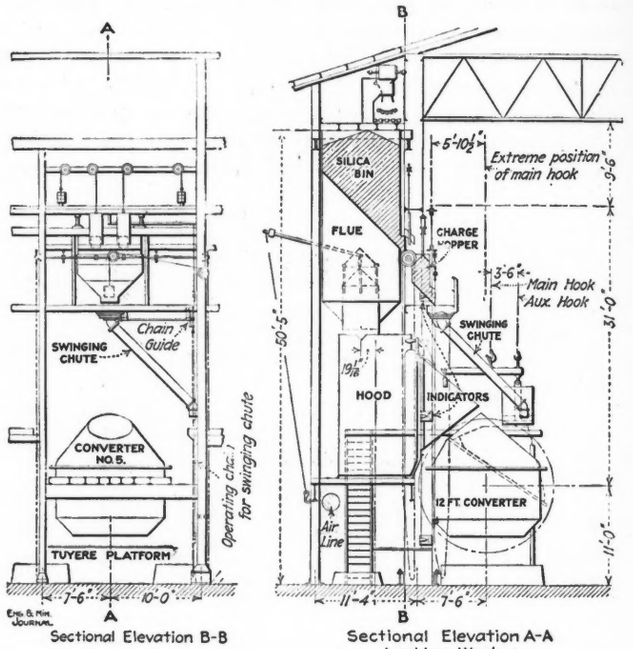
## Feeding Siliceous Flux to Copper Converters

The accompanying illustration shows the arrangement for feeding silica to converters at the Calumet & Arizona Mining Co.'s new smelting plant at Douglas, Ariz. The siliceous ore is brought to the converting department by belt conveyors, and discharged into an elevated bin. A gate controlled by a chain enables the operators on the converter floor to fill the charge hopper, in which the silica flux is automatically weighed. When it is desired to feed silica, the converter is turned over only slightly




Arrangement for Feeding Silica to Converters

and the pipe chute swung around until it is directly over the mouth of the converter. Another chain-operated gate opens the discharge from the weighing hopper, and permits the silica to run by gravity into the converter. This arrangement makes for greater speed in converter operation, especially if the crane service is inadequate and causes delay in feeding the silica into the converter from boats.

This silica-feeding arrangement has been installed in a number of the new smelting plants that have been constructed in the Southwest under the direction of L. D. Ricketts as consulting engineer, from plans of Repath & McGregor, of Douglas.

**For Sintering Pyrites Residue** the Pyrites Co., Ltd., at Roanoke, Va., has two Dwight-Lloyd machines that have developed remarkable capacity in the sintering of residues after leaching. The cinder is given a water leach that removes about one-half of the copper and the residue containing about 3% of sulphur is mixed with 6 to 8% of coke breeze and sintered, the sulphur content being reduced to about 0.11%. The Dwight-Lloyd machines developed so great a capacity that ordinarily only one is required, the tonnage averaging 140 long tons and having been as high as 220 tons in 24 hr. The sinter is sold as iron ore and at one blast furnace constitutes about 50% of the charge.

# Company Reports

## Natomas Consolidated

During 1913 the Natomas Consolidated of California, head office, San Francisco, Calif., according to its annual report earned only $107,841 above its bond interest without charging off any depreciation or bond discount. The net income from various sources amounted to $1,164,444 made up as follows: From gold-dredging department, $992,367; rock-crushing department, $73,945; water department, $17,949; miscellaneous discounts, etc., $470; interest on investments, $7500; interest on reclamation district warrants and bonds, $72,213. From these earnings a loss of $12,556 on the crop-growing business is deducted, leaving a balance of $1,151,888. Of this amount $980,534 was necessary for payment of bond interest and $63,513 for miscellaneous expenses, leaving a balance as stated. But, charging off the loss on dredge No. 7, which sank and had to be reconstructed, amounting to $129,394 indicates a loss of $21,553. There are also deferred charges standing on the books aggregating $1,105,506, none of which was apparently written off during the year. Current liabilities are $2,151,589 more than assets and there are bonds outstanding to the amount of $17,375,000. The outstanding capital stock amounts to $16,068,800. Judging from these facts and others given in the report the Natomas is far from being in a promising position. A statement of lands owned at the end of Dec. 31, 1913 follows:

| | Acres | | Acres |
|---|---|---|---|
| Irrigated lands | 28,851 | Water department | 5,056 |
| Reclamation districts | 59,709 | Rock crushing | 95 |
| Gold-dredging department | 9,502 | Total acres | 96,213 |

Considerable space is devoted in the report by the consulting engineer to previous errors in estimating the value of the dredging ground owned by the company. In 1909 when an additional bond issue was being floated for the purpose of completing the dredging fleet and other work, it was estimated that the net profit from dredging operations would exceed $20,000,000. After two years' dredging it was evident that this estimate was too high and 300 new bore holes were put down. Based upon the evidence obtained from these holes, and excluding lands the value of which was more for agricultural purposes than dredging, the present holdings of 4157 acres of remaining tested lands were valued at $20,615,000 gross on Jan. 1, 1913. It was estimated that a profit of $10,664,000 should be made from this output. With additional borings in 1913 and after deducting the year's profit, the total profit still remaining is estimated to be $10,250,000 from a gross output of $19,661,000. This estimated net profit is equal to about 52.3% of the gross output. During the last two years, only 46.8% net profit has been realized. On the basis of 46.8% the remaining profit would be about $9,200,000. Actual dredging costs have been: In 1909, 4.016c. per cu.yd.; 1910, 5.124c.; 1911, 3.193c.; 1912, 4.463c.; 1913, 5.354c. It seems that Natomas has also underestimated quite a number of items from time to time. A statement shows that the costs of four new dredges and the repairs of those which sank exceeded the estimated cost of five new dredges which it originally intended to add to the fleet. The dredging profits were only 73.5% of the amount estimated for 1913. The gross value of the output was overestimated by 0.19c. per cu.yd., and the actual cost of dredging was underestimated by 1.24c. per cu.yd. In the Feather River division the average gross output exceeded the estimate by 1.26c. per cu.yd., but the actual costs exceeded the estimate by 0.64c. per cu.yd. The reduction of costs with the 15-cu.ft. buckets, against the 9-cu.ft. bucket dredges, should theoretically be about 12% in every department except power. The following tabulation shows that this was not the case.

| Natomas Consolidated of Calif., 1913 | No. 8 Dredge 15 Cu.Ft. | No. 9 Dredge 15 Cu.Ft. | No. 5 Dredge 9 Cu.Ft. | No. 6 Dredge 9 Cu.Ft. | No. 10 Dredge 9 Cu.Ft. |
|---|---|---|---|---|---|
| Total book cost per cu.yd., incl. all 1913 charges | 6.54c. | 6.69c. | 11.05c. | 8.71c. | 5.15c. |
| Less power per cu.yd. | 1.49c. | 1.30c. | 0.97c. | 0.98c. | 1.06c. |
| Total cost less power | 5.05c. | 5.39c. | 10.08c. | 7.73c. | 4.09c. |
| Deduct cost of reconstructing Nos. 5 and 6, per cu.yd. | ..... | ..... | 6.41 | 3.65 | ..... |
| Comparative cost per cu.yd., excluding power and reconstruction cost | 5.05c. | 5.39c. | 3.67c. | 4.08c. | 4.09c |
| Cu.yd. dug per hr., dredged | 273.1 | 322.9 | 250.7 | 229.1 | 359.7 |
| Per cent. of time worked, not counting reconstruction time | 80.61 | 84.03 | 80.29 | 84.69 | 78.82 |
| Total material repair cost | $45,473 | $71,101 | $82,181 Including reconstruction. | $67,322 | $50,056 |

## Copper Queen Smelting Operations

The following data were taken from the 1913 report of Phelps, Dodge & Co., and relate to smelting operations of the Copper Queen at Douglas, Ariz. There were 1,034,357 tons of copper-bearing ores treated which yielded 134,513,330 lb. of bullion from which 133,410,582 lb. of copper, 1,870,162 oz. of silver and 31,141 oz. of gold were produced. The percentage of various ores treated was: Copper Queen ore, 67%; Copper Queen slag, 9.4%; Moctezuma concentrates, 13.5%; ore to converter, 3.6%; and other custom ores, 6.5 per cent.

The blast furnaces treated 1,013,767 tons of charge, of which 822,283 tons were raw ore, 9249 tons of calcined material from roasters, 2125 tons of slimes, and 180,110 raw material and produced 102,630 tons of calcines. The shrinkage was 16.6%. Flue dust produced was 5.2% of tons of secondaries or returns from furnaces and converters. Flue dust produced was 39,748 tons, or 3.92% of the charge, against 5.90% in 1912 and 7.59% in 1911. An average of 8.08 furnaces were operated and 343.5 tons of charge were smelted per furnace day, using 125,280 tons of coke or 12.4% per ton of charge. The matte fall was 18.79% compared with 20.97% in 1912. Experiments on dust losses from the large steel stack showed a loss of 2286 lb. of copper per day compared with 14,310 lb. in 1909 with practically the same number of furnaces and converters in operation. Roasters and reverberatory losses are not included in this figure.

An average of 5.97 roasters per day were operated in the reverberatory department, treating 123,099 tons of the charge. The composition of the charge was: 97% concentrates, 1.3% ore and 1.7% foreign flue dust.

An average of 1.71 reverberatory furnaces were operated per day, smelting 179,958 tons, or 289.6 tons per furnace day. Material smelted consisted of 93.196 tons of calcined material, 37,806 tons of furnace flue dust, 830 tons of converter flue dust, 44,041 tons of screenings from Bisbee ore, used as fettling, 3720 tons of barren quartz and 365 tons of secondaries. Oil consumption was 0.9 bbl. per ton of charge; of this 34.57% was charged to steam and credited to reverberatories. In a new furnace completed in 1913 part of the lining is of magnesite instead of silica brick.

Operations were conducted on basic-lined converters, treating 206,493 tons of matte and producing 67,256.665 tons of bullion from an average of 6.5 stands per operating day.

In the sampling department 12,378 samples were made and 318,507 tons of ore handled. This is equivalent to about one sample for every 25.8 tons of ore handled. The laboratory made 101,455 determinations for the smeltery or about one for every 10.2 tons of copper-bearing material treated. The power plant developed an average of 4595.8 hp. per day at a cost of $54.844 per hp.-year. Employees and tonnages handled are summarized in the following table:

| | | | | |
|---|---|---|---|---|
| Sampling | 70 | | 318,507 | 4550 |
| Unloading ore, flux and supplies | 36 | | ..... | .... |
| Blast furnaces | 255 | | 1,013,767 | 3960 |
| Reverberatory roasters | 69 | | 123,099 | 4400 |
| Reverberatory furnaces | | | 179,958 | |
| Converting | 311 | Matte | 206,493 | 664 |
| Mechanical | 221 | | ..... | .... |
| Power plant | 30 | | ..... | .... |
| Office, engineering and laboratory | 40 | | ..... | .... |
| Total | 1039 | men, or about one for every 995 tons of copper-bearing material treated during the year. | | |

## Alaska United

The report for 1913 of the Alaska United Gold Mining Co., Douglas Island, Alaska, shows a combined profit of $385,065 from the operations of the Ready Bullion and the 700-Ft. claims and sundry profits. This profit is exclusive of $30,050 depreciation of property and plant charged off. Dividends aggregating $414,460 were paid. A total of 448,427 tons of ore were milled from the two claims, having an average yield of $2.22 per ton. The average cost was $1.45 per ton, leaving an average working profit of 88c., from which a loss of 2c. must be deducted for loss in subsidiary accounts, leaving a profit of 86c. on both operations. The following table gives a summary of detailed costs on both claims, exclusive of miscellaneous income and losses:

| | Ready Bullion Claim | 700-ft. Claim |
|---|---|---|
| Tons ore milled | 222,992 | 225,435 |
| Feet of development | 3997 | 2783 |
| Mining | $1.0323 | $1.0582 |
| Milling | 0.2670 | 0.2255 |
| Sulphuret expense | 0.1052 | 0.0880 |
| Offices | 0.0131 | 0.0129 |
| Legal expenses | 0.0088 | 0.0087 |
| Taxes | 0.0103 | 0.0102 |
| Bullion charges | 0.0100 | 0.0102 |
| Construction costs | 0.0045 | 0.0309 |
| Total operating charges | $1.4512 | $1.4446 |
| Profit on ore | 0.8421 | 0.9159 |
| Net yield of ore per ton | $2.2933 | $2.3605 |

The average cost of development on the Ready Bullion claim was $13.40 per ft., and on the 700-Ft. claim $11.92 per ft. The average cost of stoping per ton stoped was 70.3c. and 61.6c., respectively; of tramming per ton trammed, 10.5c. and 14.2c.; of hoisting per ton hoisted, 15.2c. and 13.2c.; and of pumping, 5.2c. and 1.3c. per ton treated. Ore reserves are estimated to contain 1,708,662 tons of $2.91 ore on the Ready Bullion and 1,281,475 tons of $2.46 ore on the 700-Ft. claim. In the Ready Bullion mill, 1 lb. of chrome steel in the shoes crushed 2.6 tons of ore, and 1 lb. of iron in the dies, 5.29 tons. In the 700-Ft. claim mill, 1 lb. of chrome steel in the shoes crushed 2.35 tons of ore, and 1 lb. of iron in the dies, 4.68 tons. Total dividends to date amount to $1,576,750. The average yield of the ore from the two claims has been about $2.10 per ton.

## Alaska Mexican

The 1913 report of the Alaska Mexican Gold Mining Co., Douglas Island, Alaska, shows a profit of $171,797 from treating 227,112 tons of ore yielding $2.1562 per ton. This profit is exclusive of depreciation written off to the amount of $21,552. Dividends aggregating $180,000 were paid. The following is a summary of costs as grouped under general headings:

| | Per ton milled |
|---|---|
| Mining | $0.9070 |
| Milling | 0.2510 |
| Sulphuret expense | 0.0923 |
| Offices | 0.0260 |
| Offices | 0.260 |
| Legal expenses | 0.0132 |
| Taxes | 0.0123 |
| Bullion charges | 0.0081 |
| Construction | 0.0348 |
| Losses on sundry accounts | 0.0829 |
| Total operating cost | $1.4276 |
| Operating profit | 0.7564 |
| Total | $2.1840 |
| Less miscellaneous earnings | 0.0278 |
| Net yield of ore per ton | $2.1562 |

Development work totaled 2464 ft. and 138,217 tons of the ore milled came from mine stopes. The average cost of development per foot was $15.75; of stoping per ton of ore stoped, 81c.; of tramming per ton trammed, 15c.; of hoisting per ton hoisted, 8.1c.; of pumping per ton milled, 1.3c. The total mining cost consisted of 55.1c. for labor, 15.1c. for supplies, and 20.5c. for subsidiary accounts. Ore reserves are estimated to contain 816,882 tons averaging $2.53 per ton. Of this tonnage 385,943 tons are broken in stopes. The average grade of ore milled to date is $3.12 per ton. In the mill 1 lb. of chrome steel in the shoes crushed 2.62 tons of ore and 1 lb. of iron in the dies crushed 5.38 tons of ore.

At a point on the main east drift of the Ready Bullion mine of the Alaska United Gold Mining Co. and 1324 ft. from the east line of the Mexican mine, a concrete bulkhead was built so that in case of a fire or flood the bulkhead could be closed, thus preventing water or gases going from one mine to another. The bulkhead is hitched 2.5 ft. into the solid rock and it is 12 ft. thick and built of solid reinforced concrete. In the center is an opening 2 ft. wide which will be closed automatically from either side by a cast-iron door in case of a pressure of water. The expense of this work was divided between the three mines of the group.

# Mining & Metallurgical Machinery

## Sandvik Steel-Band Conveyor

The endless steel bands made by the Sandviken Iron & Steel Works, Sandviken, Sweden, for conveying purposes were described in the JOURNAL, Sept. 3, 1910. They are now being introduced into England by Messrs. S. A. Edwards & Co., of Birmingham.

It is obvious that the use of a hard wearing surface such as steel, tends to a greatly prolonged life of a conveyor. The use of steel in this way, however, imposes certain necessary restrictions which involve some modifications in design as compared with ordinary band conveyors.

The belt is made of hardened flexible steel, and it is therefore especially suitable for carrying material of a hard, cutting, gritty or hot nature, although the maximum temperature at which material may be projected on such a conveyor, is 212° F. The first cost is low, the


STEEL-BELT CONVEYOR HANDLING BROKEN AND LUMP MATERIAL

belt in itself being cheaper than good textile belts, and the idlers and other accessories being simpler in construction.

A special construction of the head pulleys, idlers, etc., is necessary. The steel band requires in ordinary cases head pulleys of at least 40 in. diameter and on account of its rigidity it can never be troughed. It must be protected from sharp bends and any external damage caused by hammering, chafing or pressing of the belt. It is dangerous to allow small, hard particles to stick to the face of the head pulleys, as an accumulation will cause at each revolution a depression in the steel band, and in this way in course of time, gives it a convex form that makes it unfitted for carrying material.

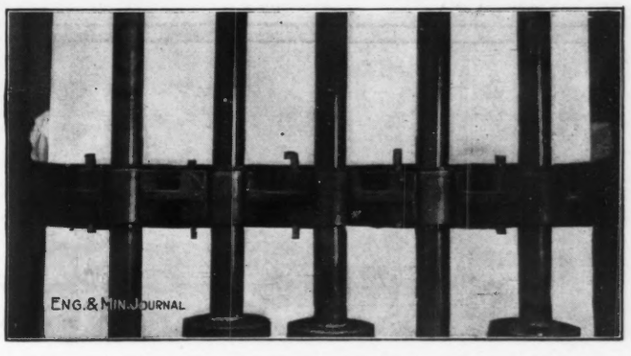
The usual widths of band adopted are 9 in., 11 in. and 14½ in. In order to obtain a width of more than 14½ in., three bands are put together in such a way that they cover one another without any joint; the middle band overlaps the two others by about 3¾ in. on each side, and is given a little less tension than the two others in order to secure a perfectly tight fit of the bands. Moreover, as the greatest part of the load comes on the middle band, this distribution of weight assists in pressing the middle band down against the two others.

The maximum inclination at which the Sandvik conveyor will work satisfactorily depends of course on the material that is to be carried, but in general is 14°. A conveyor of this type has, it is claimed, a capacity from 50% to more than 70% of the capacity of a troughed textile belt-conveyor, the figure depending on the class of material which has to be handled. For ore in lumps, however, the capacity is about the same with the two kinds of conveyors. The illustration shows a steel-band conveyor handling lump material as it would ore.

## New Battery-Stem Guide

The accompanying photograph illustrates the "Little Wonder" battery-stem guide, first introduced in the Yellow Aster mill, at Randsburg, Calif. This guide was designed by J. A. Little, mill superintendent for the Yellow Aster.

The guide frame, which may be either of special-grade iron or of cast steel, is a permanent fixture. There are only eight nuts used in the frame for the battery of five stem guides. These are used to hold the frame to the girt. The only wearing part in the entire structure is the




STAMP-STEM GUIDES AT THE YELLOW ASTER MILL

bushing, which may be made of cast iron or cast steel, and can be renewed at small cost.

The bushings are made in single pieces or in halves, as desirable. They are 6 in. long and cylindrical in shape, and cannot stick in the frame, as is the case with tapered bushings. They are made with a shoulder, which prevents them from dropping through the frame. The guide frames are made with pockets in which gibs are placed. The bushing is placed with the shoulder resting on the frame and the key is driven lightly behind the gib. This holds the bushing with a tight grip, but causes no extra strain on the frame. The back of the keyway is a curved surface on the frame, and requires no machining.

The key is 1¾ in. distant from the stem, giving ample room for the use of a light hammer when necessary to

remove the key. This arrangement prevents the stem being battered with the hammer, as is the case in the removal of many other stem guides. The rigidity of the guide frame insures perfect alignment of the stems.

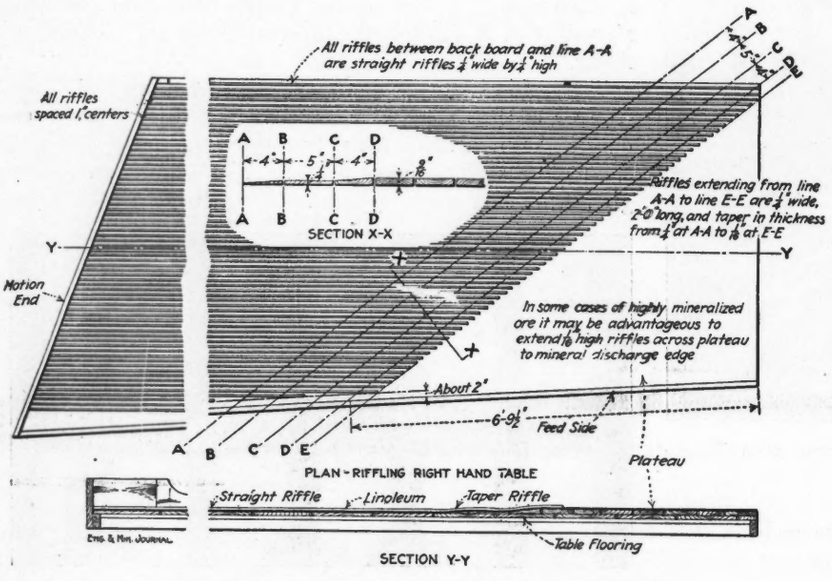
These guides have been in use on two 5-stamp batteries in the Yellow Aster 100-stamp mill for 8 months. In that time there have been no alterations, repairs, or losses of time. As other stamp guides in use break or wear out, the "Little Wonder" is substituted. They have been given a thorough comparative test with other designs and found to be really superior in performance and in economy of cost.

## Increased-Capacity Device for Concentrators

A new device for concentrating tables has been patented by the Deister brothers, of the Deister Machine Co., and is known as the Deister plateau and riffle. The improvement consists essentially of an incline and elevated portion, which is added under the linoleum at the end, or discharge of the table, and may be applied either to Wilfley or Deister machines. It crosses the tables on a slant, starting 24 in. from the ore-discharge end and coming out on the upper side under the feed box, 7 ft. from the end of the table. It will be seen from this that the feed box can be made 10 ft. long if desired, in place of the usual short box employed on Wilfley machines. The accompanying drawing showing a plan of a Wilfley table, with the sectional views, explains the device satisfactorily. Where the increase in the table height begins, 4 in. is devoted to an inclined rise, and then there are 5 in. of plateau, or level surface, ¼ in. above the previous table plane. In the next 4 in. there is another rise of $\frac{5}{16}$ in., the balance of the surface from there to the end of the table being level again.

The riffles, instead of being tapered, may be carried ¼ in. high, the height of the Wilfley riffles at the head of the table, straight across to the rise. The riffles are also placed closer together. According to the idea of the Deister brothers, this permits a heavy drawing motion through the deep riffles, allowing the handling of a great deal more material, and in order to clean the material thoroughly, the drawing force is opposed by the risers and plateau, where it is satisfactorily separated.

This device has been tried on a Wilfley table at the Hunter mill, at Mullan, Idaho. The result is said to be increased capacity and extraction. The machine is in operation beside another Wilfley of the same pattern, but not equipped with the plateau and riffle, and a careful record is being made of their operations, for comparison. The streak of ore on the old Wilfley is about 6 in. wide, while on the table equipped with the plateau and riffle it is about double that width. The record shows that the new idea has increased the grade of concentrates produced from 50% to 60% lead, and also produces about 15% more concentrates from the same feed than the old table. It uses less water by two gallons per minute. The separation between waste and ore is said to be very distinct. The handling capacity of the table is increased nearly 100%, it is claimed, by the use the device.




THE DEISTER PLATEAU FOR CONCENTRATORS

## Pulleys for Line Shafts

The question of the sort of pulleys to be used on line shafts, in mills and in other places around mines, is one of importance. Of the three kinds, wood, steel and cast iron, no doubt each has a field where the others could not be used. but it seems strange that the cast-iron pulley is still used to a large extent, for general purposes in the face of the many advantages of steel. The use of steel pulleys, however, has increased to such an extent in this country that two factories making them it is claimed are now turning out more than all the makers of cast-iron pulleys, combined.

The following information obtained from the Oneida Steel Pulley Co., Oneida, N. Y., throws some light, perhaps, on why steel pulleys have become popular:

(1) The weight of steel is about one-third that of cast iron, permitting a saving in freight charges.

(2) The power required to revolve a ton of pulley weight on a shaft, results in economy from the use of steel.

(3) Steel pulleys are easy to remove and install, no expensive staging and few men being required.

(4) Steel pulleys are carried in stock in trade centers near mines, eliminating possible delay in shipments.

(5) On an average, steel pulleys cost somewhat less than those of cast iron.

(6) Steel pulleys can be operated at much higher speed with safety.

(7) Steel pulleys will take sudden variations in the load without breaking, due to their greater tensile strength and their greater number of parts.

When compared to wood pulleys, the steel of the same weight are of greater strength. They are made in a variety of sizes, either straight face or with flanges, and can be built to transmit 750 hp. or even more.

# Use of the Vertical Sinking Pump

By E. Mackay Heriot*

*SYNOPSIS—For successful pumping results in shaft sinking loss of pumping time arising from necessity of hauling up pump when blasting, and lowering as shaft deepens, with concomitant necessity of lengthening pipes, must be reduced to a minimum. The article describes a pumping installation meeting these requirements, using electrically or steam-driven pumps.*

The cost and time of sinking a shaft must depend in a great number of cases on the quantity of water encountered. If this be so, it will also depend on the efficiency of the pump work. By pump work is meant the whole pumping installation and operation. If the shaft is equipped with a Cornish pump, a bucket lift is used. This is well known to miners, but in out of the way places, where most mines are situated, prospectors' shafts are not fitted with such apparatus. In ordinary

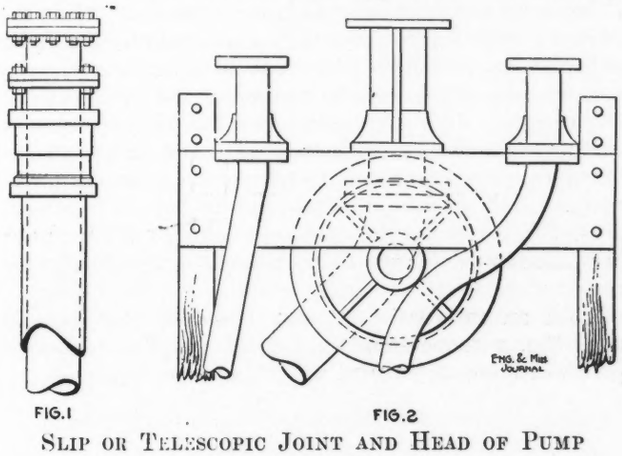


FIG.1 FIG.2

Slip or Telescopic Joint and Head of Pump Supporting Frame

practice unwatering operations during sinking are either carried out by electrically or steam-driven vertical pumps. The electrically driven are easier to manipulate, because there is only one conduit of pipes, the rising main, whereas the steam pump needs three lines of pipes, the steam, exhaust and water pipes. Condensers cannot be used, because they make the water too hot, therefore the exhaust steam must be carried to the surface.

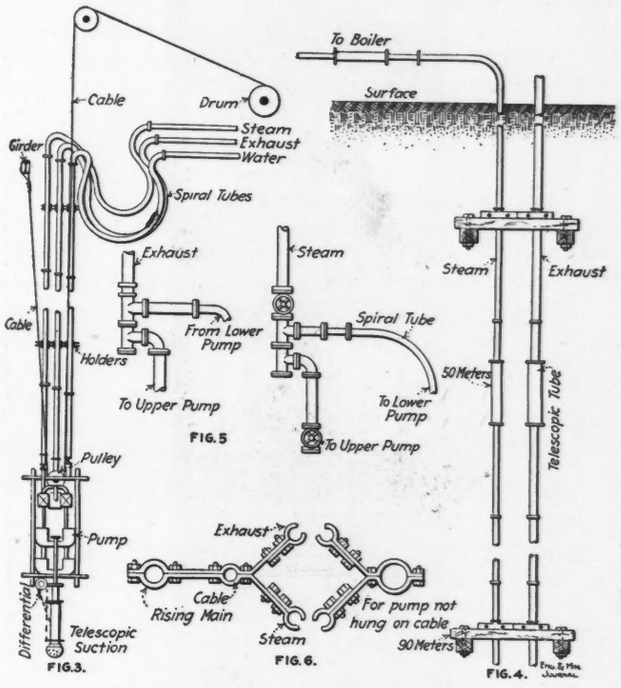
### Excess Pumping Capacity Desirable

In order to demonstrate the time that can be lost during the various pump operations, I will take a small shaft 3x2 = 6 square meters. This will make six tons of water for every lineal meter of shaft. If the inflow be 20 tons per hr., during a stoppage of one hour the water will rise over three meters.

When buying a pump one should remember that the capacity should be far above the actual inflow, and this for more than one reason. As a rule it is difficult to keep a pump working at its rated capacity. The plungers get furrowed quickly and the packings do not hold as well, thus reducing the working output. Furthermore, after blasting or any other stoppage, considerable water has entered the shaft and must be pumped out quickly, otherwise valuable time is lost. A pump with 30 tons per hr. capacity will take nearly two hours to get out the water of one hour's stop; thus three hours are lost.

### Piping Connections and Difficulties in Making Them

Just before blasting, the pump is lifted up a few meters in order to safeguard it against any flying rock. If the piping were made fast in the shaft the connections would have to be unfastened before the lifting could take place. This is carried out in one-quarter of an hour, in which time the water rises one meter, or a little less. During joining, waiting for the smoke to rise and making connection, at least another 1¼ hr. are




Details of Sinking-Pump Fittings

lost. The water is now 5m. deep in the shaft. Before the bottom is reached nearly four hours have been lost. It will be seen that with the 20 tons per hour it is practically impossible to use stiff pump connections when the pipes are made fast in the shaft.

A similar operation is putting in piping. With stiff connections this is tedious work because each pipe must be cut exactly to measure. In theory this may seem easy, but in practice it is difficult and sometimes impossible. If the pipes must be made fast in the shaft, spiral tubes will be a great help. These would then be connected to the pump. The disadvantage is that they are liable to be damaged by rock when blasting. By this method the pipes have to be changed underground, often enough in small shafts with water falling everywhere.

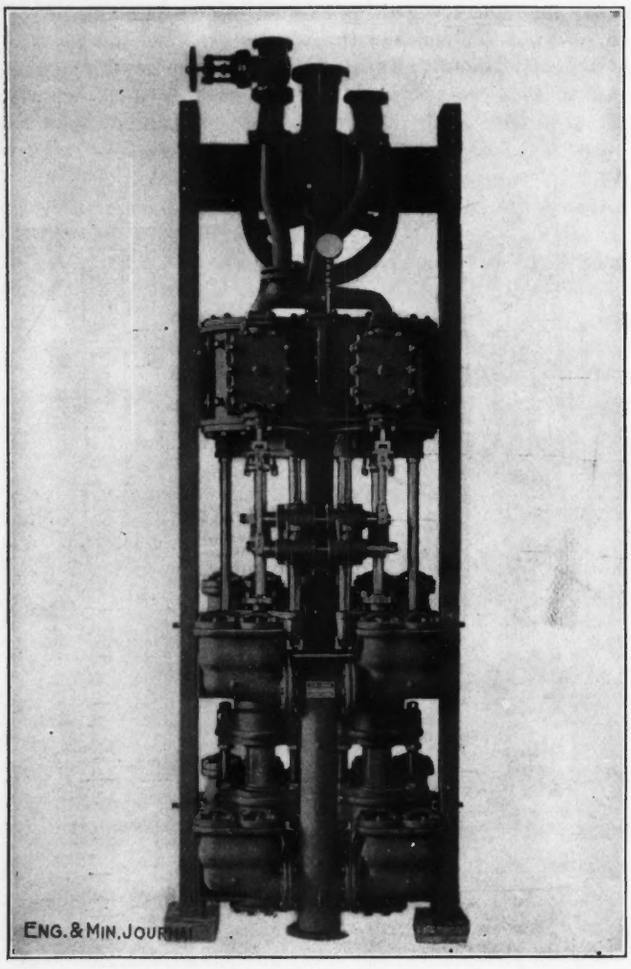
A rubber hose is generally used for the suction. This is not to be recommended, because when the pump has been sunk the end of the hose lies in a horizontal position. This is apt to let the retention-valve clap lie open

*Mining engineer, 19 Campden Hill Gardens, Kensington, London.

and cause trouble. Wherever possible the sinking pumps should be so erected that the changing of pipes takes place at the surface. It should be possible to do any lowering or raising without unfastening any underground connections. Last, but not least, it should be possible to lower the pump without stopping it. It will be seen that such an installation must cause a minimum loss of time, and I propose to describe here how it can be made.

### How to Install an Elastic Pumping Plant

I will take for the example the same conditions as before mentioned. A duplex, steam-driven, vertical sinking pump with a capacity of 750 liters per min. will suffice. The steam pipe leading to the pump will be 65mm. in diameter, the exhaust 80mm. and the delivery 150mm. The pump is so constructed that the pipes are connected directly to the pump. This is of the utmost importance and I would draw special attention to it. With ordinary makes of sinking pumps the weight of the pipes cannot rest on the flanges of the inlets. However, with a pump constructed inside a steel frame where the pipe connections are strengthened and rest on the upper part of the frame, it may be done. The water pipes must be light. A special spiral-wound steel pipe without rivets gives excellent service. All pipes are fitted with flanges because it is difficult to repair leaky threaded joints. A leakage at any flange is easily stopped. The joint is loosened and the column above lifted by the aid of a winch or differential pulley at surface. The defective gasket is then taken out and replaced. For such work in shafts special gaskets are made with wire handles. This allows quick repairs; the hands are not burnt by the hot pipes.




Type of Steam-Driven Sinking Pump

Every 10m. the pipes are held fast by flat holders. Their construction is shown in Fig. 6. They grasp firmly the rising main, but the cable can run free. The steam and exhaust are held fairly fast, but may move to allow for expansion.

It will be well to say a few words regarding the expansion of the pipes in the shaft. For the system of pumping I am describing compensation pipes are not used, but when the columns are held fast in the shaft and connected to the pump with spiral tubes a compensation pipe is necessary both for the steam and the exhaust. These should be placed half way up the shaft. For the steam piping another is used at surface. The piping in the shaft is secured just above the pump, and at every 10 or 15m. rests are placed, but these must be made to allow for movement of expansion. The conduits are held firmly above the compensation pipes. The so called compensation pipes are, in other words, telescopic tubes. They work in and out as the pipes expand and contract. In a shaft 100m. deep the telescope should be drawn out a half meter before letting in the steam. Great care must be taken in letting the steam in gradually. Each conduit of pipes is fitted at surface with a 5-m. long spiral tube, made of bronze or steel. Rubber hose is used for the rising main, but the spiral tube stands more wear.

With an installation of this kind the rose can be sunk 6m. without stopping the pump. The telescopic pipe will allow 1½m. and the spiral tubes 4½m.

### All Piping Connections Made at Surface

During the blasting operations pump and pipes are raised without unfastening a connection. Changing pipes is done at surface. This does away with hastily made and uncomfortable platforms underground. Any one who has had to change pipes in drenching cold water and burning steam will appreciate the installation I have described here.

At surface one hour before the changing, each new pipe is examined, together with the necessary bolts, keys and gaskets. In this way the work can be arranged so that it can be done with a minimum loss of time. Electric sinking pumps throw to great heights; steam pumps are also made for 200-m. lifts, but as a rule only for 100m. When water has to be raised over 100m. two pumps are used, one of which is anchored fast in the shaft. The sketch, Fig. 5, shows the steam connections from one pump to the other. If water has to be lifted over 200m., steam should not be used, unless a permanent installation be made.

When buying pumps one should order spare valves, pistons, rod and plunger, order all pipe connections and spiral tubes, and see that the pump is fitted with a telescopic tube for suction, a pulley for the cable, and built solidly in a frame. The steam, exhaust and water inlets should be strengthened and built up on the crosspiece of the frame. It is also well to have a good supply of packing on hand, because as soon as the plunger is worn the packing will have to be renewed at intervals.

## The Prospector

By T. M. C.

George Wharton James, in Chapter 20 of his work, entitled, "The Wonders of the Colorado Desert," gives an extremely vivid picture of a certain type of prospector, following this description with the common-sense advice given by one of a different type. We think this is rather interesting material:

"And in the dry times what will not a man drink? Oh, you city dwellers, who must have distilled water and Apollinaris and Shasta and iced drinks, just think once of the poor prospector at an alkali pool! Stagnant, dirty, full of filth, a standing place for animals and fearful night creatures, bitter, salt—yet that is all he can get. It is lukewarm and sickening. And what encourages him through all these trials? He 'hopes' to strike it rich. He has what the phrenologist would term a well developed organ of hope. He is imaginative. He sees visions. He dreams dreams. He doesn't look like an idealist; his hands are horny, his nails untrimmed and black-bordered, his hair and beard unkempt, and if he ever shaved no one would now know it. His eyes seem ever bent downward to the earth, and his lips are as thick and sensuous as his eyes are dull and heavy.

"Yet he is a dreamer. He can see in these inhospitable barren plains or these dreary, sandy deserts or these rough and rugged slopes, pockets of the precious metals. He can see his pick discovering them, and then, in succession, the shaft, the drift, the stope, the bonanza, the mill, the bricks of precious metal and the hoard at the bank. He sees his wife in silks, satins and diamonds, riding in her carriage drawn by fiery horses driven by liveried coachmen; or himself in an automobile with a French chauffeur. He sees a brownstone front with lackeys innumerable, and a table covered with finest linen set forth with cut glass and silver and loaded with every delicacy the markets afford. Who sits at the head there? Who moves about in this lordly mansion, smoking 25c. cigars and giving orders with consciousness of power and right? Who saunters into the library to meet distinguished guests or to greet the flower of society in the parlor or drawing room? It is he, the dreamer, the prospector, the burro driver, the eater of flapjacks and bacon, the sleeper under the stars, the shelterless wretch of the storm.

"Ah! there is an allurement in these dreams that exercises such a power of fascination over minds as renders weak the bewitching enchantment of a Lorelei or the singing of the sirens.

"Once let a man yield and his course of life is cut out for the whole of his days. Should he strike it rich his dreams will come true. He sees the Clark mines of the Verde at Jerome. He remembers the Copper Queen, the Anaconda, the Comstock.

"But, alas, should he be taken ill! Who is there out in that forsaken place to care for him? He tries his simple remedies, in his extremity tries herbs the Indians have shown him how to use. He is too weak to gather wood, to go for water, to light a fire. He grows weaker day by day. Now and again he faints, and the hours fly past and he wakens, parched with fever and the deadly glare of the unsympathetic sun. His burro wanders off forgotten, the rats and other vermin come and watch. The timid lizards even approach nearer. The cottontails look on with great, brown, liquid eyes, and even the dread of the desert, the rattlesnake, comes and coils upon his breast, starting with surprise when the yet alive wretch makes some meaningless movement in his pain. The hours pass. The darkness of night follows the brilliancy of the day. Still he lies, but he moves not. The lizards run over his face and he makes no stir, the rats gnaw at his flour sack and he hears them not. There is a flapping of wings heard above, and a great black, bald-headed bird with hideous beak and great, bleary eyes swoops down upon him, and dreams and dreamer are at an end.

* * * * *

"I once asked an old and experienced prospector what advice he had to offer to those who thought of going on to the desert in search of the precious metals. His immediate response was, 'Tell them to stay at home.' He then continued: 'To be a good prospector a man must be well prepared in a variety of ways. He must be able quickly to determine the general character of the country over which he passes, hence he must have some knowledge of dynamics, general geology, mineralogy and chemistry. He must have nerve and backbone, for danger is his constant companion, yet he must be most cautious, for foolhardiness is quickly rebuked on the desert. One day of risk, going without water, or attempting to go too far, may have fatal results. In wandering into these ranges alone, one should always put up small monuments—just a few stones piled together—to show the way back to the nearest water hole, for many a man has lost his life through being unable to get back to where he last watered. The fact of the matter is, there are very few men qualified to be prospectors, and that is the reason so few, comparatively, succeed. With most of them it is pure good luck. If they strike anything it just happens so. The major part of the men now out had far better be at home.'"

## Greenway & Lowry Flotation Patent

Henry H. Greenway and A. H. T. Lowry, of Australia, have been granted a patent (U. S. Pat. 1,102,738) for the flotation separation of various metallic sulphides by means of a chromium salt and a frothing agent. A differential separation of sulphides is claimed to be obtained by digesting the ore with a salt of chromium, such as sodium or potassium bichromate, agitating with an emulsifying agent, such as eucalyptus oil, and removing the sulphides in the form of a froth or scum. The patent cites the separation of a lead-zinc slime, using a 1% solution of sodium bichromate and one pound of eucalyptus oil per ton of material treated. A test on molybdenum ore containing 15% molybdenite and 25% pyrite gave a concentrate containing 93% molybdenite and 4.9 pyrite; the pulp was agitated at 120 deg. F. with 0.25% sodium-bichromate solution and eucalyptus oil in the proportion of one pound per ton of ore treated. Tests of copper ore are also cited but most of the claims in the patent are for zinc-lead sulphide separation.

**The United States Produces More Asbestos Manufactures** than any other country, but only 1100 tons of asbestos per year, according to the U. S. Geological Survey. There are two producers in Georgia and one in Arizona. In 1911 there were 7604 tons produced. The difference is due to closing the Crysotile Asbestos Corporation's mill (Vermont).

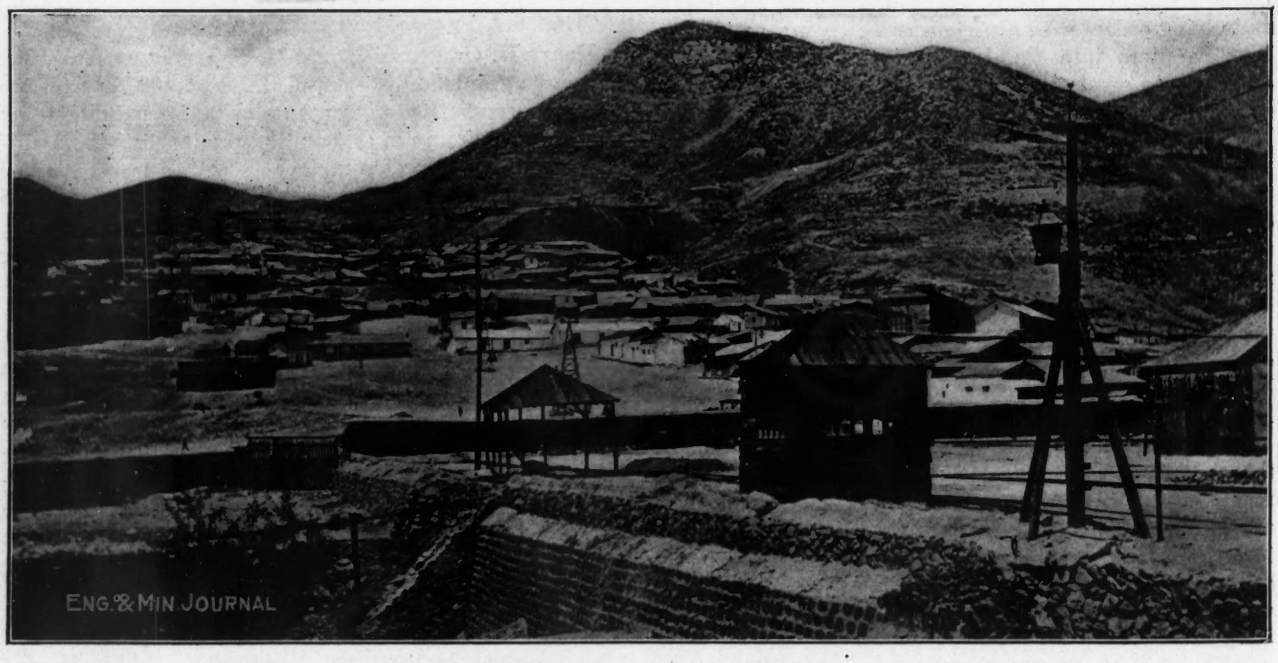
# The Tofo Iron Mines in Chile


TOFO FROM THE SOUTHEAST, AND TRAMWAY BUILT BY FRENCH COMPANY

**These, the largest iron-ore deposits in Chile, were worked by a French company prior to 1912 when they were purchased by Bethlehem Steel Co. interests.**


SOUTH HILL FROM THE NORTH AND NORTH HILL FROM THE SOUTH

**The dotted lines indicate the lower limits of the ore.**

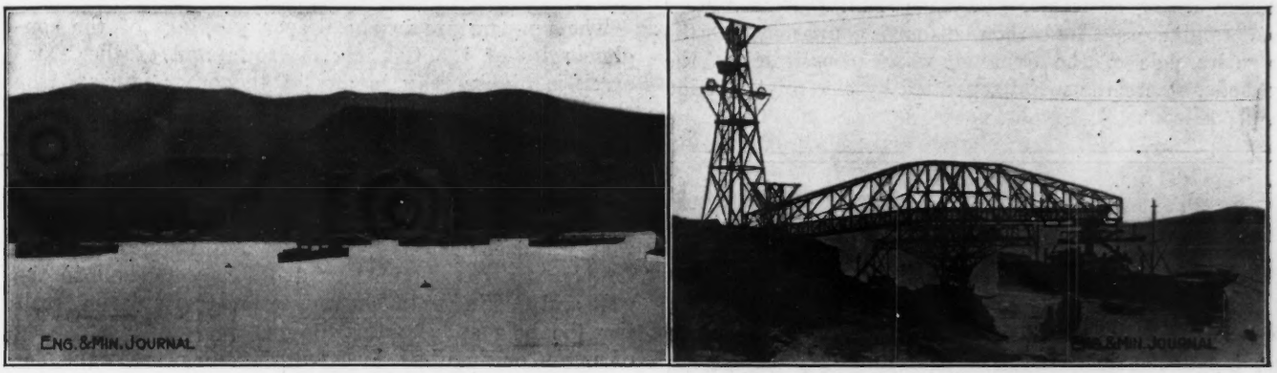



LA HIGUERA, IN THE PROVINCE OF COQUIMBO

**The town, once an important copper-mining center, is four miles from Tofo.**

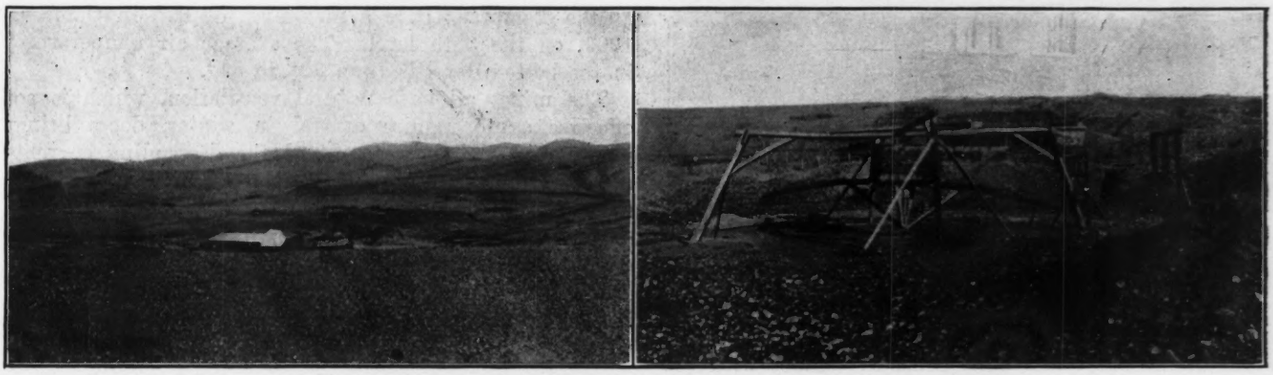

LABORERS' VILLAGE, AND ORE ON THE TOP OF SOUTH HILL

**The village was built in the spring of 1913. Tofo ore will be brought to South Bethlehem, Penn., via the Panama Canal.**




CRUZ GRANDE, THE SHIPPING PORT FIVE MILES FROM THE MINES

**The tramway of 500 tons daily capacity was built by the French company and is still in operation.**



ARGUEROS, AN OLD SILVER CAMP IN THE TOFO REGION

**The ore deposits resemble in general character those at Cobalt, Ontario.**


A COPPER MINE NEAR TOFO AND TOWN OF MARQUESA

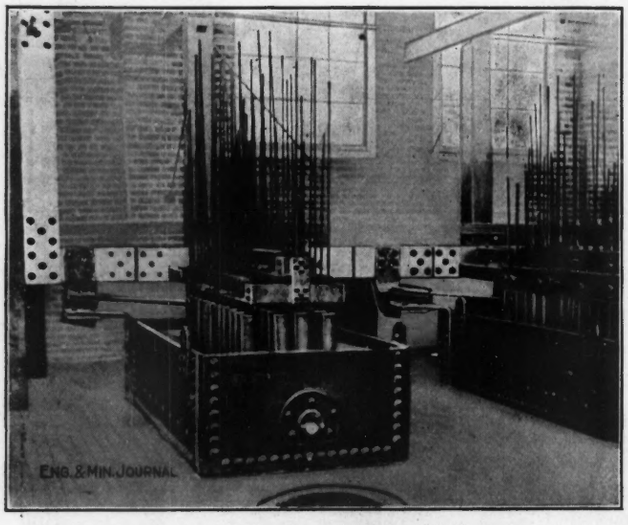
**The mine is 15 miles from Tofo. Agriculture in irrigated valleys like those at Marquesa is of great importance to the Chilean mining industry.**

## Aluminum Furnace

The accompanying illustration is that of a modern furnace for the production of aluminum by electrolysis of alumina, $Al_2O_3$, dissolved in a bath of molten cryolite, $Na_3AlF_6$. It consists of a low rectangular carbon-lined crucible, into the interior of which are suspended a number of carbon electrodes.

The usual dimensions of these furnaces are from 6.5 to 13 ft. in length, by 4 to 5 ft. width, and 2 to 2.25 ft. in depth. The exterior is formed of iron plates reinforced by angle irons. The crucibles rest on masonry supports, and are either stationary, or arranged to be inclined at will, in order to tap.

To diminish the loss of heat by radiation, there may be interposed between the walls of the crucible and the carbon lining some refractory material, that is a poor heat conductor. The carbon bottom is connected with the negative pole of the dynamo, which constitutes it the cathode, where the metal separated by electrolytic action is deposited.




ELECTRIC ALUMINUM FURNACE

The interior lining of the crucible should always be well made and present no discontinuity, because the liquid aluminum would thus come in contact with the refractory lining or the iron of the casing, and rapidly absorb silicon or iron.

To obtain the most economical use of the current it is necessary that the connection between the carbon bottom and the electrical conductor be as nearly perfect as possible. This is accomplished by making the connection with the steel shell, or (in those cases where the refractory layer is interposed) with bars of iron buried in the carbon lining.

The electrodes are made of carbon as pure as can be obtained, inasmuch as all the impurities they contain are accumulated in the metal. Petroleum coke containing less than 1.5% of ash is used for this purpose. Graphite, which contains only an infinitesimal amount of ash, seems to be admirably adapted, but its high price stands in the road.

To put one of these furnaces into operation, current is first passed through it empty, circuit being completed by placing pieces of carbon between the electrodes and the carbon lining. Cryolite is added little by little, until the electrodes are submerged in the liquid bath, when the current is allowed to pass at normal voltage, 8 volts.

Breaking in is a delicate operation requiring two days, after which the procedure consists in feeding alumina, replenishing the cryolite which is slowly decomposed and volatilized, and at intervals tapping the furnace to collect the metallic aluminum. The electrodes are consumed by oxidation, and are adjusted mechanically, or by hand in order to maintain the distance between their extremities and the cathode lining at from 2 to 2.5 inches.

## Calumet & Hecla Ventilation and Temperatures*

The temperature in the deeper workings of the conglomerates of the Calumet & Hecla and of the Tamarack is higher than in any of the other mines. The temperature varies with the depth and with the season, but the temperature of the amygdaloid mines is universally low. The average temperature of the air in the bottom part of the Calumet & Hecla conglomerate is about 80°. The highest temperature ever found in that formation was in the rock and was 87°. Rock temperature was obtained by drilling a long hole in the wall and putting in a low-registering thermometer, sealing the hole and leaving the instrument for a period of weeks or months. The temperature of the amygdaloids will vary from 55° to 70°, being higher in the lower levels of the Tamarack than at any other mine in the district. A long series of tests of air temperature at the Tamarack gave a maximum of 89° in October, 1909, on the 39th level. The average air temperature in the bottom level is from 82° to 84°.

The mines all have natural ventilation, which is so effective as to require control in winter, doors being placed over the shaft to retard the descending current of cold air. There is no artificial ventilation other than the compressed air used in drilling. Mr. MacNaughton gave as his opinion that no advantage could be had by artificial ventilation, since the only real difficulty encountered was that of gas clinging in moist muck after blasting, for which fan ventilation would of course be no remedy.

## Reducibility of Iron Ore

L. Mathesius, in *Stahl u. Eisen,* 1914, XXXIV, 866-873 (abstr. in J. S. C. I., June 30, 1914), reports that various raw and calcined ores and briquettes were heated for five hours in a current of coal gas at 450° to 900° C., and the amounts of metallic iron and ferrous oxide formed determined. Calcined spathose ore was easily reduced; the reducibility of other ores was smaller and roughly proportional to their porosity. The FeO content of magnetite was hardly affected by the treatment, the ferric oxide being more easily reduced. Ore and fluedust briquettes were much more easily reduced than ores, over 80% of the iron being reduced to metal at 900° C. Sintering caused an increase in ferrous oxide and decrease in the reduction to metal.

*From testimony given by Manager James MacNaughton before the Congressional Committee investigating the miners' strike in the copper country.

# Correspondence and Discussion

## The Longmaid Process of Copper Extraction

Having read in the JOURNAL of May 30, with much interest, the very scientific article by Arthur Carpenter on chloridizing the Sudbury silver ores by the Longmaid process, and being the son of the inventor and acquainted with the various processes connected with the original patents, I send you a few remarks thereon, in order to correct some errors in regard to dates of those inventions.

Longmaid in the 1830's was manager of an extensive mine of copper pyrites in the west of England, which produced for many years a quantity of ore too low in copper for the smelters of that date. This ore was piled up in dumps in the hope that some process might be introduced for rendering it available. During a rainy season my father visited the mine and found streams of deep-green liquor flowing from the said dumps. On testing the liquor, he found it contained a commercially valuable percentage of copper. He at once came to the conclusion that some process might be worked out which would render the copper rapidly soluble instead of slowly as effected by the weather. He first tried plain roasting and leaching, which was only partially successful, but he found by adding salt before roasting that the copper could be rendered completely soluble. He secured a patent for manufacturing sulphate of soda and recovered the copper by this process, and various other substances as byproducts, most notably the sulphate of soda for the manufacture of soda ash. This patent was dated 1842.

In the early '40's, with the aid of some friends, he built a works in St. Helen's, Lancashire, where they manufactured an average of 52 tons of dry soda ash per week, besides various quantities of byproducts. The chlorination was generally over 99%. The roasting department of the works consisted of six reverberatory furnaces, each 65 ft. long by 12-ft. span in the clear, and 12 furnaces 96 ft. long by 15-ft. span in the clear. The roasted ore was leached in large tanks 40 ft. square and the solutions were made as concentrated as possible. These liquors were then run into tanks with scrap iron, and the copper, together with the silver and gold, recovered in what they called "copper mud." This copper precipitate was then oxidized in a reverberatory furnace and treated with sulphuric acid. The liquors were concentrated and then crystallized, producing a good commercial bluestone. The residue from this operation consisted of iron scale from the scrap iron used for precipitating the copper and silver, and a small quantity of undissolved copper. The sulphate of soda solutions from the lixiviation were, after being freed from copper, partially evaporated and then run into reverberatory furnaces on burnt lime and slack coal and converted into black ash, from which the soda was leached in the ordinary way and evaporated to dryness, the product being soda ash or alkali, used for soap and glass-making and other manufactures. The residue from the bluestone manufactured, which was rich in silver, with some gold, was sold to lead smelters.

These operations having been brought to a successful condition, the company having paid 12% dividends, attention was turned to the utilization of the other constituents of the ore and salt. In the first place, the residue of the ore, consisting of iron oxide and gangue, was carefully levigated and the finest portion consisting of iron oxide, after being dried, was ground with oil and made an excellent paint of great durability.

About 1846, Longmaid took out other patents, one for converting a part of this levigated iron oxide into black paint. The process consisted of mixing it with coal tar in pugmills and then putting the mixture into large retorts, closed with a tight cover, except a small hole for the escape of the gases. The retorts were then placed in a furnace by means of a crane and after being kept at a dull-red heat until no more gas was seen to escape, they were lifted out and allowed to cool for several days. By this means the iron oxide was converted into magnetic oxide, and, with a certain percentage of carbon from the decomposition of the coal tar, made a black paint of fine quality and great durability.

Henderson's patent process was entirely different from the Longmaid processes. I visited a small works built by Henderson to carry out his process at Flint, North Wales. He first roasted the ore with salt and then attempted to volatilize the copper chloride by a high temperature, but was entirely unsuccessful, only a small portion of the copper being thus recovered. During these experiments, some of the roasted ore and salt fell into water and it was noticed that much of the copper was soluble. His investigations on this subject led finally to Henderson's pirating the Longmaid patents, and as a result of a suit in chancery, Henderson was restrained from using the process and Longmaid's claim to priority was fully confirmed.

In 1851, Longmaid exhibited the various products of his patents at the great international exhibition and was awarded a council medal, being the only Englishman who obtained a first-class certificate in the manufacturing-chemical class. I have both the medal and the certificate now in my possession.

Another branch of the process was the manufacture of bleaching powder. The quantity made was about eight tons per week. This process consisted of roasting the ore in the large reverberatory furnaces until the charges had reached the fourth bed, at which point the sulphur and chlorine had entirely changed places, the sulphur being oxidized and combined with the sodium of the salt and the chlorine being combined with the iron in the form of iron chloride. The charges were then withdrawn and transferred to a muffle furnace, where the mixed ore and salt from the roasting furnaces was submitted to a higher temperature and dry air blown through it. By this means the iron was completely oxidized and the chlorine evolved was conveyed into a chamber where slacked lime was laid on shelves which absorbed the chlorine and produced bleaching powder of a fine quality.

The extra demand of these works on the Cornish and

Irish pyrites soon exhausted the supply and no other material could be obtained suitable for the Longmaid processes, so the St. Helen's works were consequently closed; for it must be remembered that the importation of Spanish and other pyrites had not been introduced in the English market at that date. Henderson did not start his operations until the Spanish sulphur trade had reached large proportions and the burnt pyrites in the various sulphuric-acid works had become a drug on the market.

The statement that the processes were first employed upon the cupriferous pyrites of Spain, etc., is incorrect, for it was not employed with those ores until all accumulations of such ores in and about the mines of Cornwall and the west of England had been worked up and the St. Helen's works had been closed. I consider that these facts fully confirm the priority of the Longmaid process.

JOHN LONGMAID.

Helena, Mont., July 3, 1914.

## American Engineers and the Mexican Situation

The editorial "American Engineers and the Mexican Situation," in the JOURNAL of June 27, is deserving of comment. That "mining districts all over the world are flooded with applications, personal and by letter, for employment . . . from men who have been forced to leave Mexico" is indeed true, and I dare say no mining district has been so flooded with the same as the Southwest.

"Those that have been forced to leave Mexico have not faced the situation with composure" is a broad statement, and I think unwarranted. The average engineer from Mexico is an analyst; his conception of the present situation is based on first-hand observations, covering a period of from one to five years, probably in several districts.

That some few should place the profession in a wrong light by such a statement as you quote is regrettable; for you would be surprised to know the number of younger engineers who are looking upon their sojourn in the States during these troubled times as an opportunity to acquire experience or to perfect themselves in the work they were doing or expect to do upon returning to Mexico.

They do not look upon Mexico as a land to be exploited and abandoned. The resources are unlimited and their development depends first of all upon the American engineer. He is anxious to return, but you will find that his attitude toward Washington is not as you suggest. He knows the Mexican people and he knows their ways, and possibly if his stay in the States is sufficiently prolonged, he may come to know the merits of grape juice over *pulque* and *agua miel*.

ONE FROM MEXICO.

Morenci, Ariz., June 30, 1914.

## What Becomes of All the Mining Engineers

In the JOURNAL of May 30, 1914, I note some comments made by J. I. Blair on "What Becomes of All the Mining Engineers?" from which I must infer that Mr. Blair's observations have been somewhat unfortunate. In looking over the report of the largest nonferrous metallurgical company in the world I find in the list of directors at least three names of graduates of mining schools; on the executive committee there are the names of three mining engineers; and among the names of those in charge of various departments there are at least three other names. This company has several mines in Mexico and of the 12 superintendents, nine are technical graduates. I believe it would be safe to say that 40% of all the American force employed at these mines are technical graduates. At one of the larger properties among a list of 40 men employed as shift bosses, foremen, engineers, etc., during the past three years, 14 were technical graduates. The general manager and assistant general manager, in charge of all these mines are technical graduates; and the entire general staff, with the exception of the two secretaries, are technical graduates.

It must be admitted that not all of the graduates of engineering schools become prominent as engineers, nor, indeed, do all of them follow the profession for which they studied. There is a process of elimination which starts from the day these men leave college and continues throughout their lives. Many are physically unfit to follow mining engineering; many find other occupations more lucrative; and a large number continue in minor positions simply because they have not proved to be better men than those occupying the better positions. The man who finds time to mourn over the hard luck he has encountered and to berate his superior officers had better try some other occupation, because it is necessary to employ all the time that a man has at his disposal in qualifying himself for the more important positions.

S. F. SHAW.

New York, June 16, 1914.

## Erroneous Results from Angle-Hole Drilling

It was with considerable interest that I read Mr. Glass' article in the JOURNAL of July 4. He states that vertical churn drilling is much more reliable than angle churn drilling or angle diamond drilling, and cites as an example a piece of property which was abandoned after prospecting with angle holes, but on which by subsequent drilling with vertical holes, a rich orebody was proved. In each case the vertical holes yielded richer samples than the angle holes. Now it was only natural to assume that the angle drilling was absolutely unreliable. Mr. Glass neglected to state whether the property has since been developed, and we are left in doubt as to which drilling was correct, the "angle" or the "vertical."

There have been several thousand vertical churn-drill holes put down in this camp, and upon sinking on, or drifting to them, it was found that in every instance the drill hole had intimated a richer deposit than really existed. It has consequently become the custom to regard the "metallic" value of the samples as representing the percentage of "ore" in place. Thus, if the drill cuttings assay 10% metallic zinc (15% blende), the prospector will not expect to find over 10% blende or approximately 6.6% metallic zinc.

In conclusion, is it not just as possible that the samples from the vertical drilling were enriched from one cause or another, as that the samples from the angle drilling were decreased in value due to the addition of disintegrated quartz?

NELSON B. GATCH.

Granby, Mo., July 9, 1914.

# Editorials

## The Situation in the Metal Markets

The radical decline in the consumption of metals in the United States during the last year has put the producers in an uncomfortable, even awkward, position. In the main, production has been maintained at an undiminished rate. In many cases a restriction of production increases cost per unit of product to such an extent that the result is not relished, while the large units of plant of today makes a complete shutdown a step that is not to be taken lightly. In the production of steel, however, the present practice of putting the pig iron hot into the steel mill and so on through into the finishing mills adds so much labor to the crude material, and the difficulty and cost of stocking up such products are so great that we note more shutdowns of steel plants than of copper, lead or spelter smelteries. The decrease in the mining of iron ore and the production of pig iron during the last year has been considerable.

In copper, on the other hand, there has been no decrease in production. Probably there will never be any decrease in the production of this metal, until the important mines begin to show signs of exhaustion, unless there should be a very low price, lower than any one now contemplates, prevailing for a very long period. The production of copper under present conditions is more or less independent of demand. If the latter underruns the production, there is a piling up of stock; if it overruns it, there is a sharp elevation in price. Lately the former condition has prevailed, and we have witnessed a gradual accumulation of stock, but the statistical position was so good to begin with that the accumulation has not yet become burdensome. The copper market is better off than any other in that it is international, and consequently broad. However, each of the producers is desirous of selling copper all the time and averse to carrying stock out of proportion to his production, and the price for the metal is therefore depressed.

The situation in spelter is the most awkward. Here the smelters have accumulated a stock greater than ever known before in the history of the United States, and they claim, probably with reason, that it has cost them upward of 5c. per lb. They cannot sell it for that, and are averse to taking a loss, although the needs of some of the weaker producers compels them to do so, and their pressure depresses the market. However, many of the big producers are financially strong, the cost of carrying stock is relatively low, and they hold on patiently, waiting for the better day to come. Europe also being overstocked with spelter, there is no relief for America in that direction.

In lead the situation is quite different, the European supply having been materially cut off by the cessation of lead exports from Mexico. This has kept the European market at a relatively high level and has permitted a considerable exportation of lead from the United States, which has bolstered up our market. There is a convention among the producers of lead in Europe, which looks rather jealously upon the introduction of uncontrolled supplies, and the exportation of American lead has been conducted rather quietly, but little being said about it in the market reports. In the aggregate it has amounted to more than is commonly supposed. If it had not been for this the price of lead in the United States would surely have fallen to a much lower level. Lead producers may well bear this in mind at some subsequent date, when the condition may be reversed.

## Lead Poisoning in the Smelting and Refining of Lead

The Department of Labor has lately issued a noteworthy bulletin on the subject of lead poisoning in the lead-smelting industry of the United States, its author being Dr. Alice Hamilton, who is a well known sociological investigator, associated with Hull House, in Chicago. We are not wont to look for a treatise upon any branch of the metallurgical industry from the hands of a woman, but Doctor Hamilton is an exceptional woman, and having availed herself of good technical advice, none of our smelters and refiners can find fault with her for any lack of grasp of her subject, although much of what she says is unpalatable. Indeed, much of what she tells the smelters and refiners will be real information to them about their own business. They will be foolish if they do not take some profit from it.

We have always known that the workers in our smelteries and refineries suffered from lead poisoning, but a good many of us had no doubt dismissed the subject with the *a priori* assurance that in our modern works the danger was much less than it used to be, and probably was of no great consequence. It is therefore a shock to learn from Doctor Hamilton that in 1912, out of 7400 men employed in 19 American works there were at least 1769 cases of lead poisoning, while in Great Britain in the same year there were only 56 cases out of 2404 men similarly employed. This mere statement is a sufficiently serious indictment, without going further into statistical details. It may be added merely that in Great Britain there are effective laws for the amelioration of the trouble and official inspection of the smelteries and refineries. In the United States there are not.

It has been the common notion that the preventive of lead poisoning is cleanliness on the part of the men, and such companies as have given attention to the matter have provided bathing facilities and have complained of the difficulty of getting the men to make use of them. Indeed, one of the leading manufacturers of white lead has paid its employees for bathing, so much per bath. While personal cleanliness is important, both among white-lead makers and lead smelters, particularly the former, Doctor Hamilton shows conclusively that

the danger in the smelteries and refineries is especially from lead dust and smoke, and the chief offender in the matter of cleanliness is the employer, not the employee. Some of her strictures respecting existing works are severe. Thus, she notes of one large Western smeltery, not mentioned by name, "The feed floor is decidedly bad, almost all the furnace doors are leaking, one quite shockingly. The charges were dry and the feeders raised a good deal of dust." Of another, "This was in a worse condition than any other feed floor visited, frightfully smoky and smelling strongly of garlic. The feed doors in the floor are large, about 4x10 ft., and only partially closed by ragged, broken pieces of iron which are not nearly large enough to cover the ends. Every furnace was leaking and one was simply belching forth fumes."

Among the processes of lead smelting Doctor Hamilton rates smelting in the ore hearth as distinctly the most dangerous. The exposure to lead fume is great and the work is unusually fatiguing, while physical fatigue is notoriously one of the predisposing causes to plumbism. Next to smelting in the ore hearth, the cleaning of dust chambers and baghouses is the most dangerous work. Work around the blast furnaces is dangerous, but the converter house where leady matte is blown is worse. The Huntington-Heberlein department is severely censured. When the H.-H. process was first introduced, an improvement of sanitary conditions was regarded as one of its advantages, but that appears to have been wholly a mistake. However, the Dwight & Lloyd sinterers were a real improvement in this respect, although even they may be operated in an unsanitary way.

The conclusion to be drawn from all of this is that the lead poisoning from which our smelters and refiners suffer so severely may be greatly reduced. The experience in Europe is by itself a sufficient warrant for this. Even the perilous ore hearth may be employed with a fair degree of safety, as shown at Gailitz, in Austria, where there is a rate of lead poisoning so low that it can be explained only by the short working day and the fact that the physician in charge suspends from furnace work all men who have lost appetite and puts them on out-door work. In the United States, according to Doctor Hamilton, "there is not one plant in which no fumes are allowed to escape, not one in which there is a complete system of hoods and exhaust ventilation. Nor is there one plant which is kept as free from dust as it might be." The statistics show the price that is paid for the carelessness. Unfortunately, that price is apparently paid by the workmen themselves, from whose wages is generally deducted a monthly medical fee, while of course the consequential damages of sickness to themselves are borne by themselves. Obviously, this is not as it should be. It is the duty of the companies to remedy the evil primarily by preventing it. As has been the result of many similar reforms the outcome of this will, we say "will" since there is no doubt of its being in view of the attention that has been called to it, will be the economic benefit of the companies themselves.

## Workmen's Compensation in New York

The new Workmen's Compensation law of the State of New York is now in effect and claims are coming up for settlement under its terms. The first to be decided in favor of the claimant was to indemnify the widow and orphan of a workman who fell from the new Equitable building, now in course of construction.

The New York law is a fair one in many respects. It is limited to regular, vocational employments and excludes casual employment from its terms. Also it gives the employer the right to insure himself if he sees fit, and thus makes it directly to his interest to prevent accidents, which, of course, is the cheapest way out. However, the New York law is extraordinarily liberal in its compensation to widows, so much so that it has been computed that the killing of a married man may cost an employer upward of $40,000.

A natural result of this is the putting of the services of married men at a discount, simply because some employers cannot afford to take the chance. This has led to a protest to the Governor by the State Federation of Labor, which also objects to the physical examination to which some employers are subjecting their men.

These developments illustrate the complexity of settling a relatively simple social question, respecting the principle of which everybody is agreed.

Huerta at last has gone, but he was so late in his going that prophets have become numb and nobody ventures to predict the next development in the Mexican situation. In the meanwhile, affairs in the north of Mexico appear to have settled sufficiently to permit the American Smelting & Refining Co. to resume operations at Chihuahua. In Sonora, however, there has been new trouble at Cananea, and the mines are closed, the company resisting an exorbitant demand for increased wages, but later reports indicate that things have been adjusted. According to press dispatches, some I. W. W. agitators started in to make trouble at Chihuahua, but Villa told them to get out or he would shoot them, which ended the matter. We have read in the newspapers that Señor Villa has been offered engagements in several American cities.

Notwithstanding the flourishing reports recently made, there seems to be doubt about the real value of the platinum deposits in Westphalia. According to German papers, new stock in the company is being offered for sale in rather an underhand way. Complaint is made that the position of the company is not clearly defined financially, and that the promised mining explorations and metallurgical experiments are not being carried out. A point of some importance is that the Compagnie Industrielle du Platine, of Paris, which had been carrying on some negotiations for a share in the German company, has withdrawn after an examination made by its own engineers.

It is reported from London that the negotiations recently in progress have resulted in an agreement to which the De Beers Company, the Premier Diamond Co. and the German Diamond Co. are parties, which will continue the control of the diamond trade with the London syndicate. This will obviate the possibility of an open break between the De Beers and the Premier companies, which at one time seemed quite probable, when the old agreement expires this year. Doubtless there will be some regulation of the output or at least of the offers for sale.

## BY THE WAY

In a recent issue of that readable little paper, the *du Pont Magazine,* it is stated that tamping ought always to be used in blasting; the authors of U. S. Bureau of Mines Bulletin 57, Messrs. Brunton and Davis, rather look with disfavor on the use of tamping in tunnel work. Again the doctors disagree.

⁂

A man who attempted to enter the house of a miner in the Joplin region recently, met with a severe reception. The local paper says: "Mrs. S—— fired at him from the window and the bullet struck him between the fence corner and the front gate." Burglars and tramps will do well to avoid the Joplin country. A wound "between the fence corner and the front gate" sounds pretty serious.

⁂

It takes about six weeks to convert Calumet & Hecla copper into cash, according to James MacNaughton, manager of the company, testifying before the Congressional Committee investigating the late strike in the Copper Country. If the copper contains arsenic and has to pass through the electrolytic process, the transformation into cash occupies, perhaps, 10 to 12 weeks.

⁂

That the examining mining engineer is kept in training by his work was exemplified in the recent 200-mile canoe race from Mont Laurier to Ste. Rose, Quebec. Jas. G. Ross, consulting mining engineer, of the Milton Hersey Co., Montreal, with his partner, T. M. Paplineau, representing the Cartierville Canoe Club, Montreal, came in second. The winners were two Gowganda prospectors, R. Gamble and F. Thompson, representing the Rideau Aquatic Club, of Ottawa. The course down the Lievre and Ottawa Rivers was covered in 40 hr. paddling and portaging, the elapsed time from start to finish being 60 hr.

⁂

The following is from the New York *Sun* of July 16:

Col. Michael J. Reagan, as chief mediator of the State Board of Mediation and Arbitration, went to Flushing, L. I., yesterday, in the effort to settle a strike of building mechanics on the new high-school building there, which he acknowledged is one of the most difficult propositions he ever undertook. The trouble is over a dispute among the unions of bricklayers, plumbers and electrical workers as to which had the right to cut the holes in the cement floors for the standpipes and electric wires. The work was first given to the plumbers, and electrical workers and the bricklayers were ordered on strike. To settle the dispute the work was then given to the bricklayers, and the plumbers, electrical workers and men in other trades who supported them went on strike. To give the work to the plumbers and electrical workers would mean another strike of the bricklayers, and as the latter are not in the American Federation of Labor no ruling from that body would have any effect.

Are such operations in restraint of trade?

⁂

Sir William Crookes has been conducting a research to prepare a glass which will cut off the rays from highly heated molten glass that damage the eyes of the workmen, without obscuring too much light or materially affecting colors of objects seen through spectacles made of the glass. Sir William's investigations led him to the conclusion that the eye trouble knows as glass-workers' cataract is ascribable principally to the heat rays. A great variety of glasses was tested. In general, the more the heat rays are absorbed the more the light rays are cut off. Thus, one glass, sage-green in color, absorbed 98% of the heat rays, but let through only 27.6% of the light rays. On the other hand, a certain glass, practically colorless, passed 99% of the light rays while absorbing 27% of the heat rays. It would be interesting to know to what extent metallurgical workers experience eye trouble analogous to that of the glass-workers.

⁂

The examination of Mr. Jones by the Senate's Committee on Banking and Currency manifests that some of the reverend senators like to feed on piffle. Thus, from the testimony:

Senator Hitchcock—You think this is not a combination in restraint of trade or in control of trade, the New Jersey Zinc Co.?

Mr. Jones—I do not.

Q. It has 85%, you say, of the zinc trade of the country?

A. Of the oxide of zinc.

Q. Well, is there any other concern that controls a larger percentage of the products it manufactures?

A. No, sir. . . . I will say frankly that mine is the whole business. There is no artificial combination of units to eliminate competition. It has not been attempted at all, and has not been accomplished, but that mine constitutes a natural monopoly.

Q. How would you go to work in destroying the zinc monopoly?

A. I do not believe it is destructive, because I do not believe it is a monopoly in that sense.

Now, any schoolboy might tell the august senator that the way to destroy the zinc-oxide monopoly, or near-monopoly, would be to induce more concerns to enter into competition with it, as the Sherwin-Williams Paint Co. did some years ago. If the inducements be not sufficiently attractive to lead anybody else so to risk his money, let the constitutional provisions safeguarding property be abolished and then let the Franklin mine be confiscated. What else is there to do?

⁂

A correspondent who has had much experience on both sides of the Atlantic writes us as follows: "Comparing the characteristics of the American mine superintendent and his English confrere, why is it that the former seems to organize his work so as to give him apparently any amount of spare time whereas the latter usually wears a worried look and is always in a hurry? I have visited the superintendents of many American mines quite unexpectedly and have invariably found them courteous to a degree that is almost embarrassing. They invariably find time to show a visitor all he wants to see, or hand him over to the heads of the various departments who, in their turn, appear to have ample leisure to reply to all questions, intelligent or otherwise (all inquirers consider their questions intelligent and I am no exception). The English mine manager on the contrary is obviously anxious to be polite but is generally too busy to give his visitor more than a few moments and then hands him over to a very junior assistant who does his best but lacks the experience and knowledge of detail necessary to explain the various points. Presumably the difference is due partly to superior organization and delegation of work on the American side, and partly to Englishmen setting themselves daily chores which have to be got through, leaving no time for any business outside the daily routine."

## PERSONALS

Donald Gillis recently left Anaconda, Mont., on his return to Mexico.

E. J. Carlyle sailed from New York on the "Aquitania," July 21, on his way to Siberia.

C. A. Burdick has returned to New York from a four months' professional trip in the Southwest.

R. E. Cranston has just gone to Cripple Creek from New York on professional business and is still in Colorado.

W. B. Mangan is manager of the Timber Butte Milling Co., of Butte, Mont., and W. N. Rossberg is the superintendent.

Hon. R. W. Brock, deputy minister of Mines of Canada, was in New York this week, and sailed for England July 21 on business.

S. Pearson, of the British firm of S. Pearson & Son, who have extensive oil interests in Mexico, is looking over the Canadian oil fields.

John Landers, vice-president of the Mexican Mining Co., and president of the Union Mining Co., expects to visit Virginia City soon.

S. B. Patterson, Jr., superintendent of mines for the Spanish-American Iron Co., Mayari, Oriente Province, Cuba, has returned to his post after a month's visit in the States.

Fred H. Nye, of Denver, recently with the Sutton, Steele & Steele Co., has assumed position of general superintendent of the Northwestern Zinc Company, Galena, Illinois.

David H. Ladd of Houghton, Mich., returned last week from a trip abroad which lasted four months. He visited copper consumers in Austria, Germany, France and England.

R. R. Heap, who has been superintendent of the Lennan Zinc and Lead Co. and Miami Zinc & Lead Co., at Miami, Okla., has given up his positions there and has gone to Mexico.

Harry J. Wolf, of Denver, Colo., recently completed mine examination in Gilpin and Clear Creek counties in Colorado, and has gone to the state of Washington, to investigate properties near Oroville.

William H. Warren, recently superintendent of the rail mill department of the Illinois Steel Co., has been appointed general superintendent of the steel mills of the Brier Hill Steel Co., Youngstown, Ohio.

H. L. Slosson, Jr., president of the Mexican Mining Co., has returned to San Francisco from a visit to New York where he had been for several months on professional business connected with Comstock affairs.

Stopford Brunton, of the Canadian Geological Survey, is at Cobalt, Ont., testing specimens of ore with a view of discovering minerals possessing radio-activity. He will continue the search for radium in the Porcupine and Kirkland Lake fields.

Hermann J. Reiling, president of the French Gulch Dredging Co., Breckenridge, Colo., and his chemist W. C. Cracy, were injured recently by an explosion resulting from a mistake in placing about 10 oz. of metallic sodium in water containing gold amalgam. Most of the injury was around the faces of these gentlemen.

Maurice H. Hare, president of the Idaho Placer Mining Co., has been missing from his office at Spokane, Wash., since June 22, and no trace of him has been found. He left his business affairs in excellent shape, and the only cause for his disappearance is the fact that he had been suffering from nervous trouble. He had lived in Idaho and in Spokane for 25 years past and has many friends.

## OBITUARY

Murdock Lloyd, engineer of the Tough Oakes Mine, Kirkland Lake, Ont., aged 45, was so badly scalded by the explosion of the boiler, at which he was working on July 11 that he died the following day. He was formerly a resident of Aurora, Ont., but for the past few years had been living at Haileybury.

The fate of W. H. Marston, engaged as an assayer at the Hollinger Mines, Porcupine, Ont., who disappeared in September, 1913, is now known. His body has been found in the bush between Porcupine and Schumaker, only about three miles from home, and though much decomposed was identified by the clothing. There was a bullet hole in the top of the skull. An inquest held at Porcupine resulted in the verdict of "Death from a gunshot wound."

J. Wheeler Hardley died at his residence in Brooklyn, N. Y., July 21, aged 66 years. He had been in failing health for some months, and finally submitted to an operation, from which he failed to rally. He had been connected with the Atlantic, the Mohawk, the Wolverine—the whole group of Stanton copper companies—some 25 years, at first as cashier and confidential clerk and for over 15 years as a director and secretary. He was thoroughly familiar with the copper market and the New York or selling end of the business, and was much esteemed by his associates.

Edward C. Limbach, superintendent of the American Girl mines at Ogilby, Calif., at 1 p.m., on June 15, slipped and fell upon the drive-belt of one of the Hardinge mills, passing around the pulley on the countershaft. He died two hours later. Mr. Limbach was a graduate of the Colorado School of Mines in the class of '95, and followed the profession in Colorado and Montana and later in Loomis, Wash., where his family are living. He was a man of charming personality, always well liked by his associates in school and in the field, honest, upright and fair.

Francis C. Robbins died at his residence in Los Angeles, Calif., of pneumonia, June 28. He was born in Portland, Oregon, 1856. He was prominently identified with Eureka, Nevada, mining and smelting industries from 1877 until the later eighties; subsequently going to Leadville, Colo., as general manager of the New Elkhorn Mining Co. In 1898 he went to Phœnix, B. C., and was active in the development of the Boundary District; later going into the East Kootenay country as general manager of the McKenzie & Mann interests in that region. In 1902 he moved to Los Angeles, Calif., and engaged in general practice until the time of his death. Mr. Robbins was a member of the Executive Committee of the Los Angeles Section of the American Institute of Mining Engineers. A man highly esteemed in his profession and much loved by those favored with his friendship.

## NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

DECARBURIZING METALS. J. E. Bucher, Providence, R. I. (Brit. No. 4667 of 1913.)

DRILL. John Thomas Curnow, Palatka, Mich. (U. S. No. 1,095,085; Apr. 28, 1914.)

DRILL-BIT-ROTATING DEVICE. George H. Gilman and Lee A. Knights, Claremont, N. H., assignors, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,103,002; July 7, 1914.)

ELECTRIC SHAFT FURNACE—Improvements in or Relating to. W. N. Crofts, Oberlin, Ohio. (Brit. No. 18,073 of 1913.)

FLOTATION PROCESS—Ore Concentration. Henry Howard Greenway, Clare, South Australia, and Alfred Henry Piper Lowry, Prahran, Victoria, Australia. (U. S. No. 1,102,738; July 7, 1914.)

IRON—Improvements in or Relating to the Manufacture of Iron and Other Metals. A. E. Bourcoud, London, Eng. (Brit. No. 12,960 of 1913.)

OPEN-HEARTH FURNACE. Kurt Albert, Wiesbaden, Germany. (U. S. No. 13,763; Juiy 7, 1914.)

ORE CAR—Hopper-Ore-Car Construction. John M. Rohlfing, St. Louis, Mo., assignor to American Car & Foundry Co., St. Louis, Mo. (U. S. No. 1,097,945; May 26, 1914.)

ORE COOLER. Robert W. Hanington, Denver, Colo. (U. S. No. 1,101,433; June 23, 1914.)

ORE FEEDER. Thomas G. Worthington and Herman O. Langstaff, Oatman, Ariz. (U. S. No. 1,098,206; May 26, 1914.)

ORE REDUCTION—Process of Reducing and Separating the Metals from Their Ores. John M. McCormack, Reno, Nev., assignor to Gertrude A. McCormack, David R. Williams, James Constable and Ellsworth L. Brown, Reno, Nev. (U. S. No. 1,099,388; June 9, 1914.)

ORE WASHING—Improvements in or Relating to Apparatus for Washing Ore. H. A. Brackelsberg, Hagen, Germany. (Brit. No. 13,987 of 1913.)

PRECIPITATION—Metal-Precipitating Device. Frank A. Ross, Spokane, Wash., assignor to Chalmers & Williams, Inc., Chicago Heights, Ill. (U. S. No. 1,101,569; June 30, 1914.)

ROASTING—Ore-Roasting Furnace. William F. Murphy, Iowa City, Iowa. (U. S. No. 1,099,309; June 9, 1914.)

ROASTING — Shaft for Roasting Furnaces. Edward J. Fowler, San Francisco, Calif., assignor to General Chemical Co., New York, N. Y. (U. S. No. 1,100,426; June 16, 1914.)

SCREEN—Self-Cleaning Screen. Fritz Oscar Stromborg, Seattle, Wash. (U. S. No. 1,100,793; June 23, 1914.)

SINTERING—Calcining, Desulphurizing, Agglomerating, and Sintering Ores and Like Materials. Francis D. Weeks, Salida, Colo., assignor, by mesne assignments, to Dwight & Lloyd Sintering Co., New York, N. Y.

# Editorial Correspondence

### SAN FRANCISCO—July 15

**The Northern California and Southern Oregon Mining Congress,** held at Ashland, Ore., in July was not well attended and the display of minerals was not equal to exhibits at former sessions. The next meeting will be held at Etna Mills, Siskiyou County, Calif. The following officers were elected for the ensuing year: James Logan, of Grants Pass, Ore., president; George Metcalf, of Kennett, O. A. Jillson, of Shasta County and G. A. Reichman, of Fort Jones, vice-presidents: G. F. Hellmuth, of Etna Mills, secretary; J. W. Newman, of Redding, treasurer. The congress held at Ashland was not lacking in interest nor in contributions of papers and speeches. The members of the congress are no less interested in its affairs, or in the mining industry than they have been in the past, but it appears that hitherto there has been a disposition to make a holiday of the meetings, and it has been somewhat difficult to impress upon the members the importance of advancing the mining industry along some special line. At the session held in Redding in 1913, the congress did some excellent work in the appointment of a committee to visit the so called smoke belt, which committee reported adversely to the complaints of the farmers. But before that session of the congress met the members were not greatly interested in the matter and it was only by the quiet, careful work of a few members that this valuable work was accomplished. A larger interest in these sessions of the congress would undoubtedly be created by the selection in advance of a special subject for investigation and discussion. Such subject should be of vital interest to the entire mining region represented by the membership.

**Natomas Consolidated of California** has mailed to the bondholders, stockholders and creditors a letter prepared by the reorganization committee, urging the depositing of their holdings under the terms of an agreement previously submitted. This letter was accompanied by a letter from the general manager, Mr. Oliver. The estimated net income for the balance of 1914 is given as follows: Gold dredging, $700,000; rock crushing, $48,000; land receipts, crops, etc., $55,000. Total, $803,000. But Mr. Oliver shows that while the properties of the company are extremely valuable, embracing dredging lands, rock crushing plants, agricultural lands, and water rights, the principal asset is in the reclamation products and orchard lands, comprising about 60,000 acres on the Sacramento, Feather and Bear Rivers, and 20,000 acres of orchard lands on the American River. It is to these lands, Mr. Oliver states, that the bondholders must look for their security and reimbursement. The status of the reclamation work on June 30, 1914, was that there remained only 21.3% of the levee along the Sacramento River, 32.1% of the east side levee and 59.6% of the cross-canal levee yet to be completed; and that 31% of all the levee system is yet to be built. Beside the necessity for completing the reclamation it is urged by the letter that money is required to discharge obligations to the holders of the following underlying bonds: Natoma Development Co., $400,000; Natoma Land & Mining Co., $345,000; Clark & Cox Farms Co., $98,000. Total, $843,000. The total amount owing for lands purchased and partly paid for, including interest, is $489,000. The principal items which must be paid by Jan. 1, 1915, include purchase-price installments, underlying bonds, insurance, taxes, notes, reclamation work, etc., amounting to $1,332,236. Natomas Consolidated has done a vast amount of gold dredging and recovered a large amount of gold. It was the first company in the United States to build an all-steel dredge, and has now three steel dredges in operation and seven wooden boats in Natoma field and three wooden boats in Oroville field. A great deal of fuss has been made about the destruction of agricultural lands by the gold dredging industry, but Natomas Consolidated has put the earnings of the dredges on the American and Feather Rivers back into reclamation of the dredged lands and purchase of other agricultural lands. While there is sufficient ground in the Natoma field for several years further work for the dredges, the ultimate benefit to be derived from the gold-dredging operations of the Natomas Consolidated will accrue to the agricultural and horticultural industries of the State.

### DENVER—July 16

**Strike of Trainmen on the Cripple Creek Lines** that seriously threatened activities in the district was settled July 13 at a conference between officials and employees of the roads. The trainmen resumed duties promptly. Every employee will be reinstated with the exception of the central figure in the controversy, Charles D. Robinson, conductor, who secured a position with one of the mining companies and withdrew his demands.

**History of Cave Basin Mining District in Notheastern La Plata County** is contained in a private letter from the discoverer, as follows: "Last fall (1913) Sam L. Dowell opened a body of copper-silver ore in what is known as the Dowell mine. From this claim he made several shipments to the American Smelting & Refining Co.'s plant at Durango, the best lot running about $95 per ton, the lowest, $24 per ton. Ore occurs as replacement of limestone above Cambrian quartzite. The Dowell mine is under option to C. L. Young, Jr., of Durango, Colo., who is driving a crosscut adit 135-ft. to reach the same orebody at greater depth. Until about 50 ft. more be driven, the success of his project cannot be known. Two miles north of the Dowell mine is the Mary Murphy mine, from which ore has been shipped running as high as $134 per ton, the values being silver-copper, as in the Dowell. Nearly midway between these two properties Mr. Dowell is now working a new claim known as the Red Cloud, and he believes he will have a similar orebody, as he has the same formations and indications."

**The New Smelting Plant of the Western Zinc Mining & Reducing Co.** at Leadville went into service July 11. Erection has been under the personal supervision of Vice-President E. J. Jones and General Manager A. B. Augustine, both experienced zinc smelters from the Eastern fields. Preliminary experiments on Leadville zinc ores were conducted at Coffeyville, Kan., by Mr. Augustine. The process as installed cannot handle sulphide ore. Lead ore is not desired and ore carrying above ½% lead is declined. The sole product of this plant is intended to be zinc oxide in pigment form. The sampler building contains usual crushers, rolls, screens and elevators, the ore being reduced to ¼-in. mesh and stored in bins of 200 tons capacity. At present, ore is trammed the short distance from bins to the furnace building, but with the addition of another unit, mechanical conveyors will be installed. There are eight furnaces in the block. Charges consist of 2 parts of crushed ore and 1 part anthracite slack. The charges are placed upon grates of perforated cast iron, through which air under pressure of 4 to 5 oz. is forced from below and maintains the proper oxidizing atmosphere. Gaseous products pass through a long combustion chamber and into a 4-ft. flue, 680 ft. long, being drawn by a large exhauster at the terminal. From the exhauster, the fumes enter the battery of 288 bags which are periodically shaken by hand. Daily capacity of the works is between 50 and 60 tons of crude ore. Present schedule for purchase of zinc carbonate ore is $3.50 per ton carrying 16% zinc, with a 25c. variation for each per cent. up or down.

### BUTTE—July 15

**Butte Miner's Union No. 1,** the old union, has served notice on the city of Butte through its attorney, Peter Breen, that suit for $138,291 is to be instituted against the city for damages done upon the Union hall on Miners' Union day, June 13, and again on June 23. For the damage alleged to have been done on Miners' Union day, the claim is for $68,291, and for the dynamiting of the hall on June 23, $70,000 is asked. The notice states that the damages sustained were caused by the neglect of the city to protect properly, or at all, or to attempt to protect, the personal and property rights of the complainant. Acting Mayor Smith and the assistant city attorney, N. W. Davis, state that the city will fight the damage suit to the last ditch. One of their defenses will be that the miners destroyed their own property. Another, that the officers of the Miners' Union and the Federation were primarily responsible for the trouble. With regard to dynamiting the hall, the city will advance the claim that the shooting done by the Federation officers and representatives, in which Bruneau was injured and Noy killed, aroused the indignation of the rebelling members of the Federation, and led to the dynamiting.

### HOUGHTON—July 18

**Calumet & Hecla** at the present time is employing a larger working force than ever before in its history, and is also paying higher wages. Several of the subsidaries are not only showing a larger rock tonnage, but are breaking all previous records in the yield of copper and in the earnings, notwithstanding the low price of copper.

**The Moyer Trial Has Been Postponed** to the September term of the circuit court, at L'Anse, Baraga County, Mich., and will be tried, if at all, during the latter part of September or about the first of October. There is a strong local sentiment in favor of dropping the case entirely because of the expense involved; in fact, Special Prosecutor George E. Nichols, who has had charge of the case so far, is one of the few persons who is still in favor of trying the case. It is his opinion, in view of the fact that the county has already spent so much in the preparation of the case for trial, that it ought to be carried through. There seems to be an idea among some, also, that the mining companies are not anxious to try the case. It is estimted that the cost of the trial would be between $15,000 and $20,000, and is is quite likely that the mining companies consider that the expense of the strike has been large enough already.

### MARQUETTE—July 18

**Signs of Improvement in the Iron Trade** are noted in the Lake Superior region, although these signs are not so prominent as desired. The tendency toward betterment is noted particularly on the Menominee and Gogebic ranges. Here, while production is still well below the normal, shipments are increasing. Ore is moving from Iron River more freely than heretofore this season. Gradually the surplus ore is being reduced.

**The Improvement Has Not Yet Extended to the Marquette.** Stockpiles are growing at a season of the year when normally ore is being sent out at a rapid rate. This is raising apprehension of still further curtailment. In the Ishpeming field, only the Cleveland Cliffs is working anywhere near capacity, and its shipments to date have been small. Some of the men recently laid off when the Steel Corporation closed its Hard Ore mine are leaving the district, having been unsuccessful in obtaining employment. It is considered unlikely that the Hard Ore will be reopened for a year at least.

**The Mining Properties at Ironwood,** metropolis of the Gogebic range, are valued this year at a total of $24,258,826, according to the assessor's rolls, as against $22,699,579 a year ago. The increase is $1,559,247. The Ironwood mines are operated by Hayes Bros. of California, holding the Ashland; Ferdinand Schlesinger of Milwaukee, holding the Newport, and the United States Steel Corporation, holding the Norrie group. The Pabst of the Norrie group is listed by the assessor at $7,341,000; the Newport at $7.232,557.

**An Assessment of $3 Per Share Has Been Levied on the Huron Iron Mining Co.,** formerly operator of the Youngs mine at Iron River and now a defunct concern, whose affairs are in the bankruptcy court for adjudication. The levy will net approximately $45,000. The assessment was agreed to by the principal stockholders, chiefly Ohio men, for the purpose of paying debts. At the time the Youngs mine was purchased from G. W. Youngs of Iron River for a purported consideration of $500,000, it was agreed, it is claimed, that the property would revert to the original interests if royalty on the ore produced was not paid. Whether such reversion will take place is to be determined by the United States Court of Appeals at Cincinnati. The tangle involving the Huron company is one of a series affecting several Menominee range mining concerns in which the same interests are associated. The Groveland Mining Co., controlled by the Lake Erie Ore Co.; the McDonald Mining Co. and the Youngs Mining Co. are all concerned one way or another, and much complication exists. The Youngs and the Groveland, the latter near Iron Mountain, are considered valuable and promising mines. Neither is in operation, pending the outcome of the existing litigation, and the McDonald, at Crystal Falls, is idle also.

**Conditions in the Crystal Falls Field** are not so encouraging. Big stockpiles are in evidence and in some instances they continue to grow. Corrigan, McKinney & Co. have been shipping most of the ore to date, and it appears likely that the stockpiles at both the Tobin and the Dunn mines will be wholly removed this season. Most of the Corrigan-McKinney group, however, continues in idleness as heretofore. At the Bristol property of Oglebay, Norton & Co. the big stockpile is still intact, and the mine is idle while repairs and other dead work are in progress. The Bristol product is a desirable ore for furnace use, and it will be surprising if the stockpile is not largely reduced before the close of navigation. Shipping from the Traders property at Iron Mountain, operated by the Republic Iron & Steel Co., has been hampered since the resumption of mining in the spring, due to the stripping work under way at the same time. This is now practically completed, and it is expected the daily output of 500 tons will be doubled. More stripping has been done than was first intended. The original contract was for the removal of 15,000 to 20,000 cu.yd. This has been enlarged so that the overburden excavated approximates 70,000 cu.yd. In some places 40 ft. of ground covered the orebody.

### ISHPEMING—July 18

**Quinnesec Hydro-Electric Plant** built by the Steel Corporation at Quinnesec Falls of the Menominee River, and which was completed a few weeks ago, is now furnishing power for the operation of machinery at the Chapin mine at Iron Mountain. The first use of the electricity in this manner was in the operation of an underground pump at the Hamilton shaft. The service is being extended to other mechanical equipment as fast as installations can be made. Delivery of the machinery for the Indiana mine of the Thomas Furnace Co., of Milwaukee, has been retarded because of the delay of the railroad company in building the spur track. However, it is expected to have the equipment installed before the end of July. The machinery consists of engine, boilers, pumps and air compressor. The plant has been shipped to the Menominee range from the Baraboo field in Wisconsin. The Indiana, part of which was operated years ago on a small scale, has been explored the last few years and is expected to develop into a good-sized producer. The property is near Iron Mountain.

**A New Chemical Plant Will be Started** during the summer by the Lake Superior Iron & Chemical Co. The works will be built at the furnace at Ashland, Wis., and the plant will replace the one destroyed by fire several months ago. Its construction will provide work for the greater number of men thrown out of employment when the furnace recently suspended operations. The equipment of the plant will be modern. The capacity will be double that of the old works. The Zaremba company, of Buffalo, will erect the greater part of the plant. Contracts for other parts of the work have been awarded to the Vulcan Copper Works Co., of Cincinnati, and the Detroit (Mich.) Heating & Lighting Co. The Lake Superior Iron & Chemical Co.'s furnace at Newberry, Mich., was blown out the last of June. Operations at the retort plant had been suspended previously. Repairs will be made, and this will employ part of the working forces; 150 woodchoppers have, however, been laid off. The sawmill operated in connection with the furnace will continue in commission. The company's Manistique, Mich., plant has been shut down for the last fortnight and more. It will remain out of blast for an indefinite period. Extensive improvement work is planned, including the installation of the retort system of manufacturing chemicals. The Elk Rapids, Mich., plant of the company is in blast again. Part of the Newberry force has been transferred to that establishment. At Gladstone, the Kipling furnace of the Pioneer Iron Co. is again producing charcoal iron, after having been out of blast for several months, during which period much needed repairs were made.

### CRYSTAL FALLS—July 18

**Seven Miners Lost Their Lives** at the Balkan mine, near Alpha, July 15, when a run of sand and water occurred on the first level. The men were engaged in putting up a raise, when the sand was encountered. Several of the men on the level were able to escape, but all of those who were near to the scene were caught. The ground was thought to be safe and it was not known that there was any sand in the vicinity. It was not long before the mine was filled with water to within 35 ft. of the collar of the shaft, and it will be weeks before the bodies can be recovered. Just how much sand entered the workings is not known. The accident is one of the worst that has taken place in the Lake Superior region for several years. The Balkan is worked by Pickands, Mather & Co., of Cleveland, and part of the property is to be operated as an openpit, while the other half will be mined by underground methods. Stripping is now in progress with a dragline excavator, and excellent progress is being made. The Balkan shaft is down 240 ft., but no mining has been done as yet, none of the drifts having reached the ore. The Balkan will be one of the largest properties in the Menominee region within a year or two.

### DULUTH—July 17

**Shipments from Hibbing Mines** and from the assembling yards in that field of the Mesabi range approximate 2300 cars per 24 hr. The Great Northern is moving 1900 cars, of which 1050 cars are furnished by the Steel Corporation from properties it is operating under the Hill ore-lands lease.

### SILVER CITY—July 17

**Mining in Southwestern Grant County** has taken a sudden spurt, especially in the Lordsburg, Steeple-Rock and Steins districts, where ore shipments are now larger than they have been in years and a large amount of development work is under way. It is understood that the Guggenheims have acquired property in the region of Lordsburg and will undertake extensive prospecting and developing. The 85 Mining Co. is shipping regularly to the smelters and negotiations are under way to construct a spur of the Southern Pacific R.R. from Lordsburg to the 85 mine. In the same region the Bonnie Mining Co., is preparing for larger operations in the near future and will install new mining equipment. The Carlisle mine at Steeple Rock, via Duncan, Ariz., is reported to have been purchased by George H. Utter, of Silver City, and preparations are being made for the re-opening of the entire Carlisle group. The property was at one time a large producer and ranked with the leading mines of the Southwest. Ore shipments will commence as soon as transportation facilities have been improved. There is a large quantity of commercially valuable ore on the dumps. The National Gold & Silver Mining Co. of Steins, is developing a body of high-grade gold, silver and copper ore, which is now from 12 to 18 in. wide. On account of scarcity of Mexican labor a 5-drill compressor, air drills and other mining equipment are being installed. The main shaft on the property is 300-ft. deep with between two to three miles of underground workings. There is a 50-ton mill on the ground which has been used principally in grinding up cobbings from shipping ore and also concentrating some of the low-grade ore. Shipments are made to El Paso smelting works.

### JUNEAU—July 12

**Contracts for the furnishing of Additional Equipment** to the Treadwell group and Alaska Juneau companies, costing altogether more than $250,000, have been signed by Fred W. Bradley, president of all four companies. Bids also have been asked for an electric hauling system and the contract will be let next month. The contract for the central steam plant for generating power for winter use by all companies was let to the General Electric Co. and Chas. C. Moore Co. The plant will have a capacity of 4000 hp., which, added to the 6000 hp. already installed at the Treadwell group, will give the companies 10,000 hp. for winter use and enable them to work at full capacity for the entire year. During the summer, power will be obtained from Nugget Creek, where the work of constructing a dam will be begun shortly. The plant will have a capacity of 12,000 hp. for about 9 months of the year, and during the other three the auxiliary steam plant will be used. An order for a 40-drill Ingersoll-Rand compressor has been placed and the big machine will be installed this summer. It will be driven by electricity and used for tunneling and other purposes in the Alaskan Juneau property. The Alaska Juneau was first developed by C. D. Lane with an opencut. Two years ago it was taken over by Bradley and others.

### CORDOVA—July 2

**A General Stimulation of Activity All Over Alaska** since the passage of the Alaska Railroad bill is reported by Robert W. Baxter, vice-president of the Copper River & Northwestern, who says that there has been more freight going into the territory than ever before in its history.

**The So-called Morgan-Guggenheim Syndicate,** according to report, will spend a large sum in the purchase and development of mining properties in Alaska during the coming year These interests control and operate the Bonanza, Beatson and other copper properties. More than $600,000 will be expended on improvements on the Bonanza and Beatson mines this summer, and a number of properties on which the syndicate has options will be developed. If the developments justify the investment, at least $10,000,000 will be expended in purchases and in the installation of machinery. The "Syndicate" is one of the strongest combinations operating in the Northern territory, where it has investments of more thn $25,000,000. Its transportation plants include the Copper River & Northwestern Ry. and the Alaska Steamship Co., which has a fleet of about 16 freight and passenger ships in commission. Stephen Birch, general manager of the mining end of the syndicate's holdings, reached Seattle a few days ago from New York, where he has been conferring with his principals, and will leave for Cordova in a few days, taking a large field force. He will make a trip through the White River country, where a number of options have been secured, and will visit other properties which have been offered. In an interview in Seattle, Mr. Birch stated that the first work would be to build an aerial tram to the Jumbo mine, near Kennecott, and to increase the concentrating capacity of the Bonanza. The tramway will be about 12,000 ft. long and will be used to move the ore down to the plant. An aerial tram is now working on the Bonanza 15,000 ft. long. At the same time the power plant at the Beatson mines at Latouche will be increased and a concentrator with a capacity of 500 tons will be installed. "One of the next big fields to be developed," he said, "will be the head of the White River, about 90 miles from Kennecott."

### TORONTO—July 18

**Beaver Lake Gold Field,** Saskatchewan, continues to attract prospectors. So far 850 claims have been filed, representing an acreage of 44,200 or 70 square miles. Staking is still going on and numerous rich finds are reported.

**Canada Iron Corporation** went into liquidation a few months ago. Proposed reorganization was formally approved at a recently held meeting of bondholders. The next step in the reorganization proceedings will be a meeting of the general creditors in Montreal on July 5. If the creditors give their consent to the plan, arrangements will be made to put it into effect at once. The resolution adopted by the bondholders provides for the cancellation of the existing trust deed and the acceptance by the first-mortgage bond holders of 6% debenture stock to be known as "B" debenture stock in a new company. The exchange will be on the basis of par for par. Prior to this security, will be an issue of "A" debenture stock of an authorized amount of £200,000, of which no less than £120,000, and no more than £140,000 will be subscribed for at 95 to provide the necessary cash for working capital. Preferred and common shares will also be created, the amounts to be determined after negotiations with the second bondholders, holders of secured notes and other creditors in the old corporation. The old preference and common stock will be wiped out but shareholders who subscribe to the "A" debenture issue will be given a bonus of common stock which in the event of the reorganization proving successful, will offer some chance of the old shareholders recouping part of their losses.

**The Gradual Passing of La Rose** is one of the outstanding features of the present situation in Cobalt. It is understood that the consulting engineer has recommended the closing down of some of the properties in the immediate future. This, the first mine to be developed in the Cobalt district, and at one time the most important producer in the camp, is practically worked out, and high officials of the company entertain only a slight hope for a continuance of its productiveness. The property was discovered in 1903 and subsequently purchased by the Timmins-McMartin-Dunlop Syndicate for a comparatively small sum. At that time, it was believed orebodies as rich as these would have only a short life, and the shipments, while of surprising richness, did not excite any great comment. After the syndicate had taken out ore to the value of $1,200,000, the property was sold in 1908 for $1,000,000 in cash, and the undertaking of the purchasers was to take up other stock from time to time. The various properties included La Rose, La Rose Extension, Princess, Violet, Silver Hill, Fisher Eplett and University. Subsequently, the famous Lawson property was included. In 1909, the present Montreal holders, acquired a large interest and the stock having a par value of $5 rose to $8.50 a share. It was soon found out, however, that the production was being forced and that it would be impossible to maintain the output. The bottom of the main La Rose vein had been reached and the Lawson had proved a great disappointment, the famous silver sidewalk carying its high values to a depth of only about 15 ft. The Montreal shareholders forced the hands of the New York owners and took over the management of the property, with D. Lorne McGibbon as president. The first act of Mr. McGibbon was to cut the dividend from 16% to 8%. and as a consequence the bottom fell out of the stock. Since that time the property has been worked in the best manner and everything possible has been done in the interests of the shareholders. The several properties have been aggressively developed, but with the exception of La Rose, Princess and Lawson, the production amounted to practically nothing. To date, however, the La Rose Consolidated, which embraced the various properties, has produced approximately 21,500,000 oz. of silver, for which was received $11,500,000, and the profit on which would be about $6,500,000, including the $1,200,000 taken out by the original owners. About $5,000,000 has been paid in dividends and the surplus in the treasury stands at about $1,500,000. While it is possible that other discoveries may be made, the aggressive policy of development carried out under competent management would seem to preclude the possibilities of any further discoveries of great importance. There is still, however, a large amount of low-grade ore in the mines and on the dumps which should yield a profit.

# The Mining News

## ARIZONA

### Gila County

INTERNATIONAL SMELTING (Miami)—Considerable work now in progress at building site. Fume stack started Tuesday by Short company, of Chicago, steel stack erectors, to whom contract was let by Oscar Daniels company. "Bell" of stack now in place. Expected about six weeks will complete job. Stack erected in sections of 6 ft.; riveting must be finished as work progresses, since plates are always handled from top of structure. Stack will be brick lined for the first 100 ft. Erection of the bedding bins completed, steel for receiving bin being swung. Main building fast assuming shape should be erected in few more days. Stirling waste-heat boilers being installed, enormous amount of detail involved in this work and will probably be several weeks before installation is complete. Large shipment of Stirling boilers also received for power plant. Work resumed on cooling pond, expected concreting will begin in short time. Foundations for five 20-ft. Wedge mechanical roasters now being poured, also those for drier plant equipment. Foundations for engine-house machinery now complete.

INSPIRATION CONSOLIDATED (Miami)—Upper 400 ft. Main East shaft, Inspiration Consolidated, completed July 15; about 40 ft. remaining to be concreted in Main West shaft. Tearing out forms and false sets now in progress, as soon as all timbers are removed guides will be placed in one compartment to allow lowering timbers required for concreting lower 200 ft. Most difficult part of this work disposed of; remainder should be completed in record time. Fourth and last compressor foundation in compressor and hoist house poured during week, with walls and building foundations completed for mine transformer stations, surface concrete work at Inspiration will be finished. Carpenters erecting runways for various conveyors of crushing plant, storage bins and main transfer between the two. Total of 1500 ft. of conveyors will be used, all trippers self-propelled and self-reversible. Corrugating and carpenter work on concentrator building progressing at rapid rate, erection gang hurrying work to finish part of building over bins to avoid delaying work of finishing force. West end of concentrator bin partitioned off; as soon as riveted, will be used instead of low-line bin for storage bin for test mill. Another fine crusher, an Overstrom 36-in. grinder, being tried out at test mill. Principle is entirely new, depending for grinding action on impact alone, no direct crushing between metallic surfaces. Machine consists of impeller revolving at 1800 r.p.m. and annular die. Ore averaging 1½ in. diameter, is fed in top and hurled by centrifugal force against die with linear velocity about 18,000 ft. per min. Design of machine allows no choking, capacity limited only by power of driving motor and rate at which ore can be fed. Claimed machine now being tested will handle 40 tons per hr. Metals Recovery Co.'s pneumatic flotation machine been in continuous operation past week, seems to do good work. Different kinds of oil experimented with, little doubt it will prove efficient with proper conditions of feed and operation worked out.

## CALIFORNIA

### Amador County

FREMONT (Drytown)—Marko Veramenta was killed July 3 in shaft of Gover claim. With partner was doing repair work at 400-ft. level, was struck by ascending skip. Stated that in endeavor to get partner out of way was caught himself.

### Calaveras County

MELONES (Melones)—New shoot of high-grade ore has been discovered on 800-ft. level.

ECONOMIC (Esmeralda)—New 20-stamp mill is ready to operate. Tunnel has been advanced beyond 800-ft. point in good milling ore.

HEXTER (Mokelumne Hill)—Electric-power haulage is being installed for ore cars in 3000-ft. tunnel. It is said that pay gravel has been developed in large amount.

VICTOR LAND & MINERAL CO. (Angels Camp)—This is a new corporation organized at St. Louis by stockholders of Reiner Mining Co. to reopen Reiner mine, which has been in litigation for some time. Property is worth development, and present company states that no further work will be undertaken until money is in hand to pay cost.

### Eldorado County

CALIFORNIA DIAMOND weighing ¾ carat reported found near Placerville by Frank Jones, while panning gold-bearing gravel.

RUBY CONSOLIDATED (Georgetown)—Seven properties, Aphrodite, Pluto, Proserpine, Wedge, Garfield, Garfield Extension and Little Gem have been bonded to a corporation formed by W. I. Smith and W. C. Green.

### Inyo County

WILLSHIRE BISHOP CREEK (Bishop)—A new Starrett pump is being installed to unwater shaft below first level. Upper water has been bailed out. Reduction equipment, when mine starts again, will include present 10-stamp mill, a 16-ft. tube mill, 55-ton cyanide plant, Akins classifier and Portland filter. Machinery and material for these installations are on ground.

### Mono County

LAKEVIEW (Masonic)—Stamp mill installed and crushing begun; 35 men employed.

NEW YORK (Masonic)—Reported bonded to J. D. Martin, San Francisco, and George G. Burris, Goldfield. Hoist installed and 200-ft. shaft being sunk.

### Nevada County

OUSTOMAH GOLD MINING CO. (Grass Valley)—Company secured a superior court order restraining Grizzly Ridge Mining Co., which is operating in Oustomah mine under bond, from removing any property. There is a payment about due, and it is reported that Grizzly Ridge Co. attempted to remove some machinery and to clean mill plates. The outcome was that the lease which was held by the Grizzly Ridge Mining Co. reverted to the owner and the civil action was dismissed.

### San Bernardino County

DALE DISTRICT is progressing since the Greenwater has been operating. Company is reported to have cleaned up $30,000 in June. New buildings have been added to camp. North extension of Supply group is being opened with good prospects. Ivanhoe will resume operations. Carlite group is being opened up.

PARADISE (Daggett)—It is reported that Denver men have taken over property on a purchase agreement and will build a cyanide plant, to be ready for operation in October.

ATOLIA MINING CO. (Atolia)—It is reported that leasing system recently adopted has given good returns to lessees. Five made from $200 to $1500 each, and others are reported to have cleaned up $1000 each in one month. Leasing system has been in practice in Randsburg district for several years. Whether tungsten mines will be successfully operated under lease is a problem yet to be solved.

### Sierra County

KATE HARDY (Forest)—Mine attracted attention by rich bunches taken out past three years; now undergoing thorough underground exploration under direction Superintendent A. D. Grant. Two more shoots opened at depth, one showing coarse gold, other heavy arsenical sulphurets; concentrator to be added, additional equipment as development work expands.

SIERRA-GENEVA (Forest)—Property of 270 acres covering nearly mile of channel, promises to become one of most important drift mining enterprises in district. Much fine gold panned here by old-timers, but deposit was overlooked, owing to heavy growth of timber and to surface soil, until exposed a few years ago through shaft in Hardy Kate quartz mine on the east. Channel entirely below serpentine dike and crosses big Kate Hardy ledge from which rich surface pockets of gold undoubtedly fed the gravel. Old rich New Jersey claim adjoins on west and Mexico on south. Bedrock slate. Incline shaft to bottom channel on northern rim to get into dish of channel and work up-stream. M. W. Davis and seven associates, owners and operators.

### Stanislaus County

CHURN DRILLING on Stanislaus River near Oak Dale reported in progress. Ground believed gold bearing. Further up river at La Grange dredging operations have been in progress several years.

### Trinity County

TRINITY ASBESTOS MINING CO. (Carrville)—Construction work in progress, machinery still being hauled from Castella for asbestos treatment plant. Company contemplates railroad 1½ miles long to connect the several claims and haul lumber from saw mill; hand- or horse-tramming will be used until electric plant is completed, and then electric haulage; 46 men employed in construction and development.

### Yuba County

GUGGENHEIM INTERESTS have resumed drilling dredging lands in Yuba Basin between Hammonton and old state dam. Reported drilling will also be done between dam and Park Bar bridge.

## COLORADO

### Lake County

WOLFTONE (Leadville) — Recent development exposed sufficient ore to maintain present heavy production at least two years.

VIRGINIUS (Leadville) — Angeli Travison, et al, have taken lease on this shaft of New Monarch company and will explore for orebody they discovered in adjoining property.

MOUNT CHAMPION (Leadville)—Manager Lucien Smith laid off most of miners in this Lackawanna Gulch property, explanation being no more ore will be produced until suitable mill be erected. Company leasing additional ground, intends to continue development.

### Teller County

ELKTON (Victor)—Announcement made of 10-ft. vein carrying $30 ore on 1400-ft. level. Depth of find is important feature.

## IDAHO

### Cœur d'Alenes

STANISLAUS MINING & MILLING CO. (Kellogg)—This company formed to take over four claims adjoining the Bunker Hill & Sullivan, formerly known as Lincoln group.

BUNKER HILL & SULLIVAN (Kellogg)—Lessees in upper workings are seriously considering advisability of erecting concentrator near mouth of old Reid tunnel. Several have developed large amount of milling ore and figure that with

mill at hand it could be treated at fair margin of profit. This would enable them to handle shipping ore more advantageously and cut down on transportation charges.

MAY DAY (Wardner)—Ore shipments begun from this group of copper claims on upper waters of North Fork River. Boats used in bringing ore down river a distance of 22 miles to railroad. Mine is two miles back from river and has good wagon-road connections. Boats can handle about two tons on down trip, are hauled back by horses; supplies for camp being brought back in boats. At present only one ton being brought down the river per trip owing to low stage of the water.

TWO MILE MINING CO.—(Osburn)—According to report, a strike of importance has been made in Two Mile group located many years and extensively developed, but no showing made to compare with that just disclosed. Tunnel started on little more than a stringer of quartz and talc. At a distance of 190 ft. another stringer came in. At this point shaft was started and about 2 ft. of what appears to be milling ore of fair grade discovered. This is substantial encouragement to all other development companies in district.

## MICHIGAN

### Iron

WICKWIRE (Iron River)—Orders received to place this property on full time and ship all ore mined this year and all in stock; 125 men added to payroll this week. Reported one or two other Iron River properties will increase production shortly.

BRISTOL (Crystal Falls)—No indication of immediate resumption here; no ore been shipped thus far and stockpile is large. Ore usually sells readily and management hopes to move enough before navigation closes to have stocking room so mining can be carried on next winter.

DEXTER (Ishpeming)—Cleveland-Cliffs has pumped all water from this old property, idle since 1896; examination of workings will be made at once. Probably diamond drill will be started underground to check up drilling done just prior to time that mine shut down.

## MONTANA

### Cascade County

GREAT FALLS REDUCTION WORKS (Great Falls)—During recent visit of president B. B. Thayer and vice-president Kelly at Great Falls, it is reported plans were discussed for installation of new copper refinery to handle part of Anaconda product now going to Perth Amboy, N. J. Latter plant, crowded to its capacity, treating 20,000,000 lb. of blister turned out monthly by Anaconda. New plant if installed will cost about $700,000 and will be able to handle nine to ten million pounds copper per month.

### Deer Lodge County

BUTTE-GEORGETOWN GOLD MINING COMPANY (Anaconda)—Under direction of expert operator placer ground near Georgetown will be tested by deep borings with Empire drill. Company has spent $40,000 in preliminary exploration work, will spend $5000 more this season for deep drilling operations to determine positively whether value of ground justifies purchase of dredging machinery for future exploration. Dr. F. L. St. Jean of Anaconda is resident manager.

### Fergus County

MOCCASIN MOUNTAIN MINING CO. (Kendall)—Properties are being explored preparatory to commencing active operations. Site for a shaft has been selected and sinking will be commenced soon.

NORTH KENDALL MINING COMPANY (Kendall)—Large body low-grade gold ore opened at the North Kendall mine according to report, arrangements made to further develop deposit preliminary to active exploitation in near future.

### Silver Bow County

HIGH ORE (Butte)—J. A. Leonard electrocuted on 1600-ft. level while doing repair work on two wires, one carrying 125 volts and one 250 volts. Exact manner of death unknown.

WASHOE PLANT (Anaconda)—Reverberatory furnace fitted with new pulverized-coal feeding system, has been running for week with great satisfaction.

BUTTE & SUPERIOR (Butte)—Due to labor disturbances and several holidays, June output was smallest of any month in a year. Concentrates amounted to 8600 tons, against about 10,000 tons in previous months, but running 1.1% higher than in May; average for June was 54.7%. Spelter output for the month was 9,500,000 lb.

BUTTE-BALLAKLAVA COPPER COMPANY (Butte)—Stoping on 1600 level started to exploit 6-ft. oreshoot recently encountered in face of drift, that level. Samples of ore ran 16.46% copper, 24 oz. silver, 14c. gold. Development work on level indicates continuation of oreshoot.

TUOLUMNE (Butte)—Company mining and shipping daily from 80 to 100 tons ore, carrying 4 to 5% copper. Because of sinking and other development work, mine is not quite paying expenses. Shaft is 35 ft. below the 2600-ft. level, will be continued short distance for sump. With station completed on 2600-ft. level, crosscutting will commence, expected that vein will be encountered between 250 and 300 ft. from the shaft.

BUTTE & GREAT FALLS MINING CO. (Butte)—At directors' meeting held July 10 decided to begin at once on plans for sinking to 500-ft. level. Necessary funds for this and other development work will be raised by assessment of 5c. per share on the stock which should bring in about $20,000. Churn-drilling from surface not having furnished desired information, plan of underground exploration, decided upon as more satisfactory. Power transmission line to mines, four miles north of Butte, will be put in immediately, buildings erected and machinery installed.

TIMBER BUTTE MILLING COMPANY (Butte)—Clark zinc concentrator on Timber Butte, recently started in operation, already made several shipments high-grade concentrates to Kansas smelters. Mill treats the zinc ores from Elm Orlu mine; present capacity, 500 tons per day. With millions tons ore in sight mill will probably soon be extended to capacity of 1000 tons, provided results continue satisfactory as at first. Process consists of table concentration and oil flotation according to Minerals Separation patents. Ore brought from mine to mill over company's electric railway by way of Butte, Anaconda & Pacific and Milwaukee & St. Paul.

BUTTE & LONDON (Butte)—Company added to holdings by purchase of Wall & Jackman lode claims in district west of Butte. Claims situated near Nettie mine of Anaconda comprise about 40 acres. Treasury stock given in payment. Water in property in East Butte practically lowered to the 1100-ft. level; preparations under way to lower the new electric pump for which concrete foundation is being built. Pump will have capacity of 1100 gal. per min. After installation sinking will be continued to 1600 level where Rainbow Development Co. will do large amount of development for 51% of Butte London stock.

BUTTE DULUTH (Butte)—July 7, new 1000-ton crushing plant, consisting of Blake breaker, C. I. W. rolls and Symons disk crushers was put in operation, has so far exceeded expectations. Company's energies are now directed toward completion of cell house, now in course of construction. Generator with capacity of 3600 amp. and 240 volts arrived and ready for installation. With cell house completed plant will have capacity of 1800 tons per day. Total handled by old plant during June was 3812 tons, giving 127,000 lb. copper, 85% electrolytic, 15% cement; total cost of production, 8¾c. per lb. With increased capacity, Superintendent Sherwood predicts material reduction in costs.

RAVEN COPPER COMPANY (Butte)—Understood that company's offer to sell Butte properties for $65,000 authorized by stockholders at recent meeting, will be taken up by Anaconda. Purchase price, added to the $35,000 cash on hand, equivalent to about 28c. for each of Raven shares outstanding. Effort to prevent sale being made by individual stockholders who claim property is valuable, being surrounded on all sides by large producers and because of orebodies awaiting extraction. Several years exploration work disclosed little commercial ore. Mine closed down about a year ago upon advice of qualified engineers. Raven also owns a six-sevenths interest in Snoozer claim in which large body of ore was developed in past years. This claimed by the Anaconda company as being contained in vein apexing on the Anaconda's La Platte claim. Further work on vein prevented by the Anaconda company's taking from Raven the use of Buffalo shaft through which Snoozer was worked. Raven stock then sold $8 per share.

DAVIS-DALY COPPER MINING COMPANY (Butte)—Output of company for month or more, practically nil; various rumors started concerning value of properties. Value of stock lately selling at about 60c. per share depressed. Recent exploration work in lower levels Hesperus and Belmont veins so far not encountered extensive bodies of commercial ore, but Hesperus vein has produced large bodies ore on 1400 level, likely may again in depth. Aside from prospective value of orebodies in Butte properties of company, been estimated that extensive land holdings in heart of Butte and equipment of company, if sold, would bring at least $840,000 or $1.40 per share. Besides Butte mines, company owns Hibernia and Great Republic claims, adjoining Nettie mine of Anaconda company in old silver district, three miles west of Anaconda hill. Nettie being unwatered by Anaconda to exploit extensive silver and zinc deposits known to exist; with this stage reached, value of the Davis-Daly holdings in section will be enhanced, may double present value company's assets.

## NEVADA

### Elko County

ELKO PRINCE (Gold Circle)—Mine being examined for English syndicate. Ore amenable to cyanide process; future plans include installation of 50-ton cyanide plant.

### Esmeralda County

ATLANTA (Goldfield)—Order for one Smith-Vaile 6½x15-in. triplex power pump and one 6-in. Platt high-lift, centrifugal pump placed with C. C. Moore & Co., San Francisco. Equipment will be installed in 1800-ft. shaft of Goldfield Merger Mines Co. to handle increased flow of water from long crosscut on 1750-ft. level of Atlanta.

DIAMONDFIELD MINING & MILLING CO. (Goldfield)—This lease on Goldfield Great Bend and Goldfield Daisy ground has completed addition of 20-ton cyanide plant to five-stamp mill; milling resumed. Stoping being done above east and west drifts on 75-ft. level; west drift being extended to connect with Diadem shaft on Great Bend property.

### Humboldt County

JUNE PRODUCTION OF ROCHESTER is estimated at 1400 tons; value, $35,000.

ROCHESTER MINES CO. (Rochester)—Work on milling plant reported will commence in about 30 days.

SEVEN TROUGHS COALITION (Seven Troughs)—High-grade oreshoot, 10 in. wide, opened on 1150-ft. level for length of 190 ft. Sinking No. 4 winze resumed. Car of concentrates shipped to Hazen sampler gave returns of $383 per ton.

### Lyon County

SMITH VALLEY MINES CO. (Yerington)—First shipment made to Thompson; regular shipments hereafter.

NEVADA-DOUGLAS (Ludwig)—Material for construction of leaching plant 125 to 150 tons capacity now at Ludwig. Plant will be built as soon as possible. First unit, 250 tons, of larger plant, will also be built soon, it is planned.

### Mineral County

HIGH-GRADE ORE FROM NEW CAMP OF RAND has been shipped to Thompson smelting plant.

PINE GROVE MINING CO. (Pine Grove)—Mining discontinued for present; mill running on dump ore.

**Nye County**

I. W. W. TROUBLE reported in Tonopah. It is said that 50 Western Federation men, seeking to tear down placards put up by Industrial Workers in the union hall, proclaiming three miners' hotels "unfair," met resistance from the I. W. W. supporters. In melee one man drew revolver and fired. Jack Whiting, of Western Federation crowd, was shot in leg and fell. There was a rush for man who did shooting, which was quelled by the police, and man was hustled into jail. Industrial Workers been holding meetings for about three weeks; have effected organization among restaurant employees.

SUNSET (Rhyolite)—Foundation and framework of new mill completed.

BANNER TUNNEL (Telluride)—Crosscut tunnel now in 1500 ft. Columbia shaft 160 ft. deep; station is being cut at this point.

JIM BUTLER (Tonopah)—New hoisting plant being installed at Wandering Boy shaft. Drifting on south vein of Desert Queen shaft under way.

TONOPAH EXTENSION (Tonopah)—Murray vein oreshoot opened on 1020-ft. level 20 ft. wide. Drifting west in progress. On 950-ft. level, shoot has been drifted on 140 ft., face still in ore. On 1100-ft. level, crosscutting under way to find downward extension of oreshoot.

**Storey County**

CONSOLIDATED VIRGINIA (Virginia City)—Sale of 54,000 shares of delinquent stock has been postponed 10 days from July 7. Reason given is that settlement of north end companies' differences may have beneficial effect and induce stockholders to redeem stock.

YELLOW JACKET, CROWN POINT AND BELCHER (Virginia City)—Good progress in opening levels of these Gold Hill mines, recently unwatered. New cyanide plant nearing completion; expected that addition of this plant to mill will result in much better saving of gold.

**NEW MEXICO**

**Bernalillo County**

SANTA FE DREDGING CO. (Golden)—Company is preparing for operations by Aug. 1. Is building power plant and will install placer-mining machinery. It is estimated will work 6000 yd. of dirt per day.

**Grant County**

HARDSCRABBLE MINE (Pinos Altos)—J. T. Janes has completed retimbering and unwatering. Property becoming regular shipper to El Paso. Large quantity of ore now on dumps.

SILVER CELL MINE (Pinos Altos)—Property under lease to C. W. McSherry and R. H. Gudger, with F. E. Wilcox as superintendent. Drifting being done at 100-ft. level shows good chloride silver ore. Steam hoists in use and small smelting outfit is on property.

C. & O. MINING & MILLING CO. (Pinos Altos)—John Oglesby in shaft on Langston claim encountered high-grade gold ore. Shaft is on Pacific vein, which netted Bell & Wright, recent operators, $60,000. Ore occurs in small stringers and kidneys. Strike has caused much excitement in district.

**Rio Arriba County**

RIO CHAMA PLACER MINING CO. (Abiquiu)—Company has leased 1760 acres of dredging ground above Abiquiu; is said will put in steam shovel and later a dredge.

**Otero County**

HEMBRILLO COPPER MINING CO. (Tularosa)—Company is again active. Shaft is down 140 ft. and crosscut is being driven to main lode; it has been driven 1000 ft. already. Property is located in San Andres mountains, and a deposit of bismuth is reported to have been discovered near Hembrillo cañon.

**Torrance County**

MARYLAND-NEW MEXICO OIL & GAS CO. (Moriarity)—Company has filed incorporation papers. Intends to drill for oil in vicinity of Moriarity and Clark, Torrance County, and Stanley, Santa Fe County. Oil indications reported good where company contemplates drilling.

**NEW YORK**

GOLD EXCITEMENT—Some time ago local excitement was caused by report that party making general reconnaissance in field near Port Jervis was looking for gold. Now develops prospecting was for coal, not gold. Drill hole down 2000 ft., according to reports, but results not made public.

**SOUTH DAKOTA**

**Lawrence County**

WASP NO. 2 (Flatiron)—Regular monthly dividend of 1c. per share declared. Property running at full capacity, 500 tons daily.

NEW RELIANCE (Trojan)—Diamond drilling continued. Commencing first of month whole complement of 30 stamps put in commission.

ORO HONDO (Lead)—Three shifts employed in sinking three-compartment shaft. Present depth little over 1100 ft. Two pumps purchased from Homestake company, and no trouble experienced in handling water.

TITANIC (Carbonate)—Company thoroughly prospecting and sampling property, with assay office established at mine. Work will require some time to complete. Company recently purchased Albe fraction, from Mrs. Ellen Holmes.

DEADWOOD ZINC & LEAD (Deadwood)—Lead City people, headed by County Commissioner Thos. H. Moore, taken option on large block of stock, expect to put property on producing basis at early date. Ore carries zinc, lead, gold, silver, large percentage of pyrite.

HOMESTAKE (Lead)—Valuation of Homestake properties in Lawrence county, for taxation, for year 1914, fixed by county board of equalization at $16,864,571. Last year, after returns were raised by state tax commission value was $16,610,170. Recreation hall practically complete. Furniture for Hearst free library, which will be quartered in building, received. Nearly all other furnishings have arrived.

**Pennington County**

DAKOTA CONTINENTAL COPPER (Hill City)—Crosscutting still in progress from lowest level in main shaft. Management states no ore found as yet.

KEEP AGOING M. & M. CO. (Oroville)—Company will erect small test mill to crush ore extracted in shaft sinking. Shaft now 55 ft. deep; proposed to sink to 200-ft. point. Oreshoot not large, but carries good gold values.

**UTAH**

**Juab County**

EAGLE & BLUE BELL (Eureka)—Company declared sixth dividend, 5c. a share, or $44,657, making total $267,943.

GODIVA (Eureka)—Fairbairn Leasing Co. operating on the 600- and 1200-ft. levels; work on other levels undertaken soon.

MAY DAY (Eureka)—Development progressing on upper levels along vein from which lessees shipped high-grade ore early part of year.

TINTIC STANDARD (Eureka)—Winze from 1100-ft. level down 15 ft. shows mineralization. With greater depth attained drifting will start for richer part of vein to east. Second car of ore shipped recently from property.

VICTORIA (Eureka)—Small bunch gold-silver ore opened by drift on 1000 level, south of ground so far productive. On 1200 level northeast of shaft good showing in new ground also, and winze is being sunk below this level.

IRON BLOSSOM (Silver City)—In June marketed 80 cars ore, first six months present year output 462 cars, about 20,000 tons. Shipments from 400-, 500- and 600-ft. levels. New ore being opened. Quarterly dividend 10c. a share, or $100,000, be paid July 25.

MAMMOTH (Mammoth)—Closed down July 3 for few days to allow repairs to machinery. Shipments on company account from surface dumps, for some time forming large part of output, will, it is stated, be discontinued, although lessees will send out such ore from time to time.

**Summit County**

PARK CITY SHIPMENTS for week ending July 11, 2,295,130 lb.

GLENCOE (Park City)—In May, 75 to 100 tons of ore shipped. Stated that electric power is to be introduced.

SNAKE CREEK TUNNEL (Park City)—Tunnel in 8300 ft.; in May progress of 371 ft. was made; in June, shorter month, progress was 369 ft. Total length to be 14,300. Work being done by McIlwee company.

MINES OPERATING (Park City)—In June 12,000 to 15,000 oz. silver bullion produced. Treated daily 150 tons from old Ontario stope fillings, ore running about 10 oz. silver; extraction about 60%. New Holt-Dern roaster, soon to be installed, is estimated will make saving about $1 a ton.

DALY WEST (Park City)—Foundations hoist house, compressor, mill completed. Steel framework for hoist and machine shop up; that for the mill being finished rapidly as possible. Expected that mill will be in commission by autumn.

**CANADA**

**Ontario**

MOND NICKEL COMPANY states that the profits for the past year were £297,614.

DOME (South Porcupine)—During June 18,250 tons of ore milled, producing $83,421, an average value of $4.51.

MCINTYRE (Schumacher)—Mine in June treated 4300 tons averaging $10.65, shipped $45,795 in bullion. Unofficial statements, claiming 1,000,000 tons of developed ore, not to be relied upon.

NIPISSING (Cobalt)—Estimated net production for June, $183,558, as compared with $211,256 in May. Bullion from Nipissing and custom ore to estimated net value of $360,486 was shipped. Development at 900-ft. level proved disappointing.

HOLLINGER (Timmins)—Statement for four weeks ending June 17 shows gross profits $129,168. Mill treated 13,898 tons averaging $14.59 and made an extraction of 95.2%. Working costs, $4.57, highest figure for several months. Surplus now $859,225. Mine has paid $2,000,000 since commencement of dividends.

PORCUPINE CROWN (Timmin)—In effort to find extension of veins beyond faults, economic geologist has been employed. Mill only running six days a week and not attempting to do much more than make sufficient money for dividend requirements. Only about two years ore in reserve and strenuous efforts being made to develop new orebodies.

**MEXICO**

**Hidalgo**

SANTA GERTRUDIS (Pachuca)—H. C. Hoover, who followed A. M. Grenfell as chairman, has audited accounts of this and Camp Bird. Estimates are only $50,000 losses through Grenfell operations.

**Sonora**

CANANEA CONSOLIDATED (Cananea)—Company officials announced full guarantees of protection received from Constitutionalists and work to be resumed July 20. Col. P. Elias Calles said to have offered the 2500 strikers choice of working or fighting, and the 2500 chose working.

# The Market Report

## METAL MARKETS

**NEW YORK—July 22**

The metal markets generally have remained rather quiet and there are no marked changes to be noted. Price variations have been small.

### Copper, Tin, Lead and Zinc

**Copper**—The market has been distinctly weak. The old asking prices have been no longer talked about. One of the leading producers reduced its asking price to 13⅝c., delivered, usual terms, but this simply met the actual market that previously existed and was immediately undercut by other sellers. In fact there was displayed during the last week a distinct pressure to sell from several first-hand quarters. In the early part of the week some considerable business was done at about 13⅜c., delivered, usual terms, but in the latter part it appeared difficult to realize that price and further concessions were intimated. Sales reported for the week were both for domestic and foreign delivery. A noteworthy feature was several million-pound sales to domestic consumers for near-by delivery.

The average of the prices for electrolytic copper for the week was 13.258 cents.

The London market for standard copper has declined. Speculative sentiment was adversely affected both by the quietude of the copper market, as well as the war scare and political disturbances in Europe. On Thursday, July 16, standard spot was £61 2s. 6d., three months £61 11s. 3d. On Monday, July 20, spot was £61, and three months £61 8s. 9d. The market declined 10s. the next day, and on July 22 closed at £60 5s. for spot and £60 15s. for three months.

Base price of copper sheets is now 19c. per lb. for hot rolled and 20c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 14¾@15c. per lb., carload lots at mill.

Exports of copper from New York for the week were 6850 long tons. Our special correspondent gives the exports from Baltimore at 2419 tons for the week.

**Visible Supplies of Copper in Europe** July 15 are reported as follows: Great Britain, 15,960; France, 5230; Rotterdam, 2900; Hamburg, 2930; Bremen, 1110; other ports, 600; total, 28,730 long tons, or 64,355,200 lb. This is an increase of 60 tons over June 30. In addition to the stocks given above, 930 tons are reported afloat from Chile and 3750 tons from Australia, making a total of 33,410 long tons.

**Tin**—American consumers entered the market freely during the latter part of last week. Consequently, large orders were placed by American dealers in the London market. A firmer tone developed, and quotations were advanced from day to day. At the beginning of this week, the cessation of American buying encouraged the London bear faction to become aggressive, and under their selling the market broke about £3. The close, however, is again firmer at £143 10c. for spot and £145 for three months, and about 31¾c. for July-August tin here.

**Lead**—The market is quiet but with somewhat more inquiry. Prices are a shade firmer and New York is quoted 3.90c.; St. Louis, 3.72½@3.77½ cents.

The London market is also somewhat firmer. Spanish lead is quoted £19 2s. 6d. and English lead £19 17s. 6d. per ton.

Exports from Baltimore for the week included 448,378 lb. lead to Liverpool and 1,121,153 to Bremen; 1,569,531 lb. lead in all.

**Spelter**—In the early part of the week some further round tonnages were sold at very low prices, but the improvement in the iron and steel business was later reflected in a somewhat better demand for spelter, both for early and distant shipment, and business was done at improved prices, a fairly large tonnage having been placed within the last two days at about 4.80c., St. Louis.

The London market is firm, good ordinaries being quoted £21 12s. 6d.; specials, £22 2s. 6d. per ton.

Base price of zinc sheets is $7 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

### Other Metals

**Aluminum**—More inquiry is reported and business seems to be looking up, though there is little increase in actual sales. There is some pressure for business and prices do not advance. Quotations are 17.50@17.75c. per lb. for No. 1 ingots, New York.

The Aluminum Co. of America has taken title to a large plot of land at Edgewater, on the Hudson River opposite New York.

**Antimony**—Business is fair for the season and the tone of the market is better. Ordinary brands—Chinese, Hungarian, etc—hold at 5.40@5.70c. per lb. For Cookson's, 7.10@7.30c. per lb. is asked, with 6.80@7c for other special brands.

DAILY PRICES OF METALS

NEW YORK

| July | Sterling Exchange | Silver, Cts. per Oz. | Copper | Tin | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|---|
| | | | Electrolytic, Cts. per Lb. | Cts. per Lb. | New York, Cts. per Lb. | St. Louis Cts. per Lb. | New York, Cts. per Lb. | St. Louis, Cts. per Lb. |
| 16 | 4.8705 | 55⅛ | 13.30 @13.40 | 31⅞ | 3.90 | 3.72½ @3.77½ | 4.87½ @4.90 | 4.72½ @4.75 |
| 17 | 4.8695 | 54⅞ | 13.25 @13.35 | 31⅞ | 3.90 | 3.72½ @3.77½ | 4.87½ @4.90 | 4.72½ @4.75 |
| 18 | 4.8685 | 54⅞ | 13.20 @13.30 | 32 | 3.90 | 3.72½ @3.77½ | 4.87½ @4.90 | 4.72½ @4.75 |
| 20 | 4.8700 | 54⅛ | 13.20 @13.25 | 32⅛ | 3.90 | 3.72½ @3.77½ | 4.90 @4.95 | 4.75 @4.80 |
| 21 | 4.8750 | 53⅞ | 13.20 @13.25 | 31⅝ | 3.90 | 3.72½ @3.77½ | 4.92½ @4.97½ | 4.77½ @4.82½ |
| 22 | 4.8770 | 53½ | 13.15 @13.25 | 31¾ | 3.90 | 3.72½ @3.77½ | 4.92½ @4.97½ | 4.77½ @4.82½ |

The quotations herein given are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumer. To reduce to New York basis we deduct an average of 0.15c. representing delivery charges. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0.15 to 0.25c. below. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Western brands. Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12½c.; Chicago-Baltimore, 10½c.; Chicago-New York, 13½c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16 @ 17½c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Trieste, 22c.

LONDON

| July | Silver | Copper | | | | Tin | | Lead | | Zinc | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Spot | | 3 Mos. | Best Sel'td | Spot | 3 Mos. | £ per Ton | Cts. per Lb. | £ per Ton | Cts. per Lb. |
| | | £ per Ton | Cts. per Lb. | | | | | | | | |
| 16 | 25⅜ | 61⅛ | 13.28 | 61 9/16 | 65¼ | 143½ | 145 | 19⅛ | 4.16 | 21½ | 4.67 |
| 17 | 25 1/16 | 61 9/16 | 13.32 | 61⅞ | 65½ | 144½ | 146 | 19 | 4.13 | 21½ | 4.67 |
| 18 | 25 1/16 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| 20 | 24 15/16 | 61 | 13.25 | 61 7/16 | 65¼ | 145⅜ | 147⅛ | 19 | 4.13 | 21½ | 4.67 |
| 21 | 24 9/16 | 60½ | 13.14 | 60 15/16 | 65 | 143½ | 144½ | 19⅛ | 4.18 | 21⅜ | 4.70 |
| 22 | 24⅜ | 60¼ | 13.09 | 60¾ | 65 | 143½ | 145 | 19⅛ | 4.16 | 21⅜ | 4.70 |

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

**Quicksilver**—With a moderate demand prices are rather easier. New York quotation is $36.50 per flask of 75 lb., with 52@54c. per lb. for jobbing lots. San Francisco, $36 per flask, with about $2 less quoted for export. London price has been reduced 5s. and is now £6 15s. per flask, with £6 12s. 6d. quoted by second hands.

**Minor Metals**—Quotations for **Bismuth** are $1.80 per lb. for imported, $1.72 for metal from native ores—**Cadmium,** 750 marks per 100 kg.—81c. per lb.—at works in Germany—**Magnesium,** $1.50 per lb., New York—**Selenium,** $3@3.25 per lb. for lots of 100 lb. or over, and $5 per lb. for small quantities.

## Gold, Silver and Platinum

**Gold**—The demand for gold has subsided to some extent and there is no longer urgency in it, although European banks are still accumulating the metal. No premiums were paid on the open market in London, and the price remained at 77s. 9d. per oz. for bars; 76s. 4d. per oz. for American coin. No more gold has been taken in New York for export.

**Platinum**—The market does not seem to have been affected by fluctuations abroad. It continues quiet and steady. Dealers ask $43@44 per oz. for refined platinum and $46@51 per oz. for hard metal.

Our Russian correspondent writes, under date of July 8, that demand has been light, but prices are not changed. Quotations are 9.50 rubles per zolotnik a tEkaterinburg, for crude metal, 83% platinum; at St. Petersburg, 36,400@36,500 rubles per pood for the same grade. Both prices are equal to $35.72 per oz. Development and prospecting work in the Urals are on a larger scale than ever before. There is complaint of a scarcity of miners, many men having gone to work on the new railroads.

According to "Metall und Erz," the Compagnie Industrielle du Platine of Paris, which has taken an option on a share of the Westphalian platinum deposits, has dropped all negotiations after having an examination made by its own engineers.

**Silver**—The market declined sharply this week on selling by China banks and lack of demand from India. Tendency continues uncertain, depending on China. After such a rapid fall some reaction is natural and the market closes steady and slightly higher at 24⅝d. in London.

Shipments of silver from London to the East, Jan. 1 to July 9, as reported by Messrs. Pixley & Abell.

| | 1913 | 1914 | Changes |
|---|---|---|---|
| India | £4,044,000 | £3,926,000 | D. £118,000 |
| China | 417,000 | 40,000 | D. 377,000 |
| Total | £4,461,000 | £3,966,000 | D. £495,000 |

The total imports of silver in Great Britain for the six months ended June 30 were 47,297,160 oz., or 15,160,506 oz. less than in the first half of 1913. Exports were this year 58,151,955 oz., or 10,854,195 oz. more than the receipts. Stocks in London are estimated at 4,400,000 oz., or 11,400,000 oz. less than at the opening of the year.

**Coined Silver in the United States,** July 1, as estimated by the Treasury Department: Silver dollars held in Treasury against silver certificates outstanding, $490,850,000; Treasury current balances, $4,670,087; in circulation, $70,314,176; total standard dollars, $565,834,263. Subsidiary coins were $182,315,863, making a total of $748,150,126 coined silver, face value.

**Gold and Silver Movement in the United States** six months ended June 30, as reported by the Department of Commerce:

| | Gold | | Silver | |
|---|---|---|---|---|
| | 1913 | 1914 | 1913 | 1914 |
| Exports | $63,734,616 | $83,374,535 | $33,321,778 | $22,510,170 |
| Imports | 27,909,595 | 30,743,422 | 18,131,679 | 12,590,464 |
| Excess, exports | $35,825,021 | $52,631,113 | $15,190,099 | $9,919,706 |

Merchandise exports this year were valued at $1,046,890,622; imports, $981,159,605; excess of exports, $65,731,017. Adding excess of gold and silver gives $128,281,836 as the total export balance.

## Zinc and Lead Ore Markets

### JOPLIN, MO.—July 18

Blende sold as high as $41.50, the assay base price being $38@39 and the metal base $36.50@38 per ton of 60% zinc. Calamine is $20@22 per ton of 40% zinc. The average selling price of all grades of zinc is $36.30 per ton. Lead sold as high as $47.75 on a base of $46 per ton of 80% metal content, and the average selling pprice of all grades of lead is $46.20 per ton.

The closing down of several mines tonight should offer some resistance to the declining ore market. In fact, offerings were stronger on all except the choicest grades of blende and calamine.

SHIPMENTS WEEK ENDED JULY 18

| | Blende | Calamine | Lead | Values |
|---|---|---|---|---|
| Totals this week | 10,052,030 | 1,020,090 | 1,693,510 | $240,160 |
| Totals 29 weeks | 297,520,990 | 21,748,900 | 51,040,190 | 7,287,675 |

Blende value, the week, $190,660; 29 weeks, $5,819,810.
Calamine value, the week, $10,370; 29 weeks, $246,205.
Lead value, the week, $39,130; 29 weeks, $1,221,665.

### PLATTEVILLE, WIS.—July 18

The base price paid this week for 60% zinc ore was $39 per ton. The base price paid for 80% lead ore was $46@47 per ton.

SHIPMENTS WEEK ENDED JULY 18

| | Zinc ore, lb. | Lead ore, lb. | Sulphur ore, lb. |
|---|---|---|---|
| Week | 3,205,560 | 73,100 | 330,000 |
| Year | 83,309,480 | 2,935,710 | 21,749,930 |

Shipped during week to separating plants, 2,854,500 lb.

# IRON TRADE REVIEW

### NEW YORK—July 22

Business in iron and steel is still improving. New orders are coming in increased quantity. Most people are accepting the fact that prospects are improving.

More orders for rails are coming to the mills, including some which have been held up for a good while. Structural steel is a little slow, but some large contracts are under negotiations.

Steel production in the United States in 1913 is reported by the American Iron & Steel Association in long tons: Bessemer, 9,545,706; acid openhearth, 1,255,305; basic openhearth, 20,344,626; crucible and electric, 155,237; total, 31,300,874 tons, an increase of 49,571 tons, or 0.15% over 1912. New figures include all steel ingots nd direct castings.

**United States Foreign Trade in Iron and Steel,** five months ended May 31, is valued by the Department of Commerce as follows:

| | 1913 | 1914 | Changes |
|---|---|---|---|
| Exports | $130,293,504 | $93,437,847 | D. $36,855,657 |
| Imports | 14,499,566 | 14,119,482 | D. 380,084 |
| Excess, exports | $115,793,938 | $79,318,365 | D. $36,475,573 |

There was a decrease of 28.3% in exports this year, as compared with 1913; and a decrease of 0.3% in imports.

### PITTSBURG—July 21

The leading mills in the Central West, excepting the Chicago district, and including such concerns as Carnegie, Cambria, Republic and Jones & Laughlin, have announced as effective July 21 an advance of $1 a ton in bars, plates and shapes, to 1.15c., Pittsburgh. As to shapes and bars the advance seems to be general in the territory tributary to Pittsburgh, but as to plates there are many small mills to be heard from, and they may not advance at once.

For some time past the Chicago market has been on a basis of its own, at not over 15c. per 100 lb. over the Pittsburgh market, when the freight is 18c., and while the advance at Pittsburgh may tend to stiffen the Chicago market it does not directly involve an advance in the West.

Whether the advance will be effective in the East depends upon the action of the eastern mills. In making their advance the western Pennsylvania and Ohio mills recognized that at the start they would be giving up part of their markets, east and west, but they are content to do this and hope to gain in specifications on existing contracts at 1.10c. what they may lose in prompt business in remote territory.

An advance in wire products of $1 a ton was announced by the American Steel & Wire Co. on Saturday, effective July 20, making smooth fence wire 1.35c., wire nails $1.55, base, galvanized fence wire, 1.75c. and galvanized barb wire 1.95c. The independent mills immediately advanced their prices.

Apart from these price advances the market has shown no important developments. Bookings of prompt orders in finished steel have been nearly as heavy thus far this month as in June, and thus compare favorably with the average of the first six months of the year. Contracting, on the other hand, has been heavier this month than at any time since January. The steel market has evidently rounded a turn, but progress is expected to be slow. Steel production is unchanged, at close to 65% of the full capacity.

**Pig Iron**—The market is quiet and unsatisfactory. Production is so small that stocks are not accumulating to any

extent. We quote: Bessemer, $14; basic, malleable and No. 2 foundry, $13; forge, $12.50@12.75, at Valley furnaces, 90c. higher delivered, Pittsburgh.

**Ferromanganese**—The market continues very quiet, with German quoted at $37 and English at $38, Baltimore.

**Steel**—The market is quiet and prices are unchanged at $19 for billets and $19.50 for sheet bars, f.o.b maker's mill, Youngstown, and $19.50 for billets and $20 for sheet bars, f.o.b. maker's mill, Pittsburgh. The local mills have hopes that the market will shortly advance 50c., and some are already quoting on the advanced basis.

## IRON ORE

**Imports and Exports of Iron Ore** in the United States five months ended May 31, long tons:

| | 1913 | 1914 | Changes |
|---|---|---|---|
| Imports | 895,084 | 520,399 | D. 374,685 |
| Exports | 121,102 | 159,034 | I. 37,962 |

Imports of manganese ore for the five months were 182,170 tons in 1913, and 112,622 in 1914; decrease, 69,548 tons this year.

**Imports of Iron Ore in Great Britain** six months ended June 30, were 4,022,620 long tons in 1913, and 3,060,639 in 1914; decrease this year, 961,981 tons. Imports of manganese ore were 350,079 tons in 1913, and 244,465 in 1914; decrease, 105,614 tons.

## COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 264,605 short tons; shipments, 237,107 tons. Production in the Greensburg and Upper Connellsville district was 37,626 tons.

**Connellsville Coke**—There are freer offerings of prompt furnace coke and at slightly lower prices in the case of some odd lots. There has been a little turnover at $1.75. There is no interest in contract furnace coke on the part of furnaces now operating, as those not covered can buy spot coke without difficulty. It develops that some of the recent sales at $1.75 were for August delivery as well as July. Three or four furnacemen with idle furnaces have been sounding the market on the proposition that they would blow in and make up some stocks of pig iron if they could get coke cheap enough, as they find they can buy Lake Superior ore at low figures, lower than at any time for 10 years. We quote. prompt furnace, $1.75; contract furnace, $1.85@2; prompt foundry, $2.25@2.35; contract foundry, $2.35@2.50, per net ton at ovens.

**Exports and Imports of Fuel** in the United States five months ended May 31, in long tons:

| | Exports | | Imports | |
|---|---|---|---|---|
| | 1913 | 1914 | 1913 | 1914 |
| Anthracite | 1,647,265 | 1,439,212 | 12 | 4,291 |
| Bituminous | 6,140,317 | 4,563,867 | 633,853 | 577,173 |
| Coke | 418,476 | 305,932 | 27,802 | 38,197 |
| Bunker coal | 3,048,493 | 3,165,503 | ..... | ..... |
| Total | 11,254,551 | 9,474,514 | 661,667 | 619,661 |

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The greater part of the trade, both imports and exports, is with Canada.

**Pennsylvania R.R. Coal and Coke Tonnage** on all lines east of Pittsburgh and Erie six months ended June 30, in short tons:

| | 1913 | 1914 | Changes |
|---|---|---|---|
| Anthracite | 95,418,231 | 5,654,277 | I. 236,046 |
| Bitumious | 24,282,419 | 23,555,182 | D. 727,237 |
| Coke | 7,386,908 | 5,227,885 | D.2,159,023 |
| Total | 37,087,558 | 34,437,344 | D.2,650,214 |

The total decrease this year was 7.1%. The larger part of the loss was in coke.

## SAULT STE. MARIE CANAL

Freight passing through the Sault Ste. Marie canals for the season to July 1 is officially reported as follows: East bound, 11,596,306; west bound, 5,254,411; total, 16,850,717 short tons. This is a decrease of 8,544,646 tons, or 33.6%, from last year. The total number of vessel passages was 5795, showing an average cargo of 2908 tons. Mineral freights included in the totals were, in net tons, except salt:

| | 1913 | 1914 | Changes |
|---|---|---|---|
| Anthracite | 1,004,028 | 702,339 | D. 301,689 |
| Bituminous coal | 5,492,001 | 4,038,690 | D. 1,453,311 |
| Iron ore | 15,270,994 | 9,113,190 | D. 6,157,804 |
| Pig and manufactured iron | 145,195 | 102,419 | D. 42,776 |
| Copper | 33,532 | 18,287 | D. 15,245 |
| Building stone | 273 | ..... | D. 273 |
| Salt, bbl | 265,279 | 343,194 | I. 77,915 |

Iron ore was 54.1%, and coal 28.3% of the total freight reported this year.

# CHEMICALS

**NEW YORK—July 22**

The general market shows the effect of midsummer. It is quiet.

**Arsenic**—Demand is not large, but since the producers agreed to maintain prices there is no change. Current quotation is $3 per 100 lb. for both spot and futures.

**Copper Sulphate**—Business is steady and moderately active. Quotations are unchanged, $4.50 per 100 lb. being named for carload lots and $4.75 per 100 lb. for smaller parcels.

**Nitrate of Soda**—Trade in this article is light, as usual at this season. Prices are steady, 2.10c. per lb. being asked for spot, and 2.07½c. for futures after July.

## COPPER SMELTER'S REPORTS

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded‡

| | February | March | April | May | June |
|---|---|---|---|---|---|
| Alaska shipments | 1,803,579 | 2,069,960 | 1.279.537 | 585,387 | 1,114,758 |
| Anaconda | 21,300,000 | 23,800,000 | 22,900,000 | 23,500,000 | 23,800,000 |
| Arizona, Ltd. | 3,062,000 | 3,286,000 | 3,570,000 | 3,092,000 | 3,742,000 |
| Copper Queen | 6.987,366 | 7,637,042 | 7,562,723 | 8,388,203 | 7,613,719 |
| Calumet & Ariz. | 5,596,850 | 5,875,000 | 5 450,000 | 5,495,000 | 4,630,000 |
| Chino | 5,642,426 | 5,399,814 | 5,926,591 | 5,496,875 | ..... |
| Detroit | 1,814,214 | 1,973,725 | 1,790,926 | 2,105,034 | 2,129,100 |
| East Butte | 1,193,960 | 1,546,180 | 1,178,000 | 1,179,762 | 1.215.323 |
| Giroux | 90,017 | 287,980 | 45,948 | 429,553 | ..... |
| Mason Valley | 1,254,000 | 1,250,000 | 862,000 | 916,000 | ..... |
| Mammoth | 1,400,000 | 1,800,000 | 1,850,000 | 1,750,000 | 1,725,000 |
| Nevada Con. | 4,588,243 | 5,218,257 | 4,880,043 | 4,959,589 | 4,483,175 |
| Ohio | 582,000 | 597,520 | 610,518 | 625,000 | ..... |
| Old Dominion | 3,066,000 | 2,997,000 | 2,779,000 | 3,302,000 | 2,937,000 |
| Itay | 5,432,000 | 6,036,908 | 6,089,362 | 6,300,847 | 6,039,710 |
| Shannon | 903,761 | 1,082,000 | 1,012,000 | 1,056,000 | ..... |
| South Utah | 333.874 | 406,381 | 247,641 | 55,394 | ..... |
| Tennessee | 1,232,812 | 1,262,184 | 1,370,800 | 1,336,950 | ..... |
| United Verde* | 2,700,000 | 3,100,000 | 3,000,000 | 3,100,000 | ..... |
| Utah Copper Co. | 9,207,111 | 12,323,493 | 12,739,757 | 13,208,483 | ..... |
| Lake Superior* | 8,500,000 | 11,000,000 | 13,000,000 | 12,500,000 | 16,000,000 |
| Non-rep. mines* | 7.600,000 | 8,200,000 | 8,000,000 | 8,200,000 | ..... |
| Scrap, etc | 2,500,000 | 2,500,000 | 2,500,000 | 2,500,000 | ..... |
| Total prod. | 96,790,213 | 109,649,444 | 108,644,846 | 110,082,077 | ..... |
| Imp., bars, etc. | 19.918,448 | 22,676,605 | 17,043,191 | 19,081,487 | ..... |
| Total blister | 116,708,661 | 132,326,049 | 125,688,037 | 129,163,564 | ..... |
| Imp. ore & matte. | 9,713,164 | 7,029,646 | 10,400,122 | 10,586,506 | ..... |
| Total Amer. | 126,421,825 | 139,355,695 | 136,088,159 | 139,750,070 | ..... |
| Miami† | 3,316,482 | 3,361,100 | 3,130,772 | 3,347,000 | 3,124,750 |
| Shattuck-Arizona | 1,134,480 | 1,136,458 | 1,386,594 | 1,353,043 | 1,225.987 |
| Brit. Col. Cos.: | | | | | |
| Granby | 1,661,212 | 1,775,852 | 1,692,102 | 1,669,334 | ..... |
| Mexican Cos.: | | | | | |
| Boleo† | 1,984,080 | 2,535,680 | 2,204,720 | 2,213,120 | 2,204,720 |
| Cananea | 2,688,000 | 4,260,000 | 2,632,000 | 2,222,000 | ..... |
| Moctezuma | 2,642,543 | 2,882,884 | 2,654,926 | 2,834,616 | 3,370,800 |
| Other Foreign: | | | | | |
| Braden, Chile | 2,362,000 | 1,810,000 | 2,720,000 | 2,480,000 | 741,440 |
| Cape Cop., S. Af. | 459,200 | 660,800 | 468,160 | 582,400 | 732,480 |
| Kyshtim, Russia. | 1,534,400 | ..... | ..... | ..... | ..... |
| Spassky, Russia | 902,720 | 896,000 | 904,960 | 907,200 | ..... |
| Exports from | | | | | |
| Chile | 6,720,000 | 6,944,000 | 9,072,000 | 7,616,000 | 7,840,000 |
| Australia | 7,952,000 | 8,176,000 | 7,168,000 | 8,400,000 | 5,712,000 |
| Arrivals–Europe‡ | 18,354,560 | 17,572,800 | 17,299,520 | 13,558,720 | 19,040,000 |

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡ Does not include the arrivals from the United States, Australia or Chile.

## COPPER STATISTICS

| | United States | | | Visible Stocks. | | |
|---|---|---|---|---|---|---|
| Month | U.S.Refin'y Production | Deliveries, Domestic | Deliveries, for Export | United States | Europe | Total |
| Year, 1912 | 1,581,920,287 | 819,665,948 | 746,396,452 | ..... | ..... | ..... |
| VII.'13 | 138,074,602 | 58,904,192 | 78,480,071 | 52,814,606 | 77,904,000 | 124,808,606 |
| VIII. | 131,632,362 | 73,649,801 | 73,263,469 | 53,504,945 | 66,420,480 | 120,015,385 |
| IX. | 131,401,229 | 66,836,897 | 73,085,275 | 38,314,037 | 63,716,800 | 102,030,837 |
| X. | 139,070,481 | 68,173,720 | 68,123,473 | 29,793,094 | 53,625,600 | 83,418,692 |
| XI. | 134,087,708 | 48,656,858 | 70,067,803 | 32,566,382 | 48,787,200 | 81,353,582 |
| XII. | 138,990,421 | 21,938,570 | 73,542,413 | 47,929,429 | 46,592,000 | 94,521,429 |
| Yr., '13 | 1,622,450,829 | 767,261,760 | 869,062,784 | ..... | ..... | ..... |
| I, 1914. | 131,770,274 | 47,956,955 | 87,955,501 | 91,438,867 | 53,916,800 | 145,355,667 |
| II. | 122,561,007 | 47,586,657 | 83,899,183 | 87,296,685 | 50,108,800 | 137,405,485 |
| III. | 145,651,982 | 69,852,349 | 89,562,166 | 78,371,852 | 47,376,000 | 125,747,852 |
| IV. | 151,500.531 | 63.427,633 | 82,345,216 | 64,609,319 | 46,435,200 | 111.044,519 |
| V. | 142,308,287 | 55,592,170 | 72,710,477 | 70,337,001 | 52,371,200 | 122,708,201 |
| VI. | 141,345,571 | 46,227,353 | 73,350,196 | 84,342,641 | 61,062,400 | 145,405,041 |
| VII. | ..... | ..... | ..... | 106,110,663 | 64,220,800 | 170,331,463 |

Note—Visible supplies in Europe do not include copper afloat.

### Assessments

| Company | Delinq. | Sale | Amt. |
|---|---|---|---|
| Andes, Nev. | Aug. 10 | Aug. 31 | $0.03 |
| Aurora-Sampson, Ida. | July 18 | Aug. 18 | 0.002 |
| Challenge Cons., Nev. | July 21 | Aug. 11 | 0.05 |
| D. & M., Utah | July 11 | July 31 | 0.05 |
| Emerald, Utah | July 15 | Aug. 18 | 0.0033 |
| Enterprise, Ida. | July 31 | Aug. 17 | 0.002 |
| Evergreen, Utah | July 23 | Aug. 22 | 0.01 |
| Federal-Ely, Nev. | July 20 | Aug. 21 | 0.005 |
| Four Timbers, Wash. | July 29 | Aug. 29 | 0.0015 |
| Hamburg-American, Ida. post'd | | Aug. 6 | 0.001 |
| Holy Terror, Ida. | July 15 | Aug. 15 | 0.0005 |
| Idaho-Nevada, Ida. | July 7 | Aug. 1 | 0.001 |
| Jack Waite, Ida. | July 21 | Aug. 18 | 0.01 |
| Moonlight, Ida. | July 13 | Aug. 20 | 0.005 |
| Nabob, Ida. | July 20 | Aug. 17 | 0.005 |
| New Hope, Ida. | July 13 | Aug. 13 | 0.002 |
| North Star, Ida. | July 10 | Aug. 8 | 0.0015 |
| Old Evergreen, Utah | July 23 | Aug. 22 | 0.01 |
| Oreano, Ida. | July 24 | Aug. 24 | 0.002 |
| Paymaster, Ida. | July 15 | Aug. 12 | 0.002 |
| Reeds Peak, Utah | July 6 | Aug. 10 | 0.005 |
| Santaquin King, Utah | July 11 | July 27 | 0.0025 |
| Silver Pick, Nev. | June 22 | July 27 | 0.01 |
| Smuggler, Utah | July 11 | Aug. 11 | 0.005 |
| Spider, Utah | July 21 | Aug. 18 | 0.0025 |
| Sunrise, Ida. | July 14 | Aug. 24 | 0.002 |
| Sunset, Ida. | July 10 | Aug. 1 | 0.002 |
| Utah-United, Utah | July 6 | July 27 | 0.01 |
| Wasatch-Utah, Utah | July 13 | Aug. 17 | 0.01 |
| West Century, Utah | Aug. 2 | Aug. 24 | 0.005 |

### Monthly Average Prices of Metals

SILVER

| Month | New York | | | London | | |
|---|---|---|---|---|---|---|
| | 1912 | 1913 | 1914 | 1912 | 1913 | 1914 |
| January | 56.260 | 62.938 | 57.572 | 25.887 | 28.983 | 26.553 |
| February | 59.043 | 61.642 | 57.506 | 27.190 | 28.357 | 26.573 |
| March | 58.375 | 57.870 | 58.067 | 26.875 | 26.669 | 26.788 |
| April | 59.207 | 59.490 | 58.519 | 28.284 | 27.416 | 26.958 |
| May | 60.880 | 60.361 | 58.175 | 28.038 | 27.825 | 26.704 |
| June | 61.290 | 58.990 | 56.471 | 28.215 | 27.199 | 25.948 |
| July | 60.654 | 58.721 | ..... | 27.919 | 27.074 | ..... |
| August | 61.606 | 59.293 | ..... | 28.375 | 27.335 | ..... |
| September | 63.078 | 60.640 | ..... | 29.088 | 27.986 | ..... |
| October | 63 471 | 60.793 | ..... | 29.299 | 28.083 | ..... |
| November | 62.792 | 58.995 | ..... | 29.012 | 27.263 | ..... |
| December | 63.365 | 57.760 | ..... | 29.320 | 26.720 | ..... |
| Year | 60.835 | 59.791 | ..... | 28.042 | 27.576 | ..... |

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

| Month | New York | | London | | | |
|---|---|---|---|---|---|---|
| | Electrolytic | | Standard | | Best Selected | |
| | 1913 | 1914 | 1913 | 1914 | 1913 | 1914 |
| January | 16.488 | 14.223 | 71.741 | 64.304 | 77.750 | 69.488 |
| February | 14.971 | 14.491 | 65.519 | 65.259 | 71.575 | 70.188 |
| March | 14.713 | 14.131 | 65.329 | 64.276 | 70.658 | 69.170 |
| April | 15.291 | 14.211 | 68.111 | 64.747 | 74.273 | 69.313 |
| May | 15.436 | 13.996 | 68.807 | 63.182 | 74.774 | 67.786 |
| June | 14.672 | 13.603 | 67.140 | 61.336 | 70.821 | 66.274 |
| July | 14.190 | ..... | 64.166 | ..... | 69.446 | ..... |
| August | 15.400 | ..... | 69.200 | ..... | 74.313 | ..... |
| September | 16.328 | ..... | 73.125 | ..... | 78.614 | ..... |
| October | 16.337 | ..... | 73.383 | ..... | 79.250 | ..... |
| November | 15.182 | ..... | 68.275 | ..... | 73.825 | ..... |
| December | 14.224 | ..... | 65.223 | ..... | 69.583 | ..... |
| Year | 15.269 | ..... | 68.335 | ..... | 73.740 | ..... |

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

TIN

| Month | New York | | London | |
|---|---|---|---|---|
| | 1913 | 1914 | 1913 | 1913 |
| January | 50.298 | 37.779 | 238.273 | 171.905 |
| February | 48.766 | 39.830 | 220.140 | 181.556 |
| March | 46.832 | 38.038 | 213.615 | 173.619 |
| April | 49.115 | 36.154 | 224.159 | 163.963 |
| May | 49.038 | 33.360 | 224.143 | 150.702 |
| June | 44.820 | 30.577 | 207.208 | 138.321 |
| July | 40.260 | ..... | 183.511 | ..... |
| August | 41.582 | ..... | 188.731 | ..... |
| September | 42.410 | ..... | 193.074 | ..... |
| October | 40.462 | ..... | 184.837 | ..... |
| November | 39.810 | ..... | 180.869 | ..... |
| December | 37.635 | ..... | 171.786 | ..... |
| Av. year | 44.252 | ..... | 206.279 | ..... |

New York in cents per pound; London in pounds sterling per long ton.

LEAD

| Month | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1913 | 1914 | 1913 | 1914 | 1913 | 1914 |
| January | 4.321 | 4.111 | 4.171 | 4.011 | 17.114 | 19.665 |
| February | 4.325 | 4.048 | 4.175 | 3.937 | 16.550 | 19.606 |
| March | 4.327 | 3.970 | 4.177 | 3.850 | 15.977 | 19.651 |
| April | 4.381 | 3.810 | 4.242 | 3.688 | 17.597 | 18.225 |
| May | 4.342 | 3.900 | 4.226 | 3.808 | 18.923 | 18.503 |
| June | 4.325 | 3.900 | 4.190 | 3.810 | 20.226 | 19.411 |
| July | 4.353 | ..... | 4.223 | ..... | 20.038 | ..... |
| August | 4.624 | ..... | 4.550 | ..... | 20.406 | ..... |
| September | 4.698 | ..... | 4.579 | ..... | 20.648 | ..... |
| October | 4.402 | ..... | 4.253 | ..... | 20.302 | ..... |
| November | 4.293 | ..... | 4.146 | ..... | 19.334 | ..... |
| December | 4.047 | ..... | 3.929 | ..... | 17.798 | ..... |
| Year | 4.370 | ..... | 4.238 | ..... | 18.743 | ..... |

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

SPELTER

| Month | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1913 | 1914 | 1913 | 1914 | 1913 | 1914 |
| January | 6.931 | 5.262 | 6.854 | 5.112 | 26.114 | 21.533 |
| February | 6.239 | 5.377 | 6.089 | 5.228 | 25.338 | 21.413 |
| March | 6.078 | 5.250 | 5.926 | 5.100 | 24.605 | 21.460 |
| April | 5.641 | 5.113 | 5.491 | 4.963 | 25.313 | 21.569 |
| May | 5.406 | 5.074 | 5.256 | 4.924 | 24.583 | 21.393 |
| June | 5.124 | 5.000 | 4.974 | 4.850 | 22.143 | 21.345 |
| July | 5.278 | ..... | 5.128 | ..... | 20.592 | ..... |
| August | 5.658 | ..... | 5.508 | ..... | 20.706 | ..... |
| September | 5.094 | ..... | 5.444 | ..... | 21.148 | ..... |
| October | 5.340 | ..... | 5.188 | ..... | 20.614 | ..... |
| November | 5.229 | ..... | 5.083 | ..... | 20.581 | ..... |
| December | 5.156 | ..... | 5.004 | ..... | 21.214 | ..... |
| Year | 5.648 | ..... | 5.504 | ..... | 22.746 | ..... |

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

PIG IRON IN PITTSBURGH

| Month | Bessemer | | Basic | | No. 2 Foundry | |
|---|---|---|---|---|---|---|
| | 1913 | 1914 | 1913 | 1914 | 1913 | 1914 |
| January | $18.15 | $14.94 | $17.35 | $13.23 | $18.59 | $13.90 |
| February | 18.15 | 15.06 | 17.22 | 14.12 | 18.13 | 14.09 |
| March | 18.15 | 15 07 | 16.96 | 13.94 | 17.53 | 14.18 |
| April | 17.90 | 14.90 | 16.71 | 13.90 | 16.40 | 14.10 |
| May | 17.68 | 14.90 | 15.80 | 13.90 | 15.40 | 14.23 |
| June | 17.14 | 14.90 | 15.40 | 13.90 | 15.10 | 13.97 |
| July | 16.31 | ..... | 15.13 | ..... | 14.74 | ..... |
| August | 16.63 | ..... | 15.00 | ..... | 14.88 | ..... |
| September | 16.65 | ..... | 15.04 | ..... | 14.93 | ..... |
| October | 16.60 | ..... | 14.61 | ..... | 14.80 | ..... |
| November | 16.03 | ..... | 13.91 | ..... | 14.40 | ..... |
| December | 15.71 | ..... | 13.71 | ..... | 14.28 | ..... |
| Year | $17.09 | ..... | $15.57 | ..... | $15.77 | ..... |

## STOCK QUOTATIONS

COLO. SPRINGS July 21

| Name of Comp. | Bid. |
|---|---|
| Acacia | .02¾ |
| Cripple Cr'k Con. | .006 |
| C. K. & N. | .06½ |
| Doctor Jack Pot. | .05½ |
| Elkton Con. | .47½ |
| El Paso | 1.45 |
| Findlay | .009 |
| Gold Dollar | .03½ |
| Gold Sovereign | .01 |
| Golden Cycle | 1.00 |
| Isabella | .10½ |
| Jack Pot | .05 |
| Jennie Sample | .03 |
| Jerry Johnson | .02¼ |
| Lexington | .004 |
| Old Gold | .01 |
| Mary McKinney | .52 |
| Pharmacist | .009 |
| Portland | 1.09½ |
| Vindicator | 1.00 |

SALT LAKE July 17

| Name of Comp. | Bid. |
|---|---|
| Beck Tunnel | .03½ |
| Black Jack | .05 |
| Cedar Talisman | ‡.00½ |
| Colorado Mining | .11½ |
| Crown Point | ‡.01½ |
| Daly-Judge | 5.00 |
| Gold Chain | .09 |
| Grand Central | .74 |
| Iron Blossom | 1.27½ |
| Little Bell | .13 |
| Lower Mammoth | .00¼ |
| Mason Valley | 2.12½ |
| May Day | .06¼ |
| Opohongo | ‡.01 |
| Prince Con. | .18 |
| Silver King Coal'n. | 2.92½ |
| Silver King Cons. | 1.77½ |
| Sioux Con. | .02 |
| Uncle Sam | .04 |
| Yankee | .02½ |

TORONTO July 21

| Name of Comp. | Bid. | Name of Comp. | Bid. |
|---|---|---|---|
| Bailey | .00½ | Foley O'Brien | .28 |
| Coniagas | 7.00 | Hollinger | 18.35 |
| Peterson Lake | .34½ | Imperial | .01½ |
| Right of Way | .03 | Jupiter | .05½ |
| T. & Hudson Bay | 35.00 | Pearl Lake | .02¾ |
| Timiskaming | .13 | Porcu. Gold | .05 |
| Wettlaufer-Lor. | .06 | Preston E. D. | .01½ |
| Big Dome | 8.95 | Rea | .20 |
| Crown Chartered | ‡.00¾ | Swastika | .01 |
| Dome Exten. | .08¾ | West Dome | .05 |

SAN FRANCISCO July 21

| Name of Comp. | Bid. | Name of Comp. | Bid. |
|---|---|---|---|
| Comstock Stocks | | Misc. Nev. & Cal. | |
| Alta | .06 | Belmont | 6.30 |
| Belcher | .28 | Jim Butler | 1.00 |
| Best & Belcher | .04 | MacNamara | .01 |
| Caledonia | .54 | Midway | .18 |
| Challenge Con. | .08 | Mont. Tonopah | .55 |
| Chollar | .02 | North Star | .22 |
| Confidence | ‡.22 | West End Con. | .65 |
| Con. Virginia | .14 | Atlanta | .14 |
| Crown Point (Nev.) | .31 | Booth | .04 |
| Gould & Curry | .03 | C.O.D. Con. | .02 |
| Hale & Norcross | .05 | Comb. Frac. | .04 |
| Mexican | .45 | Jumbo Extension | .18 |
| Occidental | .75 | Pitts.-Silver Peak | .30 |
| Ophir | .13 | Round Mountain | .36 |
| Overman | .23 | Sandstorm Kendall | .05 |
| Potosi | .01 | Silver Pick | .05 |
| Savage | .05 | Argonaut | ‡3.00 |
| Sierra Nevada | .05 | Brunswick Con. | 1.50 |
| Union Con. | .09 | Central Eureka | .12 |
| Yellow Jacket | .39 | So. Eureka | 1.37 |

N. Y. EXCH. July 21

| Name of Comp. | Clg. |
|---|---|
| Amalgamated | 69¾ |
| Am.Sm.&Ref.,com | 66¼ |
| Am. Sm. & Ref., pf. | 103¾ |
| Am. Sm. Sec., pf. B. | 81⅞ |
| Anaconda | 31½ |
| Batopilas Min. | 1 |
| Bethlehem Steel, pf. | 84½ |
| Chino | 40⅜ |
| Colo. Fuel & Iron | 25⅜ |
| Federal M. & S., pf. | 33 |
| Great Nor., ore., ctf. | 30⅛ |
| Guggen. Exp. | 53⅜ |
| Homestake | 113 |
| Inspiration Con. | 18⅞ |
| Mex. Petroleum | 65½ |
| Miami Copper | 22½ |
| Nat'l Lead, com. | 43 |
| National Lead, pf. | 106½ |
| Nev. Consol. | 13¾ |
| Ontario Min. | 2½ |
| Phelps Dodge | 175 |
| Quicksilver, pf. | 1½ |
| Ray Con. | 20⅞ |
| Republic I&S, com. | 22 |
| Republic I&S, pf. | 84½ |
| SlossSheffl'd, com. | 27 |
| Sloss Sheffield, pf. | 84½ |
| Tennessee Copper | 33½ |
| Utah Copper | 56⅞ |
| U. S. Steel, com. | 61½ |
| U. S. Steel, pf. | 109½ |

N. Y. CURB July 21

| Name of Comp. | Clg. |
|---|---|
| Beaver Con. | .24 |
| Big Four | .05 |
| Boston Montana | ‡9½ |
| Braden Copper | 7½ |
| B. C. Copper | 1⅜ |
| Buffalo Mines | 1½ |
| Can. Cop. Corpn. | 2 |
| Can. G. & S. | .08½ |
| Caribou | .68 |
| Chambers Feriand | .14 |
| Con. Ariz. Sm. | .50 |
| Cons. Nev.-Utah | ⅜ |
| Coppermines Cons | 1½ |
| Davis-Daly | ‡.58 |
| Diam'field-Daisy | .04 |
| Ely Con. | .05 |
| Florence | .33 |
| Gold Hill Con. | ‡7/16 |
| Goldfield Con. | 1⅜ |
| Greene Cananea | 32 |
| Kerr Lake | 5⅛ |
| La Rose | ⅛ |
| McKinley-Dar-Sa. | .54 |
| Mines of Am. | 3 |
| Mother Lode | ‡.26 |
| Nevada Hills | .30 |
| New Utah Bingham | ‡⅜ |
| Nipissing Mines | 5⅜ |
| Ohio Copper | ⅜ |
| Oro | .08½ |
| Puebla S. & R. | 2½ |
| Stand'd Oil of N.J. | 403 |
| Stand'd Silver Lead | 1½ |
| Stewart | 1 1/16 |
| Tonopah | 6⅜ |
| Tonopah Ex. | 2⅜ |
| Tonopah Merger | .32 |
| Tularosa | 1/16 |
| West End Ex. | .03 |
| Yukon Gold | 2 5/16 |

LONDON July 10

| Name of Comp. | Clg. |
|---|---|
| Camp Bird | £0 8s 0d |
| El Oro | 0 13 3 |
| Esperanza | 0 15 0 |
| Mexico Mines | 4 17 6 |
| Oroville | 0 11 3 |
| Santa Gert'dis | 0 12 6 |
| Stratton's | ‡0 0 6 |
| Tomboy | 1 1.10½ |

BOSTON EXCH July 21

| Name of Comp. | Clg. |
|---|---|
| Adventure | 1⅛ |
| Ahmeek | 268 |
| Alaska Gold M. | 27½ |
| Algomah | .95 |
| Allouez | 39½ |
| Am. Zinc | 14¾ |
| Ariz. Com., ctfs. | 4⅜ |
| Bonanza | .51 |
| Butte-Balaklava | 2½ |
| Butte & Superior | 36½ |
| Calumet & Ariz. | 65¼ |
| Calumet & Hecla | 402 |
| Centennial | 16½ |
| Cliff | 1 |
| Copper Range | 35½ |
| Daly West | 2 |
| East Butte | 9⅞ |
| Franklin | 4 |
| Granby | 78½ |
| Hancock | 13½ |
| Helvetia | .30 |
| Indiana | 3½ |
| Island Cr'k, com. | 48 |
| Island Cr'k, pfd. | 88 |
| Isle Royale | 19½ |
| Keweenaw | 3¼ |
| Lake | 6 |
| La Salle | 3 |
| Mass. | 4½ |
| Mayflower | 5½ |
| Michigan | .60 |
| Mohawk | 45 |
| New Arcadian | 4½ |
| New Idria Quick. | ‡3½ |
| North Butte | 24½ |
| North Lake | 1½ |
| Ojibway | .90 |
| Old Colony | 4½ |
| Old Dominion | 49½ |
| Osceola | 76 |
| Quincy | 55½ |
| Santa Fe | 1⅜ |
| Shannon | 5 |
| Shattuck-Ariz. | 22¾ |
| Superior | 27 |
| Superior & Bost. | 1⅞ |
| Tamarack | 33 |
| Trinity | 3½ |
| Tuolumne | .35 |
| U. S. Smelting | 35½ |
| U. S. Smelt'g, pf. | 46⅛ |
| Utah Apex | 1½ |
| Utah Con. | 10½ |
| Victoria | 2 |
| Winona | 2¼ |
| Wolverine | 39 |
| Wyandot | .50 |

BOSTON CURB July 21

| Name of Comp. | Bid. |
|---|---|
| Bingham Mines | .04½ |
| Boston & Corbin | .28 |
| Boston Ely | .25 |
| Butte & Lon'n Dev. | .27 |
| Calaveras | 1 1/16 |
| Calumet-Corbin | .12 |
| Chief Cons. | .83 |
| Corbin | .90 |
| Cortez | .32 |
| Crown Reserve | 1 1/16 |
| Eagle & Blue Bell | .90 |
| First Nat. Cop. | 1⅜ |
| Houghton Copper | 2 |
| Majestic | .19 |
| Mexican Metals | .21 |
| Nevada-Douglas | 1½ |
| New Baltic | 1⅜ |
| Oneco | .55 |
| Raven Copper | .12 |
| Smokey Dev. | .15 |
| So. Lake | 3⅜ |
| S. W. Miami | ‡1 |
| Tonopah Victor | .30 |
| Trethewey | .17 |
| United Verde Ext. | .75 |

‡Last Quotations.