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Hydraulic Flume of Boise King Placers Co.

BY ARTHUR W. STEVENS*

SYNOPSIS—Detailed description, including measurements and costs of a 22,736-ft. flume with trestles, dam and operating equipment.

The Boise King Placers Co., Atlanta, Idaho, has had under consideration a flume of great length, the preliminary description of which was published in the *JOURNAL*, June 28, 1913, together with a drawing of the flume details. The work has now been completed and further details will be interesting, as will also the accompanying illustrations, which give an exceptionally good idea of the character of the work.

The flume is 22,736 ft. long, and has nine trestles vary-

ing in length from 56 to 364 ft. and from 23 to 60 ft. in height. In the construction of this flume and its nine trestles, there was used 2,252,022 ft. of lumber. Of this amount, 1,499,470 ft. was bought from the government, for which \$1.75 per M., scale measure, was paid, the government receiving \$2624.07 for the lumber. The balance, or 752,552 ft., was taken from the company's property. To cut, log and saw this lumber cost \$10.93 per M. The contractor was paid \$13.75 per M. for hauling the lumber from the sawmills and building it into the flume, making a total cost of \$58,158.93. This included the \$2624.07 which was mentioned as paid to the government. This figure, however, does not include the cost of nails, which amounted to \$3714.25.

The trestle in Fig. 1 is 128 ft. long and 60 ft. high at

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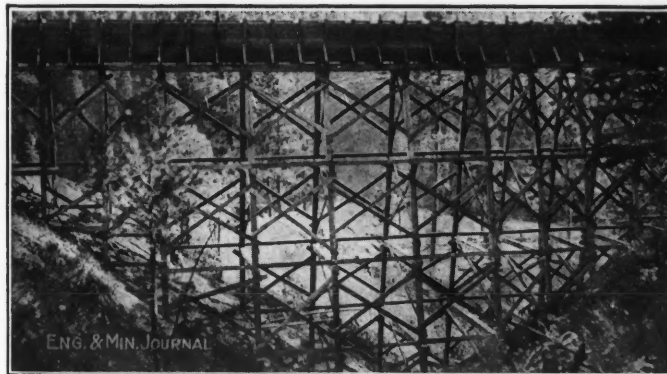


FIG. 1. LONG TRESTLE ON FLUME LINE

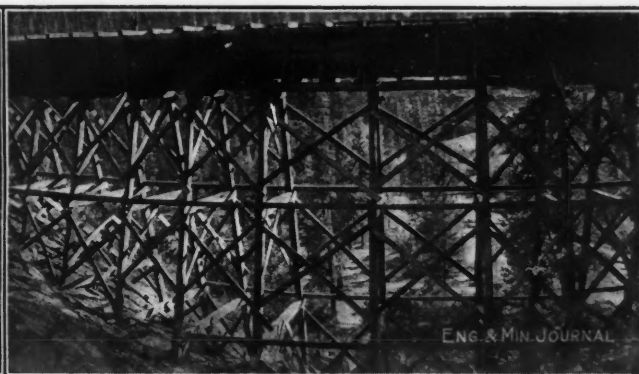


FIG. 2. ANOTHER TRESTLE ON THE FLUME LINE

In Fig. 2, the trestle is 176 ft. long, 47 ft. high at the highest point, and is constructed as follows: Top run, 8x8-in. posts, 11 ft. 10 in. long, caps, 8x10 in.; second run, 8x10-in. posts, 13 ft. 10 in. long, 8x10-in. caps; third run, 10x10-in. posts, up to 18 ft. 10 $\frac{3}{4}$ in. long, 10x10-in. caps. There are two 12-ft. spans in this trestle where 6x12-in. stringers were used instead of the usual 4x8-in. All crossties are 2x8 in. There is 32,300 ft. of lumber used in this trestle, which cost \$832.69 to build, not including the cost of nails.

The flume is of the side-hill trestle plan, and is constructed to carry 200 sec.-ft. of water. It is on a grade of 0.2 ft. to the hundred and is mostly built through a cañon which required considerable blasting to secure foundation for the mud-sills, which are made of 6x12-in. pieces, 3 ft. long. There is also a tunnel 149 ft. long, which cost \$15 per foot. On account of the seamy nature

of the rock, it was found necessary to construct the flume through the tunnel, therefore it was cut about $7\frac{1}{2}$ ft. square. There are seven spillways in the flume, all similar to the one in Fig. 4. One sand gate was put in 600 ft. from the head of the flume so as to catch all sand that might come down the river, and in that way save the wear on the bed of the flume. Therefore, from the sand gate to the head of the flume we put in a double floor of 1-in. boards in place of the usual method of battening the cracks with 1x4-in. pieces.

hp. engine. The water-driven mill was found to be by far the more economical and practical.

The dam has a long frame placed on bedrock, filled in with dirt and rock, over which is a double sheeting of 2x6 in. lumber. There are two abutments and one pier, also made of logs filled in with rock and dirt, and sheeted with 2x6-in. boards. The crest of the dam is 27 ft. 6 in. long and 5 ft. 6 in. high. The triangular pier is 9 ft. 6 in. wide at the widest part. Following this pier is the spillway, which is 12 ft. 10 in. wide and 10 ft. high. Next



FIG. 3. SPECIAL PIPE LINE FOR EVANS ELEVATOR



FIG. 4. A SPILLWAY IN THE FLUME

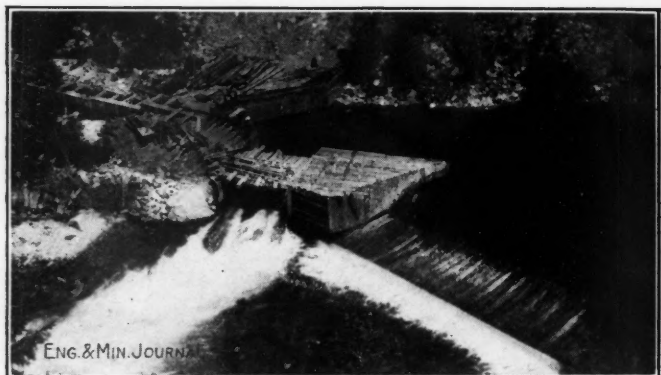


FIG. 5. SPILLWAY OF DAM



FIG. 6. GENERAL VIEW OF THE OPERATIONS



FIG. 7. HYDRAULIC ELEVATOR

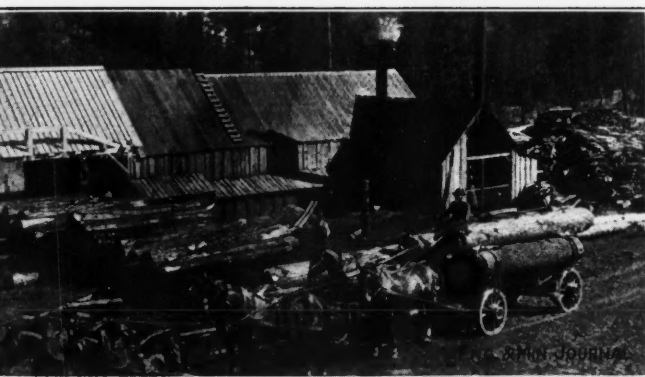


FIG. 8. THE STEAM SAWMILL

There are two sawmills, each with a capacity of 15,000 ft. per shift, so that at any time 60,000 ft. of lumber could have been turned out by running day and night shifts, had it been necessary to furnish the contractor with that amount of material per day. One mill is run by a 5-ft., double-nozzle overshot Pelton wheel, the other by steam, having a boiler capacity of 50 hp., with a 35-

to the spillway is a connecting abutment 9 ft. wide and 8 ft. 3 in. high. Then comes the intake of the flume which is 8 ft. wide and 7 ft. high. The piers and abutments are built 4 ft. 4 in. above the crest of the dam. The dam, together with its abutments, pier and spillway, cost \$450.

We have installed three No. 4 Joshua Hendy ball-bear-

ing giants and one Evans elevator that will handle 18-in. boulders. This elevator gets its power from an individual pipe line (shown in Fig. 3), which is 48 in. in diameter at the intake, and 24 in. in diameter where it enters the elevator, which has 10- and 11-in. nozzles. At present we are using the 10-in. nozzle. The elevator is working under 149-ft. head and at the present is elevating 20 ft. The work is not as yet, however, down to bedrock, but when this is reached, the elevator will be lifting 30 to 40 ft. This elevator has a capacity of 1500 cu.yd. per shift; is working perfectly and giving entire satisfaction. The pipe line for the giants has a 40-in. intake reduced to 11 in. at the giant, on which we are using 6-in. nozzles, having the same head as the Evans elevator. The little work done so far this fall showed everything working satisfactorily.

We have installed one line of sluices 24 boxes long, including the "Y." Each box is 6 ft. wide, 4 ft. high and 16 ft. long, and set on a grade of 6 in. to 12 ft. We have two undercurrents on this string of boxes, one on each side. One is 8 ft. wide by 32 ft. long, and the other, 8 ft. wide by 43 ft. long, and they are on a grade of 18 in. to 12 ft. The sluice box for the Evans elevator is 96 ft. long, 6 ft. wide and 4 ft. high, and is set on the same grade, viz., 6 in. to 12 ft. The undercurrent for the

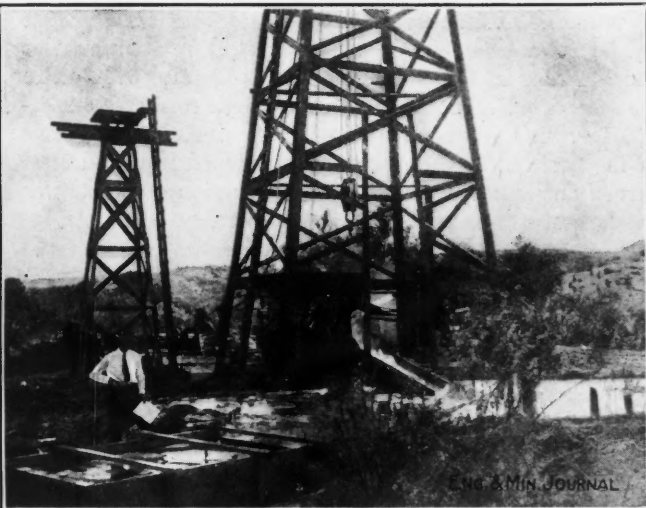
with the Bleichroeders, of Berlin. The smelting business has not turned out profitably so far, but the company has highly valuable water power, which establishes it, and the smelting business may some day be developed.

Anyway, the capacity of both the Sarpsborg and Trollhattan works has been increased. Trollhattan has not yet treated any complex ores, for several reasons, but has run on ores that are not marketable with the ordinary smelters. (Such ores might be kinds that carry considerable fluorspar.)

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Miami Copper Auxiliary Water Supply

In order to obtain an auxiliary supply of water for its mill, to be used to help out or in case of failure of the supply from the Old Dominion mine now being used, the Miami Copper Co., of Miami, Ariz., sunk a 24-in. well at the McLane ranch, which was completed about Oct. 20, and the pump was finally installed and preliminary tests made, Oct. 30, 1913. In drilling the well it was found that it corresponded exactly with the small ones originally put down. It was completed 24 in. in size to a depth of 118 ft. and about 50 ft. of perforated screen was put in.



THE MIAMI COPPER CO.'S WATER WELL ON THE MCLANE RANCH NEAR MIAMI, ARIZ.

This 24-in. well, 118 ft. deep, supplies 2100 gal. per min. when pump is making 850 r.p.m.

Evans elevator is 12 ft. wide by 80 ft. long, and is also on a grade of 18 in. to 12 ft. In the main line of sluice, there is a "Y" with a gate, so that we can close either string of sluices while the carpenters are putting in another box.

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Electric Zinc Smelting in Europe

It is in northern countries that attention is especially directed to electric zinc smelting. It is reported that a new works, of 2500 hp., has been put in operation at Helsingfors, Finland. In Norway there are two, viz., at Sarpsborg and at Ihlen; and in Sweden one, at Trollhattan.

The Sarpsborg and Trollhattan works belong to a British company, which took them over a few years ago, but the control of that company is now supposed to rest

The Layne & Bowler pump, which was installed, has a maximum capacity of about 2100 gal. per min. at 850 revolutions. A test was made with the traction engine used in sinking the well, and with this it was impossible to obtain the maximum output. However, it was found that with the power available about 1300 gal. per min. could be obtained at 600 revolutions and when delivering this amount, the water level which originally stood at 35 ft. below the surface was lowered only 25 ft. On stopping the pump, only two minutes was required for the water level to reach normal again. It was not possible to run continuously for any length of time with the small traction engine, but the test could be kept up for about 3½ hours, running intermittently and there was no doubt left that the one well would be sufficient for all needs.

In case of a stoppage at the Old Dominion, this one well will more than supply all water needs. The greatest advantage in having the pump is not from fear of a shut-

down at the Old Dominion, but the gravity pipe line from the Old Dominion mine to the pump station is laid with 14-in. wooden pipe and occasionally it is necessary to repair it. Some day rather extensive repairs may be necessary, but with the new well supply there will be ample time to do anything which is required.

British Iron and Steel in 1913

The report of the British Iron Trade Association for the first half of 1913, recently issued, gives the production of pig iron for the six months at 5,410,627 long tons, which compares with 5,282,077 tons in the second half of 1912 and 3,606,147 tons in the first half of that year. The increases were 128,550 and 1,804,480 tons, respectively.

The make of wrought or puddled iron for the half year was 622,870 tons. This was 55,610 tons more than in the first half of 1912, but 136,787 tons less than in the first half. The large increases over 1912 were chiefly due to the coal strike of that year.

The production of steel ingots for the six months was as follows:

| | Acid | | Basic | | Total | |
|--------------------------|-----------|------|-----------|------|-----------|-------|
| | Tons | % | Tons | % | Tons | % |
| Bessemer (converter).... | 594,230 | 14.5 | 294,296 | 7.2 | 888,526 | 21.7 |
| Openhearth..... | 2,094,130 | 51.1 | 1,111,853 | 27.2 | 3,205,983 | 78.3 |
| Total..... | 2,688,360 | 65.6 | 1,506,149 | 34.4 | 4,094,509 | 100.0 |

The total bessemer or converter-steel production was 848,241 tons in the second half of 1912, and 674,246 in the second half. The make of openhearth steel was 2,961,926 tons in the second half of 1912 and 2,311,731 tons in the first half. The quantity of finished iron and steel turned out is not reported. The production of ingots was the largest ever reported in a half year.

Agglomeration of Flue Dust by Magnesium Chloride

The method employed at the works of the Société John Cockerill, Seraing, Belgium, was thus described by Emile Hiertz, at the October meeting of the American Institute of Mining Engineers.

The first press was installed in June, 1910, and the second in March, 1911. They produce 1000 briquettes per hour, weighing 5 kg. each, under a pressure of about 400 kg. per sq. cm.

The chloride of magnesium is received from the potash mines at Hanover in tank cars in approximately a 35 per cent. solution. The quantity of solution added to the flue dust varies between 2 and 3%, so that the briquettes contain about 1% of $MgCl_2$. To fresh dust as much as 10% of coke breeze may be added, still making briquettes which have a crushing strength of from 25 to 30 kg. after 36 hours, and 45 kg. after six days.

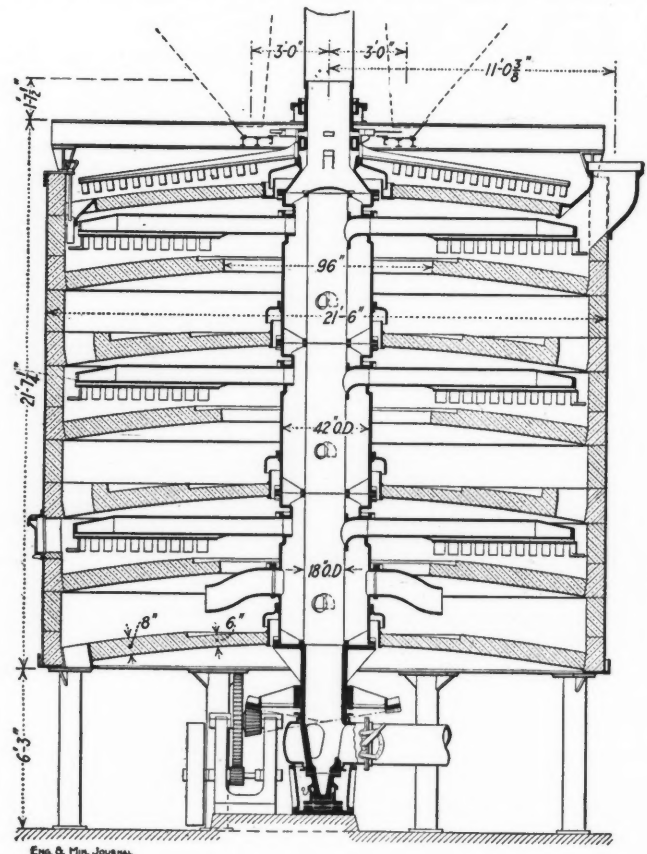
After having treated 140,000 tons of such material, the reports of the blast furnaces show that the briquettes improved the action of a furnace and produced less dust than did Minette ore. As much as 35 per cent. of briquettes may be added to the furnace charge without bad effects on operation. The presence of chlorine did not produce any corrosion in the furnace, downtakes or other piping. The presence of a certain amount of chlorine in the dust reduces the amount of chloride of magnesium which it is necessary to add for briquetting. The daily production at present, with three presses, averages 200 tons.

New Large-Type Herreshoff Roasting Furnace

A number of large pressure-air-cooled Herreshoff roasting furnaces have recently been installed in the Southwest, among which are eight furnaces of this type built at the Arizona Copper Co.'s new smelting works near Clifton. They are so arranged that all the necessary air for cooling the moving parts can be returned at will to the lower hearths in a heated condition, thus giving a considerable advantage in roasting ores low in sulphur without the aid of extraneous fuel. The general sectional view shown herewith is practically that of the furnaces as installed at the Arizona Copper Co., except that in the case of the latter installation the furnace shell is set on a steel floor, and the bottom hearth is flat.

AIR-COOLING ARRANGEMENT

The features of particular interest are the air-cooling arrangement and the design of the rabblers. The air en-



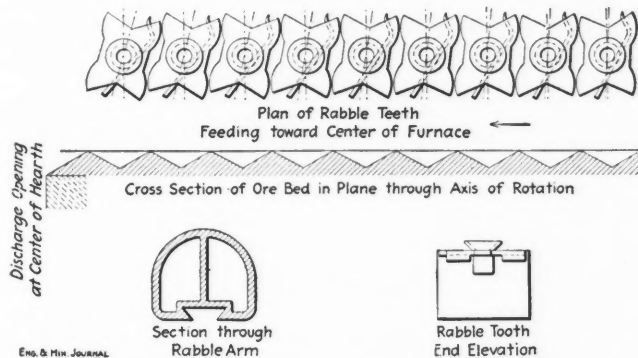
NEW HERRESHOFF AIR-COOLED ROASTING FURNACE

ters the furnace shaft by means of a split air box, provided with suitable packing glands. The shaft consists of a cast-iron tube, 42 in. in diameter outside, made in sections of two hearths to each section. Within the cast-iron shaft is a central steel tube, 18 in. in diameter, which receives the primary cooling air; to the central tube are bolted the outlets to each rabble arm. The air under pressure is forced out of the central tube into one side of the arm, back through the other side of the arm, and into the outer annular area between the central tube and the cast-iron shaft wall. The air in the outer area of the shaft may be discharged either to waste from the top of the shaft, or the outer wall of the shaft may be pro-

vided with a stub arm so that by closing a damper at the shaft top, all or part of the heated air may be delivered to the lower hearth of the furnace, thereby returning heat absorbed by the cooling air back to the furnace. The areas are such that all of the air can be returned to the furnace or such part as is desired. The rabble arms are constructed with a central vertical web, or wall, that divides the incoming and outgoing air, strengthens the arm, and necessitates the complete passage of the air through the rabble arm.

INTERCHANGEABLE SELF-ADJUSTING RABBLES

An interesting feature of the furnace is the new method of adjustment of the angle of the rabble; the latter is so designed that the same rabble can be used at any position on the arm, the proper angle adjustment being obtained by the cast-iron plate forming the top of the rabble. This plate is designed with different distances on the right-hand and left-hand side of the tooth, so that when arranged in series, the rabbles automatically adjust themselves at a slightly different angle. The rabbles fit in a slot in the arm, this slot only performing the function of keeping the tooth in place and providing the necessary driving point. The lug on the tooth is round, so that it can assume any position desired. The last rabble is held in place by a drop pin or bolt.



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The new furnaces are the design of J. B. F. Herreshoff, vice-president of the Nichols Copper Co., and with modifications are adapted to sulphuric-acid roasting and to general metallurgical roasting. The furnace for sulphuric-acid roasting differs principally in the air control, this being elaborate both in control of the incoming air and in the distribution at various places in the furnace of the heated air. The furnaces for sulphuric-acid roasting are handled by the Herreshoff furnace department of the General Chemical Co., at 25 Broad St., New York. The furnaces for general metallurgical work are manufactured and sold by the Pacific Foundry Co., Harrison and 18th Sts., San Francisco, Calif., under license from the General Chemical Co., which controls the furnace patents. The Pacific Foundry Co. also acts as general Western representative for both types of furnaces.

DETAILS OF THE METALLURGICAL FURNACE

The latter company has supplied us with the following general information regarding the construction of the standard metallurgical furnaces. The shell diameter is 21 ft. 6 in., and the height of the shell is 19 ft. 5 in. It is made of 5/8-in. steel plates, in three courses, the horizontal seams having a lap of 3 in. The thickness of the brick in the sidewalls is 8 in., and in the arches 8 and 6 in., as

shown by the drawing; the spring of the arch is 10 1/2 in. The arches are supported on special brick, and there are 54 openings, 14x8 in., around each outer discharge hearth. The central arch openings are 96 in. in diameter, from which should be deducted the area required by the cast-iron shaft, thus leaving a 27-in. annular opening. In the furnace shown, the area of the gas outlets is 18.8 sq.ft. The area of the two hot-air arms on the lower hearth is 270 square inches.

The shaft is constructed in three sections, approximately 6 ft. long; the sections are fastened together with tongue-and-groove joints, and bolt heads and nuts are protected by pockets, which can be filled with any refractory material to prevent corrosion. Similar pockets are provided where the rabble arms are bolted to the shaft. The driving mechanism of the shaft, including the surrounding air box, is so arranged that the split bearing can be examined without disturbing the shaft proper. The reduction gear, including a pinion, pulley, etc., is mounted on a complete A-frame, cast in one piece, and in case reabbtting or other repairs are required, the entire device can be removed from the furnace and fixed in the shop.

The standard furnace has six hearths, and a drying hearth on top. The five lower hearths are provided with six doors each, and the top roasting hearth has four doors, making a total of 34 doors to each furnace. Each door has a clear opening 24 in. wide by 16 in. high, and a peep hole rectangular in shape, 1x4 in., closed by a drop cover having a planed face. The doors and frames are planed on the faces so as to secure tight joints, and each door is provided with a locking lug on each side, so that it may be closed tightly.

KNIFE AND SCRAPER FEED

The feed on the surface consists only of a knife traveling around with the shaft between the hopper and the steel plate underneath. This knife disturbs the column of ore in the two hoppers, and there are three feed lugs or scrapers which push the ore off the steel plate to the top drying hearth. The ore is then gradually transferred to the outer circle of the top drying hearth by means of steel teeth, which can be set at any desired angle, depending upon the rapidity of speed desired.

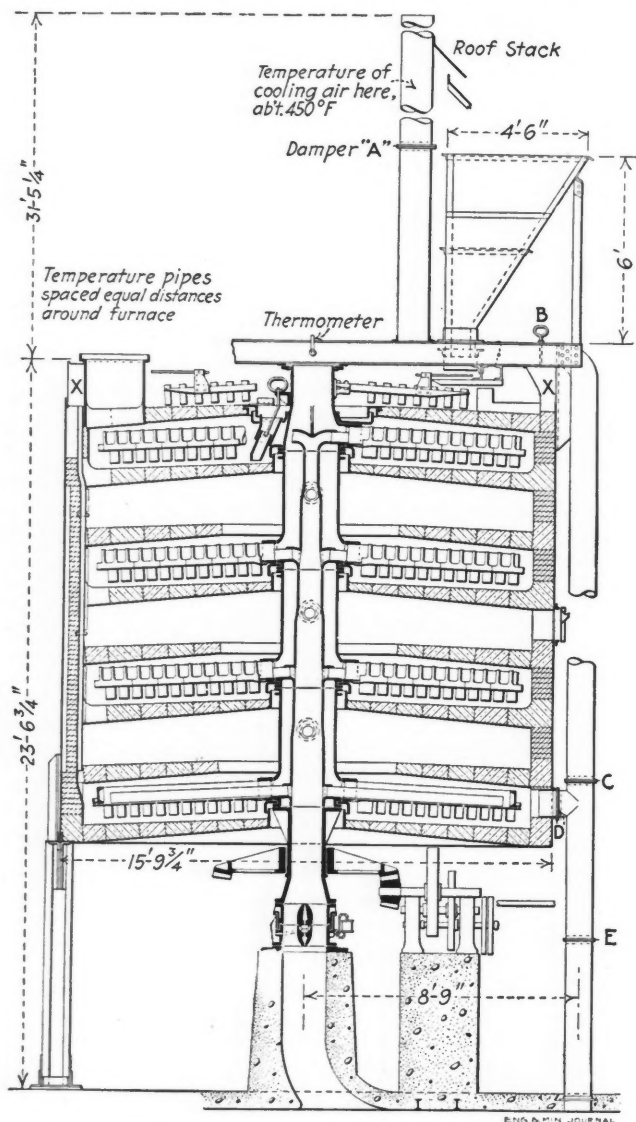
About 100 of the large-type pressure-air-cooled Herreshoff roasting furnaces have been placed in operation in various parts of the country. The most important metallurgical installations are 12 furnaces for the Calumet & Arizona Mining Co., at Douglas, Ariz., and the eight furnaces already mentioned installed at the new smelting works of the Arizona Copper Co., near Clifton.

THE ACID-PLANT FURNACES

A sectional view is shown herewith of the latest-type Herreshoff furnace for the dead roasting of pyrite in sulphuric-acid plants. This furnace is arranged with temperature-control flues and bustle pipe which permit a more delicate adjustment of air and temperature than in the standard metallurgical roaster. The various dampers effecting this control are indicated by the letters *A* to *E*. The cooling air is forced through the concrete duct at the bottom, and from the central shaft is distributed to the arms on each shelf; as in the metallurgical furnace, it passes to the outer end of the arms, around the web partition and back to the outer portion of the central shaft. From here, the cooling air may

exit through the stack of the furnace, or the damper *A* may be closed, diverting the heated air usually at about 450° F. to the bustle pipe *X*; several different arrangements are then possible.

With damper *A* closed and *B* open, the air circulates around the top of the furnace through the bustle pipe *X*, thence down the temperature pipes, spaced equidistantly around the furnace inside the brick lining, and into the furnace proper on the bottom hearth. On its way down,



A SEVEN-HEARTH FURNACE FOR PYRITE ROASTING

the air takes some heat from the two top hearths and introduces some at the bottom of the furnace. The cinder is in consequence discharged hotter than in ordinary practice.

Cooling may be accomplished in several ways. Damper *B* may be closed and *A* opened, permitting all the cooling air to leave the furnace through the stack. Or, damper *D* may be closed and dampers *C* and *E* opened; cold air will then be blown into the bustle pipe *X*, and down the temperature pipes, thus cooling the furnace more than in the previous arrangement. Another method of cooling would be: Dampers *C* and *B* closed and dampers *E*, *D* and *A* open; this would introduce a large quantity of cool air directly into the bottom hearth. With differ-

ent adjustments of the dampers, the furnace can be run to suit almost any condition encountered. Eighty-six of these furnaces have been installed in various plants throughout the country, including the works of the General Chemical Co. in New York, Pennsylvania, Delaware and California.

To Reopen Rossland Nickle Plate Mine

ROSSLAND CORRESPONDENCE

Great interest is being manifested in Rossland at the receipt of authentic information to the effect that the Nickle Plate mine is to be reopened. The property has been practically idle for 10 years, except that part of the plant being operated under lease by the Le Roi No. 2.

The Nickle Plate is owned by the Rossland-Kootenay Mining Co., Ltd., an English corporation, of which C. Williamson Milne is chairman, and F. A. Labouchere, secretary. Bedford McNeill, consulting engineer for the company, visited the property with the party of touring geologists, who visited portions of the Kootenay during the meeting of the Geological Congress in Canada last year. He carried back to England reports of the success of the operations of the Consolidated Mining & Smelting Co., Ltd., and reported that rich veins in the War Eagle and Centre Star ran in the direction of the Rossland-Kootenay company's properties.

At the annual meeting of the company it was decided to spend from \$50,000 to \$100,000 on exploration and diamond drilling. The mine workings have a depth of 800 feet.

The Hall Process at Balaklala

The Balaklala Consolidated Copper Co., at Coram, Calif., is shipping about 100 tons of ore daily to the Mammoth smelting works, at Kennett, and about an equal amount to the Mason Valley company, at Thompson, Nev. The Hall desulphurizing process was placed in commission during the last few days of 1913, but, owing to severe storms in northern California, the electric power supply was frequently interrupted. However, in a test run sulphur was actually produced and the escaping fumes were reported to be free from sulphur dioxide. After the power interruption ceased, difficulty was experienced with the scrubbers becoming clogged, but it is expected that this difficulty also will be obviated. The principle of the process is regarded as proved, but the cost at present is much higher than originally estimated. The sulphur produced is of grayish color, owing to the presence of fine flue dust and other impurities. It is anticipated, however, that the sulphur may be readily freed from the flue dust.

A Railroad Contract for \$9,000,000 has been let to the tunnel-driving firm of James A. McIlwee & Sons, of Denver, Colo. The company has agreed to drive 10 miles of tunnel for Canadian Pacific Ry. in British Columbia. Work must be completed in three years. A double-track bore, five miles long, will be driven under Rogers' Pass, at the summit of the Selkirks. A smaller and parallel tunnel will be driven with crosscuts to the main tunnel every 500 ft., from which headings will be advanced in either direction. In this manner the tunnel proper will soon be driving from a dozen different points. Construction camps costing \$50,000 are being erected at either portal.

Chemicals Used in the Cyanide Process

BY HERBERT A. MEGRAW

SYNOPSIS—The principal chemicals used in the cyanide process are cyanide, lime and lead salts. Various methods of preparing and using these materials are practiced, the custom varying at different installations. A resumé of the systems followed is given together with the practice at some well known plants. Some other chemicals are seldom used, but may be of advantage in special cases. These are summarized.

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The essential processes of cyanidation are purely chemical. In view of this basic fact, it is not strange that many attempts have been made to improve and widen it by chemical means. The strangest fact is, however, that chemical improvement has been the exception, and the process remains essentially as it was first devised. This is not to say that chemical improvement has not been made, for that would be far from the truth; but really distinctive steps have been few, and the most valuable progress has unquestionably been made in the better understanding of the reactions which were primarily used but only superficially comprehended.

ALKALINE CYANIDES

As is now well known to everyone, the cyanide process is based upon the solubility of gold and silver in water solutions of alkaline cyanides, a reaction of which the origin is somewhat undecided, but which was not applied to large-scale metallurgy until comparatively recent years, and which only within the last decade has become a markedly powerful influence affecting the world's production of the precious metals. Potassium cyanide was the salt usually supplied in the original practice, but that has changed somewhat and the salt most frequently found in the cyanide plant at this time is sodium cyanide. The latter compound has the advantage of containing more cyanogen in a given weight than potassium cyanide, and hence is cheaper to handle and transport. In round numbers, sodium cyanide contains 53% of cyanogen (CN) and potassium cyanide contains only 40%. This is in the chemically-pure salt, which is, of course, not found in commerce.

An unfortunate and rather absurd situation obtaining in cyanide treatment is the system of standardizing cyanide solutions in terms of KCN, either in pounds per ton of solution, or in percentage. This is continued even when sodium cyanide is used and the result is confusing if nothing worse. It would be a decided improvement if solution strengths were reported in terms of cyanogen contained. Thus a solution containing 0.1% KCN would contain 0.040% cyanogen, and one containing 0.1% NaCN would have 0.053% cyanogen. Adoption of this system would do away with such absurdities as the statement that a salt contains 125 to 130% of KCN. This percentage is often claimed, and there is still room

*This is the sixth of a new series of articles by Mr. Megraw. It deals with 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 and Dec. 20, 1913. The next article will deal with "The Treatment of Cyanide Precipitate," and will appear in the issue of Mar. 7, 1914.

for a pernicious percentage of adulterations, which may or may not be prejudicial to good metallurgical results. A manufactured product stated to contain 98% KCN might contain instead, 74% of sodium cyanide, leaving a full 26% to be filled in with substances useless or harmful to good work. In either case, the percentage of cyanogen present is 39.22, a somewhat insignificant figure in comparison with claims of "98-99% efficiency." Statements in terms of cyanogen content would avoid misleading anyone and would show clearly the actual content of the essential radical, either in a salt or in solution.

IMPURITIES IN CYANIDE

In practice, sodium and potassium cyanides are the ones which have always been used for making up solutions. As has already been mentioned, sodium cyanide is preferred on account of the greater content of cyanogen in the same weight of material. As might be expected, however, when such solutions are used in ore treatment on a commercial scale, other cyanides may be, and unquestionably are, formed, their character depending upon the nature of the ore and the elements with which the solutions come in contact. Originally, however, the value of each salt may be considered equal, in dissolving power, to the other. Upon this subject, Clennell¹ says:

"If, as there is good ground for supposing, all the soluble metallic cyanides (with the exception of mercuric cyanide) are completely dissociated in dilute solutions into metal and cyanogen, it would seem that the primary reaction on the gold and silver must depend solely on the presence of cyanogen. Be this as it may, it is easy to convince oneself by actual experiment that the nature of the alkali metal exerts have absolutely no influence on the extraction. I have on more than one occasion made laboratory experiments in which portions of the same ore were treated respectively with solutions of potassium, sodium and calcium cyanide, each containing the same weight of cyanogen and otherwise similar, the extractions being identical in each case."

That portion of commercial cyanide which is not actually cyanogen salts, is usually made up of chlorides and carbonates in variable proportions. Cyanates often exist and often small quantities of sulphates, sulphides, thiocyanates, ferrocyanides, formates, and perhaps other compounds. Hydroxides are by no means unknown, and sometimes ammonium salts are found, all of these impurities being byproducts occurring in the manufacturing processes, and not intentionally introduced.

Most of these impurities are more or less innocuous and have no effect as far as extraction is concerned. Some of them, however, must be classed as distinctly injurious, among which are the carbonates, sulphides and ammonium compounds. The last volatilize at low temperatures and occasion a rapid loss of strength of solutions. There is some offset to this disadvantage, though, for ammonia-

¹"Eng. and Min. Journ.," Jan. 15, 1910.

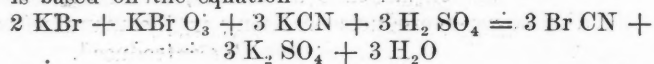
cyanide compounds are particularly efficient solvers of silver and silver minerals. Sulphides, if they exist in any appreciable quantity, are detrimental to extraction, but usually occur only in small quantities and are quickly rendered harmless either through oxidation or precipitation as zinc or lead sulphide. Carbonates rob solutions of their lime, precipitating it as calcium carbonate. This effect may be so pronounced as to expose the cyanide in solution to attack from the latent acidity in the ore. Carbonates are also objectionable because of their tendency to form an annoying scum on the surface of pulp under agitation, and because they are deposited in and upon filtering media, seriously impairing their efficiency and causing an additional cost for removal. Hydroxides or caustic alkalis are objectionable, due to their tendency to accumulate in solution and interfere with proper zinc-precipitation functions. In thus referring to the caustic alkalis, an exception must be made in cases where alumina is used as a precipitant, when lime is objectionable and must be replaced by some other alkaline substance.

It may be well to mention, in connection with the discussion of the various cyanides, that the potassium salt has an advantage over the sodium, in that it crystallized with only three molecules of water, while the latter has 12. Both salts are deliquescent and exposure to the atmosphere subjects them to rapid deterioration. An excellent chemical discussion of sodium and potassium cyanides has been prepared by W. T. Sharwood,² and is accompanied by chemical tests and a bibliography of publications on the subject.

OTHER CYANOGEN SALTS

A number of other cyanogen compounds have been proposed and used experimentally from time to time, but only in rare cases have they proved to be of practical value. Many of these have been formed preferably in the operating tanks, it being inconvenient to handle and make these salts. Among them may be mentioned the mercury and ammonia salts, both of which have shown superior dissolving efficiency when tested in the laboratory. On a practical scale, however, mercury has proved too expensive for general use, although in isolated cases it is occasionally used to improve extractions. Ammonia-cyanide compounds have been tried and have been successful on a fairly larger scale, but they have not yet proved their right to be regarded as truly commercial assets to metallurgy. There is, however, some reason to believe that they may be able to occupy that ground if the profession is interested enough to study them and design the proper methods of handling.

Probably the most prominent of the complex cyanogen mixtures is bromo-cyanogen. This mixture is used in several large-scale plants and was originated and largely used in Australia. The formation of the bromo-cyanide is based on the equation



The plants generally use what is known as "mining salts," a mixture of potassium bromide and potassium bromate, which are mixed, on the ground, with commercial potassium cyanide and sulphuric acid. The salts and the cyanide are dissolved separately and added to the diluted and cooled sulphuric acid. This mixture is added, in the desired proportion, to the pulp under treat-

ment, and usually results in a higher extraction than can be obtained by the simple cyanides. Some authorities claim that the additional extraction is due rather to the cyanogen liberated than to any virtue of the bromine itself.

One of the principal examples of bromo-cyanidation in the United States is at the mill of Stratton's Independence, at Cripple Creek, Colo. Here the slime and sand are separately treated by the ordinary cyanide process, and the slime subsequently receives an extra treatment with bromo-cyanide. At the Portland mill, in the same district, there is reputed to be in operation a modified bromo-cyanide treatment, but no official report has been made of it and the statement, therefore, cannot be altogether substantiated. Bromo-cyanogen is said to be much more seriously used in Australia than in this country. Other cyanogen compounds have been used from time to time, but have not been able to achieve any lasting success. The Clancy process, which was so widely heralded a few years ago, has not been able to substantiate its claims, and the only plant built especially for its practice has now excluded it from the metallurgical program.

METHODS OF EMPLOYMENT

The introduction of cyanide into treatment solutions is performed in any number of ways, all depending upon the convenience or special ideas of the operator. Probably the most popular system is that through which solutions are made up, tested and standardized in a special tank before coming in contact with the ore. This has the advantage that the solution can be brought to exactly the desired strength before it is used. In a continuous process, however, it is not always convenient to isolate a body of solution for sufficient length of time to make it up.

Consequently, solutions are often strengthened while they are on the move. Probably one of the most frequently followed schemes is to add the solid salt to agitation tanks containing pulp. Under these circumstances, the action of the fresh cyanide is directed immediately at the point of greatest efficiency—an attack upon the metal to be dissolved. Most of the cyanide in continuous plants is added in this way.

Addition of cyanide into tube mill is practiced in many instances. The advantages are that the strong cyanide reaches the ore under circumstances which are most favorable for dissolution of its contained metal. Agitation of the pulp is going on coincident with grinding and the whole tube-mill content is at an elevated temperature, due to the energy expended in grinding and friction of the grinding pebbles. The very violence of the agitation, however, together with the higher temperatures, leans toward destroying cyanide, and often this consideration is sufficient to prevent adoption of the system.

In adding solution to sand-leaching charges, solid cyanide is often placed on the surface in quantity sufficient to bring up to the required strength, allowing the entering solution to pass over the cyanide. This cannot be recommended as a satisfactory system, but it is convenient to follow at times. Where crushing is done in water, various modifications are necessary, and cyanide is introduced in various ways. Thus, at the Dome mill, Porcupine, Ont., where crushing, regrinding, amalgamating and thickening are done in water, solid cyanide is added to the boot of the elevator, together with the thickened slime.

²Eng. and Min. Journ., Mar. 19, 1910.

At the Goldfield Consolidated mill, crushing, grinding and thickening is done in lime-bearing water. The pulp, containing about 40% water, is taken to the agitating tanks, where it is diluted with solution from former treatment, and the whole made up to the standard strength, which is 1.2 lb. KCN and 0.5 lb. CaO per ton. At the Homestake mills, in the Black Hills, crushing, amalgamation, and in fact, all processes except actual cyanide dissolution of the gold, is done in water. Cyanide is applied to sand in solutions of standard strength, pumped on after the water has been leached out. To the slimes, standard solutions of cyanide are added in the filter press after water has been driven out.

The Hollinger mill adds cyanide in the necessary quantity to the gold solution before precipitation, a practice which is largely followed in many districts and which has the advantage of putting the solution in condition to obtain the best possible precipitation efficiency. At the Nevada Wonder mill, a rather original method of cyanide addition is practiced. The required amount of lump cyanide is placed in a small Chilean mill and, together with the lime and lead acetate, is ground up and added continuously, in the form of a concentrated solution, to the pulp stream entering the Dorr classifier. Adding cyanide already in solution has the advantage that no time is lost in getting it to work, and grinding it up in a strongly alkaline solution prevents loss through decomposition. Various methods of adding cyanide have their advocates among operators.

Perhaps the latest development is the addition of freshly standardized solutions to the final end of a continuous counter-current decantation system. Certainly, wherever else fresh cyanide is added, it should not be omitted here, where in all probability its effect is production of the most benefit. Whatever the treatment system used, this addition of fresh cyanide to the nearly exhausted ore, always aids in the recovery of the maximum amount of soluble metal.

LIME

Almost universally, cyanide operations make use of lime. As an alkali, it is usually the cheapest and most convenient chemical and finds a use in nearly all mills. As an alkali it has its primary function and for this purpose its use was begun. Many ores contain acid-forming elements, which develop free acids after contact with water. Among them perhaps the most common are the ores which contain sulphides. These readily oxidize and form sulphuric acid, with water, which would be disastrous in its effect upon unprotected cyanide solutions. When the ore is mixed with lime, or the incoming solution protected with it, distention of cyanide is reduced to a minimum or altogether avoided. Organic compounds also often are present in ores and these are the source of organic acids which destroy cyanide in solution unless they are themselves rendered harmless by application of lime or other alkali.

Although protection against the effect of acids is one of the important functions of lime, another equally important one is its assistance in settling slime. It is used quite as much for this purpose as for the one first mentioned. Lime has the property of collecting and coagulating the colloid slime, so that it usually settles quickly, leaving a clear supernatant liquid. With the introduction of continuous-agitation processes for slime treatment, the rapid settling of slime is not a point of such

vital interest as it was in the old charge system. It is, nevertheless, of great importance even in the continued system, as it has an important influence upon the filtering qualities of a slime. The coagulation or curdling of the colloids allows the formation of a thicker filter cake, which works to a point where less moisture is held in it than can be the case with the untreated colloid slime.

Lime added to ordinary cyanide solutions tends to break up some metallic salts, forming hydroxide compounds which are harmless. The calcium is utilized again in forming alkali cyanides from the cyanogen liberated during precipitation processes. One of its disadvantages is the tendency to form calcium carbonate, which robs the solution of its alkaline quality and in addition, often causes trouble by forming the insoluble foam or scum which is so often observed on the surface of agitation and collecting tanks. Carbon dioxide derived from the vaporized lubricant in air-compressor cylinders is believed to be largely responsible for the formation of the carbonate of lime. It is difficult to see how any method could be devised to avoid it, as it could hardly be considered feasible to install a gas-scrubbing plant for the purpose.

In addition to the carbon dioxide formed in the compressor cylinder, the air itself contains appreciable quantities and when this air is pumped through a charge of pulp, some lime is removed from use as calcium carbonate. The lime-consuming constituents in ores are not usually responsible for the greater part of the lime consumption, although they may be in cases where the ore is particularly bad. This also occurs in cases where accumulated tailing is to be treated, when the material is quite likely to contain all sorts of lime-consuming compounds.

Much of the lime used is lost mechanically. It may pass out of the plant dissolved in solutions which are wasted, either those thrown away purposely, or that discharged as moisture in residue. A good deal of lime is lost, too, in leaching plants, where the coarsely crushed material is mixed either with the rock before crushing, or with the material in the leaching tanks. Almost invariably there are lumps which remain through the entire treatment time and are discharged in tailings without having performed more than a small portion of the work of which they are capable. In many plants this careless use of lime may reach a condition through which appreciable amounts of money are wasted.

The essential and soluble constituent of commercial lime, CaO, is the only one that is of much value in the mixture, and unfortunately, ordinary lime contains variously diminishing quantities of it. The lime of commerce usually contains appreciable proportions of silica, together with other substances which may be more or less innocuous, but which are occasionally positively harmful. An example of material of this kind may be found in charecoal, remnants of the fuel with which the limestone was burned. This is an active precipitating agent and causes the loss of considerable of the dissolved metal in addition to destroying cyanide.

Aside from the harmful qualities of impurities, they dilute the CaO, which is the sole agent of value. Therefore, in purchasing lime, its content of CaO should be the guide, and the more nearly pure it is, the greater its proportional value. Pure calcium oxide would be

more valuable, per unit of CaO, than an impure mixture, because it introduces no complications. Lime is not soluble to great extent in water, and in contradiction to the usual chemical rules, is less soluble as the temperature of the water increases. In water of 10° C., 0.128% is soluble; and 15°, 0.124%; at 20°, 0.120%; and at 25°, 0.115%. To acquire the rates of solubility mentioned, some care has to be taken and sufficient time allowed for the solution to take place, and in order that maximum efficiency be obtained from the lime in use, special methods of handling it ought to be followed.

If a mass of lime is thrown quickly into cold water, as is the usual practice in the majority of cyanide mills, a large percentage of the available CaO is lost, being rendered insoluble. If the lime is ground extremely fine, and screened very slowly into the water, preferably somewhat warm, a better proportion of lime is obtained in solution, but the maximum is obtained by taking extreme care, slacking the lime with a spray of warmed water, not allowing the amount of water used to go beyond that chemically necessary to change CaO into Ca(OH)₂, that is, not allowing the lime to become perceptibly wet. By this method, all the available CaO is changed into Ca(OH)₂, and is ready for use. By grinding this lime in a small grinding mill of some sort with a continuous stream of cold water, adding more of the slaked lime as required, the greatest possible efficiency is obtained from the material. In all handling of lime, it should be carefully remembered that the combination of CaO and water is accompanied by great heat, sufficient to set fire to wooden bins or other inflammable substances. It should be stored in steel or concrete receptacles, and handled in nonburning vessels in order to avoid possible serious results.

METHODS OF USING LIME

Most mills do not use the most efficient methods of applying lime to ores and solutions, but some of them do take pains to get better results. At the Homestake mills, South Dakota, a 1-stamp mortar is used for crushing the lime, in which it is pulped and passed through a 9-mesh screen, 0.076-in. aperture. This is not particularly fine, but as the product goes to the pulp entering the leaching tanks, it is about what is required. The comparatively coarse grains do not give up their alkalinity at once, but dissolve slowly during the entire leaching time, about five days. In this way the acid which is developed in the ore charge is continuously met and neutralized. At the slime plant the lime is slaked in tubs, or small tanks. A 500-lb. charge is slaked and then drawn through a perforated plate to a lime-agitation tank, in which the mixture is mechanically kept in agitation. Water is continuously drawn through this tank, carrying a lime-bearing solution to the slime pulp which enters the receiving tanks. At this mill a low alkalinity is essential, as it has been demonstrated that more than 0.3 lb. CaO per ton of solution seriously retards the dissolution of gold. The same condition applies to other localities where gold is the principal constituent, although it cannot yet be stated as a universal rule.

At the Goldfield Consolidated Mill, Goldfield, Nev., the lime is kept in storage bins removed from the mill, whence it is drawn off and carried to two Wheeler pans. These pans have their mullers removed and act simply as stirrers, mixing up a milk of lime product which is continuously added to the dewatering tanks, Pachuca agit-

ing tanks, and the concentrate treatment plant. Alkalinity at this mill is carried at 0.5 lb. in the treatment solution.

At many mills it has been noticed that a lime-treatment solution has a tendency to deposit insoluble calcium salts in most inconvenient places. The Homestake operators, when experimenting with an alkaline crushing solution, found that their apron plates accumulated a lime coating that prevented further usefulness. Concentration tables soon show a deposit of lime and this often makes an appreciable difference in the results obtained with them. Pipes often are materially reduced in diameter by lime deposits. At a mill in Guanajuato where the concentrates were discharged directly into buried pipes which carried them to concentrate-storage tanks, the mill had to be suddenly shut down for about a day, due to the entire stoppage of these pipes which had to be dug out and cleaned. Open canals were thereafter used to convey the material. It is to be noticed that lime solutions carrying fine solids are particularly apt to close up pipes rapidly and in general, cover up everything with which they come into contact. The depositing lime salts seem to carry down with them a portion of the solids in the solutions. Clear solutions, on the other hand, do not deposit their lime so rapidly.

An apparent contradiction to one of the conclusions contained in the foregoing paragraph is found at the Alaska Treadwell cyanide plant. Here concentrates are cyanided, and it was found that by grinding in a 2-lb. lime solution, the amalgamating plates, following grinding, were kept bright and clean. These plates were placed so as to amalgamate the ground pulp issuing from the tube mill, and without lime this pulp developed considerable acidity and coated the plates with a black surface-deposit which prevented satisfactory amalgamation. This material is entirely different from simple siliceous ores, so that the contradiction is not one in effect, whatever it might, at first glance, appear to be. The lime is added to the cars of concentrates, first to the empty car, and later to the filled one. Lime is used, in addition to its value as an alkaline corrective of acid conditions, also to assist in settling the slime, a function of vital importance.

Probably the most followed method of lime addition is by mixing in the dry, partly crushed material, with the ore in mill bins. Thus ore and lime are in contact from the beginning and developed acid is neutralized at once. In this connection, it will be of interest to discuss the effect of acid generated in ore upon solutions containing small quantities of cyanide. Even though such solutions contain ample protective alkalinity, it has been found that cyanide is lost unaccountably. In attempting to explain it, one operator has expressed the belief that in crushing in the stamp mill there is a condition of acidity which, while possibly only momentary, is still of sufficient duration to account for the destruction of some cyanide and the formation of compounds which are detrimental to the succeeding treatment. This explanation seems to be perfectly reasonable. However strong the alkalinity of a solution may be, it cannot be sufficient to overcome the strongly acid reaction at the point and at the moment of development. It would take appreciable time for the alkali to reach and act upon the newly formed acid. It is for this reason that some metallurgists prefer to crush in alkaline water, and introduce the cyanide later in the treatment.

At the Tom Reed mill, in Arizona, the new lime additions are made in the form of emulsion added to the pulp leaving the tube mills and proceeding to the thickeners. At Nevada Hills mill, the lime is slaked before using and then fed into a grinding pan through which solution is flowing. The emulsion formed is led either to the thickeners or agitators, according to the necessities. At the Flores plant of the Guanajuato Reduction & Mines Co., a separate treatment plant, lime is added to sand as it is transferred from collectors to treatment tanks, and to the slime in the treatment agitators at the beginning of treatment. Additional amounts are added during slime treatment if necessary. The lime is used dry and is screened through a screen having a $\frac{1}{4}$ -in. opening.

At the old Belmont mill at Millers, Nev., the lime is separately slaked, mixed to form an emulsion, and added to the pulp coming from the concentrating tables. It is added at that point to avoid, as far as possible, the deposition of lime on the table tops. The Desert mill, at Millers, adds lime at the bins, disintegrated with water, ordinary bulk lime at the sand tanks, and a warm lime emulsion to the slime before beginning agitation treatment. Dry lime is added to a moist ore going to the mill bins at the Ajax mill, Victor, Colo., with satisfactory results, the lime being slaked by the moisture and attacking the acid in the ore.

It will be seen that there are a great many different ways of using lime, as well as several distinct objects to be attained. The most effective way, considering all sides of the question, is likely to be different in every mill.

LEAD SALTS

The use of lead in cyanide solutions is practically limited to those mills treating silver ores, although it may possibly be a benefit in extracting gold where large quantities of sulphides, wholly or partly soluble, exist in the ore. The object of the lead salt is to remove dissolved sulphides from solutions, which it accomplishes by precipitating insoluble lead sulphide. When the alkaline, soluble sulphides occur, which they will in all cases where sulphide ores are treated by alkaline cyanide solutions, the action would be to immediately reprecipitate the silver as sulphide, thus defeating the object of the operation. By using the lead, silver is allowed to remain in solution and is recovered at the proper stage.

It will readily be seen that any element which forms an insoluble sulphide, such as mercury for example, would accomplish the same result as lead, but the latter has been usually used because it can be obtained in soluble form and is cheaper than anything else that can be used for the purpose. The most commonly used form is the acetate, a cheap, soluble lead salt which answers all purposes. Litharge is sometimes used, being added at the tube mill and ground up together with the ore. It is not, however, as soluble as the acetate, nor, in consequence, as cheap, except where it is a byproduct. Many mills grind up all their old cupels in the tube mill, thus making use of their contained litharge, a product which would otherwise be wasted.

The method of adding the lead salt to solution is not of great moment, the only requirement being that it shall be in the required amount. Perhaps the best place to put it in is in the slime-agitation tanks, where it is in demand, or in the fine-grinding machine, so that it may be taken into solution and be held ready to ac-

count for sulphides as fast as they are dissolved. In excess, lead salts are apt to be injurious and certainly would cause a needless consumption of cyanide in addition to the cost of the lead itself.

In considering the necessity for the use of lead salts, the operator is faced at once with the apparent uselessness of the procedure. Where zinc precipitation is in use, as it is nearly everywhere, it seems that the natural excess of zinc in solution ought to do the work of removing the sulphides, as zinc sulphide is insoluble and would bring down the sulphur quite as well as lead. It is probable that this really does occur. Clennell's remarks that, "Soluble sulphides can seldom, if ever, be detected in solution, and it is probable that, even without the addition of lead salts, they are rapidly destroyed, either by conversion into thio-cyanates or by precipitation as zinc sulphide."

Lead sulphide is more insoluble in cyanide than either zinc or silver sulphide, and in this fact is found the reason for the belief that the lead is necessary. As most agitation processes are carried out with aeration, it seems likely that lead sulphide is oxidized to the sulphate, also quite insoluble, and in this form becomes part of the residue. Due to the reactions involved, explained by Clennell in the article mentioned, the loss of cyanide is about 0.5 kg. for every kilogram of lead acetate added.

In practice, it has been found possible to do without the use of lead salts for variable lengths of time, depending upon the amount of sulphur in the ore. Perhaps in some cases it could be dispensed with altogether, but as a general thing it seems most likely that it could not. After a season without lead, sulphides are apt to accumulate in the solution, even to such an extent as to show large quantities of free sulphur. In such cases, recourse must be had to the lead.

OTHER CHEMICALS

Cyanide, lime and lead salts are about the only chemicals which have attained a really wide application in the process. Other chemicals in multitudes have been suggested, tried and discarded. Some of them are continued in use in special cases, but as a general rule they have not proved valuable. Among the few that are useful in special cases may be mentioned bleaching powder, chloride of lime, CaOCl_2 . This chemical was proposed and first used as an oxidizer in cyanide solutions. It was thought that a method of supplying directly the oxygen required in completing the dissolving reaction would hasten the process and make it more complete. That idea has long been abandoned, since it has demonstrated no practical value. But the chemical is used in cases where the material treated contains cyanides—reducing agents—which can be rendered harmless by oxidation. An example of such a case may be found in treating ores or accumulated tailings which contain much organic matter. Old slimes particularly, are likely to be full of partly decomposed vegetable matter which will consume large quantities of cyanide if placed directly in solution. A safe scheme of handling such material is to pulp it or give a preliminary treatment in water containing bleaching powder. This serves to oxidize the cyanides and make the reaction neutral so that it is no longer detrimental to treatment. Other chemicals have been used for the same purpose, as has

been mentioned, but they have practically all dropped out of use.

Chemicals designed to improve extraction, such as mercury- and ammonia-cyanide compounds, have had their day, and are not now regarded seriously. The same is true of the chemicals used formerly to, presumably, assist in precipitation. They generally do no good and are not seriously thought of. Revolutionary processes do not now attract much attention, an example which may be pointed to being the Clancy process which, however sound in chemical theory its basis may be, has not been able to substantiate its claims in practice.

Where aluminum is used as a precipitant, lime must be kept at the lowest point consistent with proper slime settlement, and alkalinity must be kept up with some other reagent. Lime tends to form an insoluble calcium aluminate, which collects in the precipitate presses and reduces the grade of the material. Caustic soda is the alkaline agent used in such cases, the sodium being available to form more alkaline cyanide with the cyanogen liberated during precipitation.⁴ It is added to the solutions much as lime is, but probably has less limitations. Its effect, in addition to conferring alkalinity, is often to oppose proper settling of slime, so that a delicate balance of lime and caustic soda is required.

The only remaining chemicals which are largely used in the cyanide plant are zinc and aluminum, but these are more properly precipitants and will be considered in a separate article dealing with that subject.

Mogollon Mine Supplies by Parcel Post

SILVER CITY CORRESPONDENCE

When the 50-lb. parcel-post rate in the first zone went into effect, Jan. 1, mining companies in the Mogollon district in New Mexico made preparation for the shipment of their supplies under this new regulation. Oil was to be shipped in 50-lb. cans, and other supplies for the mines and mills, with the exception of dynamite, could be delivered by parcel post at \$1.08 per 100 lb. The present freight rate, and one that it is claimed shows a loss to the freighters, is \$1.75. The government rate would be 67c. cheaper and with expeditious service. Up to the present the government contractor has sustained a loss of \$10,000 due to the parcel post. Officials of the postal service are in Silver City and Mogollon investigating this complicated condition. Meanwhile the Mogollon mining companies are preparing for the shipment of all supplies possible to send under the new regulation, even to having hay delivered in the limit-size packages.

Mogollon is 90 miles from Silver City on a highway that is almost impassable during severe snow storms. Over 67% of the state yield of gold and over 71% of the silver yield come from this district, one of the most important in the southwest, but situated as it is, its greatest drawback has been lack of transportation facilities. If the government continues to send parcel-post packages to Mogollon at the present rate, it will necessitate a general reconstruction of the road and bridging the Gila River, improvements which are greatly needed and which will be of great benefit to the district.

⁴"Aluminum Precipitation at Nipissing," by E. M. Hamilton, "Eng. and Min. Journ.," May 10, 1913.

Godfrey D. Doveton

Godfrey D. Doveton died at Guadalajara, Mexico, on Jan. 19, 1914. His death was the result of an accident which occurred in starting operations at the Cinco Minas mill, which he designed and built. It is stated that in starting a conveyor belt, Mr. Doveton's right arm was caught in a gear and he was severely hurt. At first the injury did not appear to be mortal, and hopes were even entertained of saving his arm. He was taken to Guadalajara and given every attention, but the shock and loss of blood proved too much for his constitution and he died. He was buried at Guadalajara with the honors of the Masonic fraternity, of which he was a member.

Mr. Doveton was an Australian and was educated at Auckland University College and the Thamas School of Mines, New Zealand. He began his professional practice there in 1895 and remained in New Zealand until 1900, when he came to the United States. He was superintendent and metallurgist at the Camp Bird mines, Ouray, Colo., from 1909 to 1902, and subsequently filled many positions of responsibility. He was a partner in the firm of Doveton & Purington, of Denver, associated with C. W. Purington, after the dissolution of which firm, he went to Mexico and engaged in private practice. He became a member of the staff of Spurr & Cox in 1908 and later its successor, W. Rowland Cox & Staff, with which he was associated at the time of his death.

Mr. Doveton was responsible for many metallurgical plants of distinction, among the most prominent of which may be mentioned the Santa Gertrudis at Pachuca and the Cinco Minas in Jalisco. He was also one of the first to point a way toward the successful cyanide treatment of Cripple Creek telluride ores. He ranked exceptionally high in his profession, being one of recognized leaders in cyanide metallurgy.

Mr. Doveton's headquarters have been recently at El Paso, Texas, but he had been in Mexico almost continuously since last April. He was about 42 years old and is survived by his widow, Mrs. Mattie L. Doveton. The news of this unfortunate accident comes by telegraph, and details are necessarily meager. Mr. Doveton's death will be keenly felt by the host of his personal friends, by whom he was most highly esteemed.

State Geological and Mining Officials

In the list published in our Jan. 10 issue, two errors occurred as follows:

John H. Page is now Commissioner of the Bureau of Mines, Manufactures and Agriculture, of Arkansas, instead of G. B. Tucker.

Richard R. Hice, of Beaver, is State Geologist of Pennsylvania, and not H. C. Demming, as stated.

Dredging in British Guiana During the Year ended June 30, 1913, was conducted with favorable results, according to a report of the Institute of Mines and Forests. The Guiana Gold Co. produced 7167 oz. of gold, this being in excess of all its past records. At a recent meeting of the shareholders, it was reported that there was a profit available for dividend of \$3328. Another company's output was 1669 oz., and its results have been so favorable that it has acquired another large area, and a dredge will soon be in operation.

Stockpiling on the Mesabi

BY C. M. HAIGHT*

SYNOPSIS—The extension of an old stockpile at the Harold mine necessitated the development of a new method to keep up the capacity of the equipment in the face of a larger haul. New method substituted a long trestle for a short, provided for swinging the dump sideways instead of advancing a face and used side-dump cars in trains instead of a single end-dump for each locomotive. Details of construction and operation given. Description of incidental devices used.

During the winter, ore is not shipped from the Mesabi range. Mining in the openpits is usually suspended and

shipped the summer following its formation, but in this case the ore stocked in the winter of 1911-12 was not shipped, so that in order to add to it a radical change in the methods of operation was necessary. Both layouts are described.

OLD METHOD OF STOCKPILING

In the winter of 1911-12, since the previous winter's stockpile had been removed, a new start had to be made. To get to the ground available for stockpiling, two railroad tracks had to be crossed by a trestle, and this had to extend far enough beyond the second track to prevent

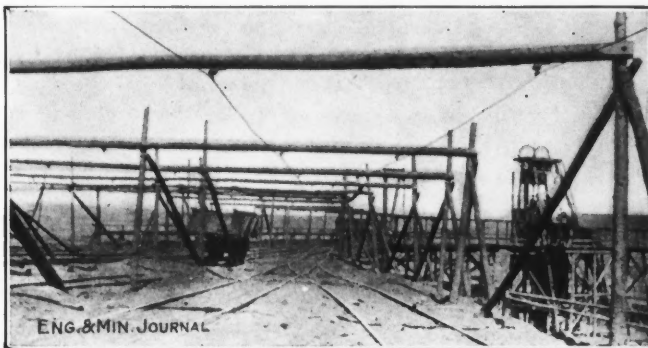


FIG. 1. OLD STOCKPILE JUST BEYOND TRESTLE

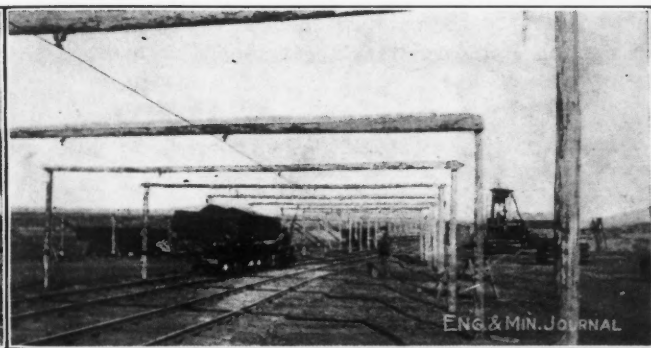


FIG. 2. NEW LAYOUT AND SIDE-DUMP CAR

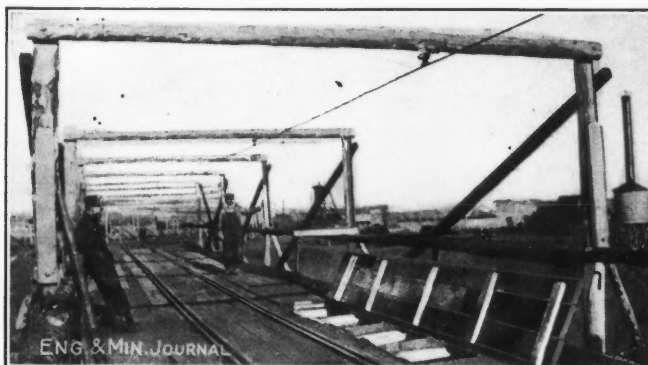


FIG. 3. NEW TRESTLE SHOWING ATTENTION PAID TO SAFETY

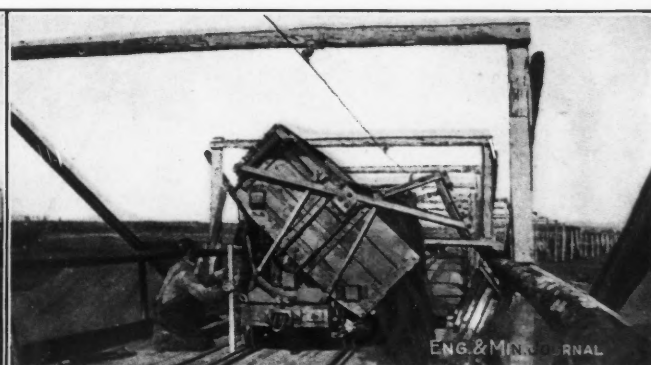


FIG. 4. CAR DUMPING ON NEW TRESTLE

only stripping is continued. The underground mines continue to operate, but stock all the ore hoisted until the shipping season opens in the spring, when the stockpile is generally loaded by steam shovel and shipped.

In stockpiling, two methods, in general, are used on the Mesabi: (1) Rope haulage, in which a loaded car, with a rope attached to the rear, runs by gravity down a grade to the end of the stockpile, where it is dumped, the rope being attached to the drum of a small engine or puffer which pulls the car back empty; (2) motor haulage, in which electric locomotives are used to move the cars, both loaded and empty.

The aim of this article is to describe a layout of the second class at the Oliver Iron Mining Co.'s Harold mine, near Hibbing, Minn. As a general rule, a stockpile is

the ore pile from covering the tracks as it reached its natural slope. The beginning of this trestle is shown in Fig. 8.

The trestle was built of round timbers, and while rough and unfinished in appearance, it was strong and substantial. The rolling stock consisted of two of the smaller type General Electric locomotives, each handling one end-dump car of one skip capacity, three tons; 30-lb. rails were used for the 36-in. gage track.

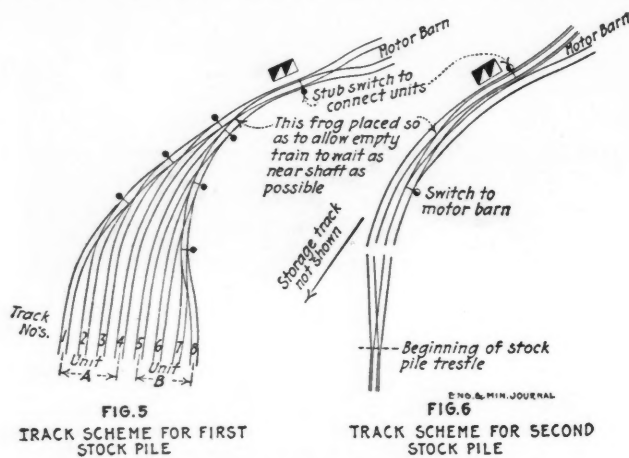
The ore is hoisted through a vertical shaft in self-dumping skips working in balance and dumping directly into the cars. The track scheme on this trestle is shown by Fig. 5. The tracks were designed for two units with four dumping tracks for each unit; as there was not enough room on the trestle for all the tracks, some of the switches were on the stockpile.

*Mining engineer, Franklin Furnace, N. J.

One car only was used with each motor, and was connected to it by an iron link. Several links of various lengths constituted a set, the longest being about 5 ft. This was to eliminate the constant lengthening of the trolley wire, thus allowing the supports for the wires to be kept farther apart.

When starting the stockpile, care had to be taken that the bents of the trestle were not knocked out of place. Had all the dumping been over the end, the pressure of the ore against the bents might have pushed them back. In order to avoid this, holes were cut in the deck of the trestle, between the bents, and the pile gradually built up from the railroad track to the end of the trestle. In this way all the trestle legs were buried in ore before the pile became too high and there was no danger of slipping.

After the ore had been piled to the top of the trestle the stockpile was advanced by dumping over the end, the tracks and trolley wires being extended as necessary. The men who dumped the cars served both units, so had to keep shifting from one track to another. To make the



DIFFERENT TRACK LAYOUTS

distance of this shift constant, operations were so conducted that there was always the same number of tracks between the dumping places, as for example, Fig. 5, when unit A used track 1, unit B used track 5; or, when A used track 3, B used track 7.

On the trestle, 2x6-in. posts about 8 ft. long, held upright by the railing and braces, supported a 2x6-in. crosspiece to which the trolley wires were fastened. These sets were about 10 ft. apart. On the stockpile the distance between supports was greater, so that heavier materials were used; round poles from 4 to 6 in. in diameter were used as posts with crosspieces of the same size extending over two tracks. These supports were well braced as shown in Fig. 1.

The crew necessary to operate the stockpile consisted of two motormen, one top man to clean out the skips, and four or five men on the pile to dump the cars, grade and advance the tracks, etc. The wires were extended by the electrical gang when necessary. About 150,000 long tons of ore were stockpiled in a period of five months, working two 10-hr. shifts. This averaged about 600 tons per shift. The best record was 356 skips, or cars, in one shift, and was made when the tramping distance was about 300 feet.

NEW METHOD ADOPTED

This stockpile was not shipped the following summer, and in order to add to it, a radical change in the operating

methods had to be made. Physical conditions necessitated an increase in length to obtain additional room. One-car trips could not be made, as the distance from the shaft to the end of the old stockpile, 485 ft., was so long that the skip would be kept waiting for a car in which to dump. It was finally decided to use side-dump cars of one skip capacity, in trains of two or three cars as necessity demanded. To do this, a trestle had to be built out from the end of the stockpile from which to dump the cars until the ore reached the top of the trestle, after which the pile could be extended sideways. This trestle is shown in Fig. 11 partly completed but in operation.

This plan made a change in the track scheme necessary. The new installation is shown in Fig. 6. The use of two separate tracks at the shaft saved the use of a switch and consequently much time. This feature was retained at the shaft and was also used where the tracks joined to go on the trestle. On account of the sharp turns in the track between the shaft and the motor barn, the motor could not start two cars; both tracks, therefore, were extended into one barn and a new switch was installed to give entrance to the other barn, Fig. 9. The stub switch was needed to allow the rolling stock to be changed from

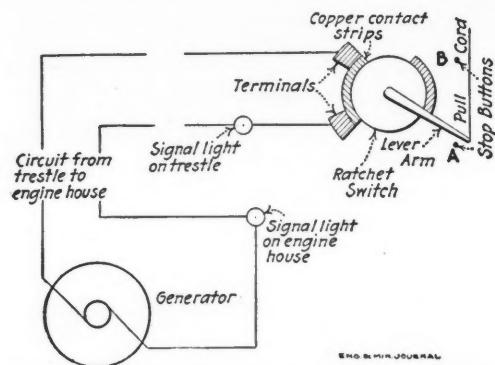


FIG. 7. LAYOUT OF SIGNALING APPARATUS

one unit to the other. The equipment consisted of two locomotives and enough side-dump cars to allow for three in a train and some spares. The style of these cars is well shown in the photographs, Figs. 2 and 4. They were made in the company's shops at Hibbing. They weighed between 3500 and 4000 lb., and held about three long tons.

The 2x6-in. posts and crosspieces which on the old trestle supported the wires had not stood up well, so they were torn down and replaced by stronger ones, as shown in several of the photographs. On the stockpile proper, the great width of tracks was no longer necessary, so a neater and more compact installation was made, the main features of which are shown in Figs. 2 and 10. Fig. 2 shows the trolley supports gradually widening from about the point where the man is standing. This is to allow the tracks to be thrown apart after the trestle is filled and the stockpile begins to be extended sideways. In both photographs the track on the extreme left is a storage track.

Fig. 11 shows the new trestle still under construction. After the other bents were raised the trolley supports were carried out as far as needed in the same manner as is shown in the photograph. This trestle is a good illustration of the efforts of the United States Steel Corporation to protect the safety of its employees. The trestle is entirely planked over, Fig. 3, but the portion outside the rails is built in the form of doors to allow for dumping. One of these doors is seen to be open, held so by an iron

hook. Hand rails and toe boards extend the full length of the trestle on each side, and movable guard bars are attached to each post to prevent men from walking into an opening. The man on the right has his left hand on one of these bars, while the bar on the next post is shown in the down position. On the post in the foreground, a

the engineer at the hoist when an empty car was at the shaft ready for the skip to dump. This is explained by the diagram, Fig. 7. The ratchet switch is moved a quarter turn every time the lever arm is moved from the stop button A to the stop button B. The lever arm drops back of its own weight, but in doing so does not move the switch. Two copper contact strips, 90° in length, fastened opposite each other on the ratchet switch serve to make and break the lighting circuit between the terminals, thus controlling the signal light in the engine room. An additional light on the stockpile, near the signal apparatus is also on this circuit to enable the motorman to know that the system is working properly. When the lights are out the skip must not be dumped. The hoisting signals are given electrically on a gong by the skipman at the underground pocket. There is thus no confusion of signals.

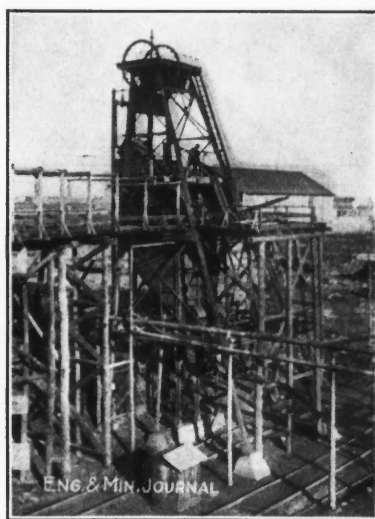


FIG. 8. TRACKS LEADING FROM HEADFRAME



FIG. 9. HEADFRAME WITH BEGINNING OF TRESTLE

little below the handrail is a hook to hold the dumping door when that is open. Electric lights are placed at intervals along the entire system and are on a circuit separate from that on which the motors run, so that in case the circuit breaker on the motor line is thrown out the lights will continue to burn. Fig. 4 shows a train being dumped.

When a train leaves the shaft the motorman moves the lever once, which breaks the circuit. The incoming motorman, his train being spotted, moves the lever again, completing the circuit, and leaves it so until his train is loaded. When first installed the motorman had to get off the motor to move the lever, and often forgot to give the signal until he had turned the trolley pole, warmed himself, etc. By connecting a cord to the lever and passing this cord over two pulleys, the motorman moved it while his locomotive was running and never forgot it, as the cord handle was so hung that it would hit him as he passed if he did not hold it aside and pull. Simple as this remedy was, it increased the handling capacity about 25 cars per shift.

The locomotives carried warning gongs; in order to make these of more value, their operation was taken out

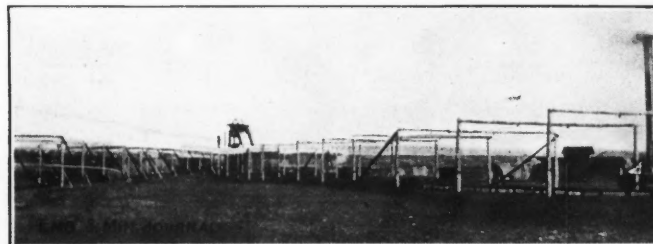


FIG. 10. STOCKPILE TOP, SHOWING NEW TRACK LAYOUT

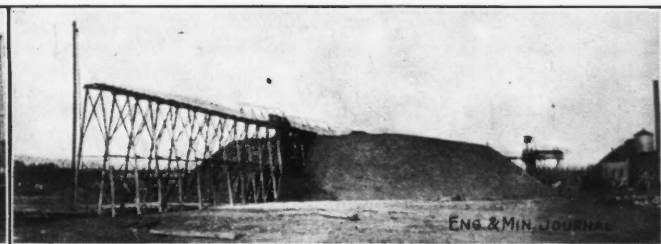


FIG. 11. NEW STOCKPILE TRESTLE

The trestle was built with timber cut on the property, the legs were in one piece and ranged from 38 to 44 ft. in length. Ordinary railroad ties, 8 ft. long, were used for caps. Poles about 4 in. on the top were used as braces. The bents, 23 in number, were spaced 18-ft. centers. The cost of the trestle erected, including labor, supplies, etc., was in the neighborhood of \$600.

Two cars to a train were sufficient to cause no delay to the skip; a rate slightly faster than one car every two minutes could be maintained without difficulty. Later in the season a more powerful locomotive was installed, and did the work alone. About 125,000 long tons of ore were stocked in a period of five months. This was somewhat less than the previous year. The labor cost, however, was only about half of what it had been then.

Several operating kinks were employed which are of interest. One of these is the signaling system to show

of the motormen's hands and was made automatic and regular. The gong was placed on the side of the motor and its clapper operated by a ratchet catch and release. The lever which operated the ratchet was attached to the end of a wheel axle, at a point off center; thus the action was like that of a connecting-rod on a locomotive, and every time the wheel made a certain number of revolutions the gong would sound.

South African Asbestos

Considerable interest is again being taken in the asbestos deposits of the Transvaal and Rhodesia, and it is interesting to note that both in the Umswezwé district of Mashonaland and the Carolina area of the Transvaal, much activity prevails on the asbestos fields, says the *South African Mining Journal*. It may be remembered

that about four years ago the Carolina Asbestos Co. suspended all operations on the farm Diepegezicht, operations having proved unprofitable. Just recently, however, certain British asbestos merchants have entered into an agreement for working the property on a tributing basis, and it is expected that work will be resumed early next month. As to the Umswezwe discoveries considerable excitement prevails in Gatooma regarding them, and it is understood that material of good fiber and quality has been opened up.

National Copper Electric Equipment

Electric installations now being made for the National Copper Mining Co., in the Coeur d'Alene, Idaho, constitute some of the most interesting in that district. Power will be purchased from the Washington Water Power Co. under a contract which makes it desirable for the mining company to maintain as high a power factor on the load as possible. The mining company has water rights from which approximately 600 hp. can be developed, and it was determined to utilize this to supply part of the power requirements of the mine and mill and at the same time to use these generating stations to improve the power factor as much as possible. Accordingly two hydro-electric plants will be built on Dead Man's Creek, located so as to secure the maximum amount of power. In each plant, there will be installed an impulse waterwheel, driving a 200-hp., 3-phase, 60-cycle generator. These plants will be connected to the load in parallel with the power supply of the Washington Water Power Co. No attempt will be made to regulate the load taken by these plants, and consequently the waterwheels will not be supplied with governors of the ordinary design. They will, however, be supplied with overspeed governors which will deflect the waterwheel nozzles in case through any accident the load on either or both of the plants is disconnected, which would tend to allow the waterwheel to race. When the machines are connected in parallel with the Washington Water Power Co.'s lines, the frequency of the power-company current will necessarily fix the speeds at which the generators can run and they will take as much of the mining company's load as the water running through the waterwheels will permit. They will, therefore, always be developing as much power as possible, yet their speed will be fixed and held constant by the frequency of the power company's supply lines.

The fields of these generators will be so designed that by adjusting the excitation properly, a high power factor on the entire load will be secured. One of these hydro-electric plants will be designed for operation in the usual manner by an attendant in the station. The other plant is designed for remote control from compressor station at the mine. The governor on the waterwheel will be controlled by the same mechanism which operates the switches and the plant will be stopped or started without anyone going near it.

The installation at the mine will consist of approximately 300 hp. in induction motors, the largest being a 200-hp. Westinghouse motor driving an air compressor. The mill, which has been designed and is being built by the General Engineering Co., of Salt Lake, will be driven by approximately 600 hp. of induction motors. Each department of the mill will be driven by a separate motor,

the largest individual motors being one of 300 hp. in the Hardinge mill department, and one of 200 hp. in the dry-crushing department. All the motors will be equipped with suitable protective apparatus to cut them off from the supply lines in case of overload or in case of failure of power.

Electric haulage will be used underground, and the ore will be transported from the tunnel portal to the mill over an electric railway which is unique in some of its features. The run from the adit to the head of the mill is about 10,000 ft. and in this distance there is a drop of 450 ft., necessitating a grade of $4\frac{1}{2}\%$. The railroad is built along the side of Dead Man's gulch, is 24-in. gage and laid with 30-lb. rails. The ore will be brought down this railway in trains of from 8 to 12 cars, each car carrying from 4 to 5 tons of ore. The equipment is designed for hauling 500 tons in two shifts of eight hours each. The average haul within the tunnel will be 5000 ft. and the grade on this inside run will be $\frac{1}{2}$ of 1 per cent.

A comparatively light locomotive would be suitable for all work inside the tunnel, but an 8-ton locomotive would be required for the work on the electric railway from tunnel portal to the mill. It was, however, considered undesirable to have two locomotives which could not be used interchangeably, particularly in view of contemplated extensions underground which might require the service of an additional locomotive. Accordingly it was decided to standardize on 4-ton locomotives, which could be used independently underground, but which could be consolidated into an 8-ton tandem unit for haulage over the electric railway. This arrangement is of particular advantage in that it reduced the number of motormen required. Other advantages are that a double 4-ton tandem unit is easier on the rails than a single 8-ton unit would be, and also that with the gage in use, adequate motor capacity of good design can be placed between the wheels of the locomotive.

It is estimated that the tonnage hauled can be doubled by adding another 4-ton locomotive later, and arranging motors so that the two locomotives used underground be used alternately as the following unit of a tandem couple with a third locomotive operated only on the outside haul.

It was originally intended to install a gravity tram to take care of the transportation of the ore from the adit to the mill, but investigation proved that an electric railway would be considerably cheaper even on the steep grade. The installation cost of the railway is a little less than the estimated installation cost of aerial tramway. The saving in operating cost is effected by obviating the necessity of rehandling the ore at the tunnel portal mouth, and by reduced labor charges at the mill. With the installation as at present made, the trips will be made up at the ore chutes in the mine and the complete train as there made up will proceed out through the tunnel over the railway to the storage bins at the mill, where the same crew, consisting of a motorman and a trip man, who comes out with the train, will attend to the dumping of the ore.

All the electrical equipment for this installation is being furnished by the Westinghouse Electric & Mfg. Co. The electrical designs for the mill equipment were made by the General Engineering Co. and the electric haulage system is the work of F. Cushing Moore, chief engineer of the National Copper Mining Co.

Details of Practical Mining

Rock Drift for Air Receiver

BY L. D. DAVENPORT*

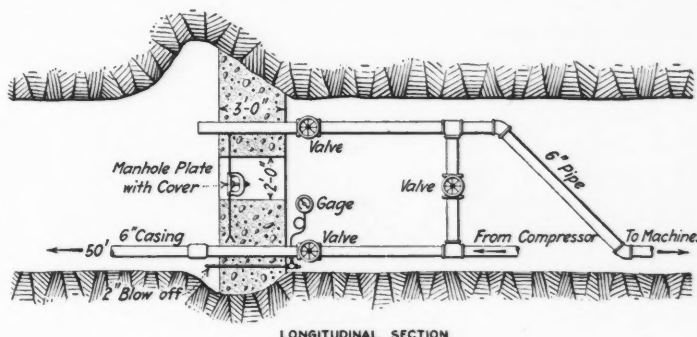
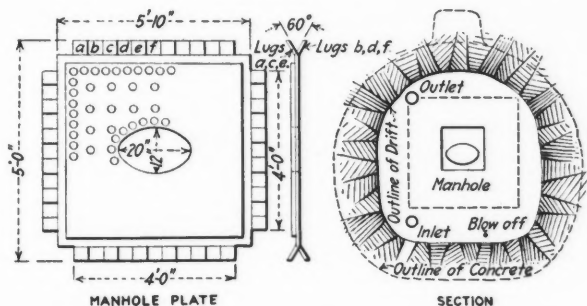
Compressed air for the hoist and the machine drills at the Ernestine mine, Mogollon, N. M., is furnished by two Ingersoll-Rand machines. The air is conveyed from the compressors at the power plant, across the cañon and into the mine to the receiver by a 6-in. pipe line.

The air receiver was formed by placing a concrete bulkhead 3 ft. in thickness in an unused crosscut in the brown andesite foot wall. This was built against a beveled recess cut in the rock. The crosscut thus bulkheaded is 109 ft. long and has an average cross-section of 42.7 sq. ft., giving a storage capacity of 4654 cu. ft. A manhole plate, fitted with a cover, was set in the concrete 6 in. from the inside face of the bulkhead as shown.

The 6-in. line from the compressors passes through the bulkhead near the bottom of the crosscut and 6-in. casing pipe extends this line about 50 ft. beyond the bulkhead inside the receiver. Air is taken out near the top

Churn-Drill Blast Holes in Diabase

The Eagle Rock Quarry Co., at East Orange, N. J., carries a face 100 ft. high by 1500 ft. long. According to *Engineering News*, Jan. 1, 1913, the rock is full of crevices which interfere with the operations of rock drills. When using a bench system and tripod drills, the costs were high, the quarry face always rough, and the production below what it should have been. The installation of a Cyclone drill putting down a 5 $\frac{5}{8}$ -in. hole for the full depth of face, has resulted in squaring up the face and producing an abundance of rock. A recent four-hole shot, representing 335 ft. of hole, which cost \$325 to drill, took 1600 lb. of powder costing \$200, making, with \$15 for detonators and loading, \$550. The rock dislodged amounted to 15,337 tons, or 3.58c. per ton; 6000 tons needed no further crushing. When the whole length of face has been thus shot, the holes can be spaced to better advantage and a further reduction in costs effected. At



ENG. & MIN. JOURNAL

BULKHEAD AND PIPE CONNECTIONS TO CONVERT CROSSCUT INTO COMPRESSED-AIR RECEIVER

of the crosscut through another 6-in. line, which extends just through the bulkhead.

A cross-connection and the necessary valves were provided so that the receiver may be cut out if it is desired to remove the manhole cover. A 2-in. blow-off close to the bottom of the drift allows any water collecting in the receiver to be removed.

A 1:3:5 mixture was used in the bulkhead and the structure was reinforced with old 10-in. rails, machine screws and other scrap. Sand was screened from the creek bed and packed on burros to the mine dump. The rock used was shot from the rhyolite hanging wall near the receiver. The cement, like the manhole plate, was freighted 90 miles overland from the railroad.

The manhole plate was made of two 1/2-in. boiler plates riveted solidly together. The larger plate is 5 ft. square and has its edges cut back to form lugs 4x4 in., as shown, which were bent out alternately in opposite directions to anchor in the concrete. The smaller plate is 4x4 ft. The opening in the concrete is 2x2 ft., so that the plate had sufficient bearing in the concrete.

*Engineer, Oliver Iron Mining Co., Eveleth, Minn.

present, although the bottom of the hole often has a burden 25 to 30 ft. thicker than the top, the bottom rock is broken satisfactorily.

[The fact that these results are obtained in diabase is important, since the rock is a hard one to drill and tough to break. It is held in many quarters that churn-drill work is economical only in the softer rocks, of which the hardest would be limestone.—EDITOR.]

Safety Factor of Hoisting Ropes

The vexed question of how safely to reduce the thickness and weight of hoisting ropes in deep shafts, is treated by Professor Herbst in *Glückauf (Min. Journ., Dec. 20, 1913)*. The author deals with the proposal recently introduced in the proceedings of the German Hoisting Rope Commission to the effect that separate safety coefficients be fixed for the rope itself and for the loaded skip or other vehicle, the fundamental principle being that the resistance to rupture of the rope should be equal to at least 10 times the weight of the loaded skip plus four times the weight of the rope from the rope drum down to the bottom

of the shaft. Making allowance for subsequent wear and tear, these figures would have to be raised to 12 and five, respectively, for new ropes. According to this system of calculating the safety coefficient, the cross-section of ropes for small depths would be slightly larger than it need be under the present regulations in the Bonn district of Prussia, where the combined coefficient for rope and loaded skip is fixed at eight (or $9\frac{1}{2}$ for new ropes), but this drawback might be obviated by a clause in the rules to the effect that in no case need the coefficient be higher than it is at present. For great depths, however, the thickness and weight of the rope would be considerably reduced under these proposals, with corresponding effect upon the now prevailing and constantly increasing difficulties in hoisting operations in deep shafts. Certain objections are shown by Professor Herbst to be either of trifling importance, or subject to easily found remedies. These German proposals ought not to be confounded with seemingly similar proposals discussed some time ago by South African experts, the principles on which the latter are based being fundamentally different.

Security Hook for Car Check

In cases where ore is mined on contract, and payment made by counting the number of cars delivered, it is customary to use brass checks to distinguish the various contracts. The device herewith illustrated is one used in



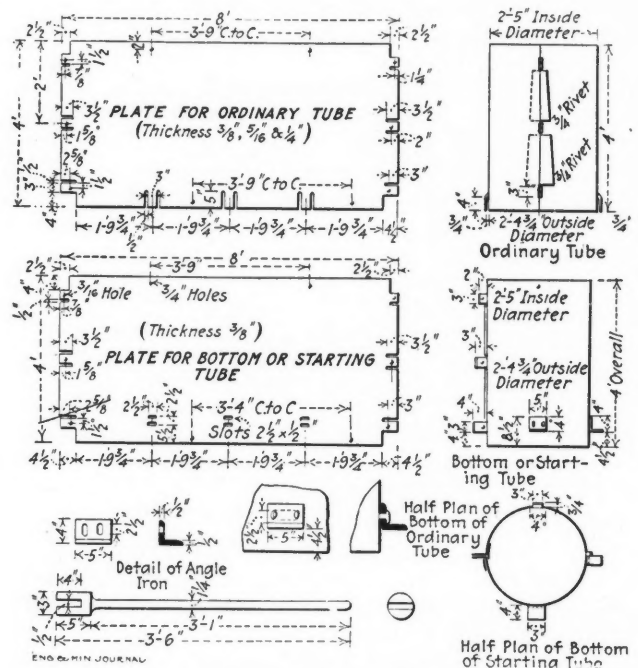
CHECK HOOK BEFORE AND AFTER INSERTION IN CAR

Germany and is described in *Glückauf*, according to *Coal Age*, Dec. 27, 1913. Its object is to protect the check against tampering. An iron rod of the shape shown has its originally straight end thrust through a hole in the car, and then bent into a ring, which hangs down. The check can be hung on the outside hook only when the inside ring is free to be lifted, that is, when the car is empty. When the car is full, the check cannot be removed except with great difficulty. The device is manufactured by the Rheinischen Handelsgesellschaft m.b.H., of Mors, Germany.

In Substituting Wood for Coal in a Boiler Furnace it is enough to allow $2\frac{1}{2}$ lb. of wood as equal to 1 lb. of coal, if the wood does not contain over 20 to 25% of moisture; such wood is usually known as "dry." (*Power*, Dec. 30, 1913). For wood burning, there should be fully half more area of grate openings, the boiler should be 50 to 75% higher above the fire and the flue-chimney capacity should be about twice as much as for coal. With natural draft and dry wood 20 to 25 lb. of wood should be burned per hr. per sq. ft. of grate and with forced draft 40 to 50 pounds.

Ore Chutes of Sheet Steel

The essential requisites of an ore chute are that it have a life at least equal to that of the stope it serves, a minimum tendency to hang up, a suitability to stoping conditions, and, above all, a small first cost and cost of maintenance. The following are some of the types of chutes in use: (1) Square chutes cribbed of round or square timber, either built by themselves, or immediately inside the posts of square sets, and projecting over the caps and girts for additional support and rigidity; (2) square-set chutes lagged outside, and lined inside with vertical timbers spiked to each set, or else with the cribbing just mentioned; (3) circular stone chutes hand-packed, sometimes bonded and strengthened by occasional timbers placed radially; (4) circular wooden chutes of radially shaped timbers placed vertically, the grain of the timber being parallel to the fall of the ore; (5) circular steel passes. These have been used on the South Blocks mine for the last five years, and continue to give satisfaction under the conditions existing there. The ones first installed were



DETAILS OF CONSTRUCTION OF CHUTE SECTIONS

16 in. in diameter and $\frac{3}{16}$ in. thick, being rolled from 4x4-ft. plates. The vertical joint was made by riveting a cover plate on the outside, and the lugs for fastening one length to the one below were also riveted.

As these proved too small, some of 20-in. diameter, rolled from 5x4-ft. plate were tried, but developed the same fault. Next, some 30-in. diameter by $\frac{1}{4}$ -in. were tried, made from 8x4-ft. plates, and similar in construction to the others. The size of the latter proved adequate, but the riveting was a source of weakness, as the heads of the rivets got worn off, partly by abrasion, but mainly by the constant jarring of the falling ore. This loss of rivets, in the case of the longitudinal joints, caused the tube to bulge and the chute to hang up. In case the lugs became detached, the tube to which they belonged slipped down, and left an annular space, in which the ore

Note—An abstract from an article by John M. Bridge entitled "Notes on Steel Ore Passes" (*Proc. Aust. Inst. M. E.*, No. 10, 1913).

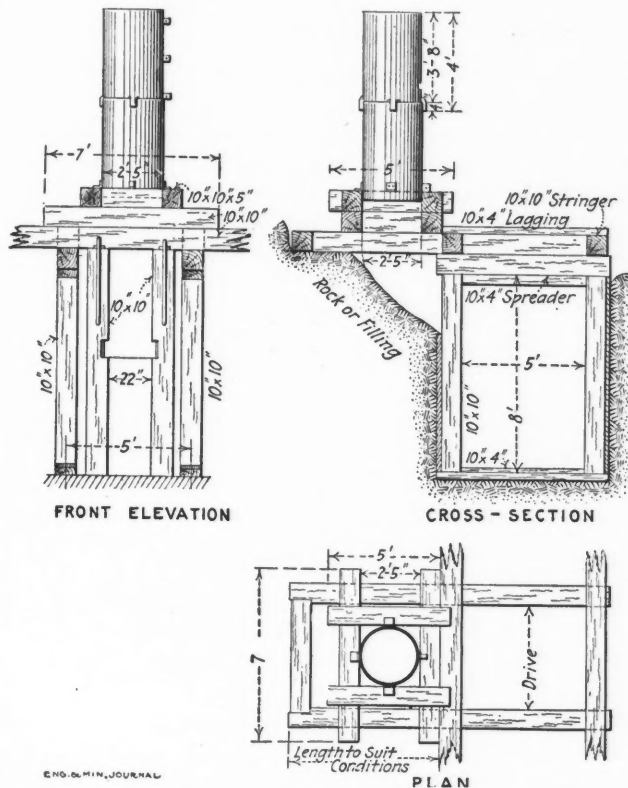
again collected and hung the pass up. To overcome this defect the present type of tube was adopted, with no rivets at all in the lugs, and with those in the longitudinal seams placed far enough back from the side of the chute to allow of the jarring effect being deadened.

The sections are made by cutting slots in 4x8-ft. plates with a 1/2-in. slotting punch, the final cut in every case being made with a round instead of a rectangular punch, thus giving a round root to the lugs, to prevent tearing. The circular holes for riveting, and for attaching the slings, are punched at the same time and by the same machine. Provision is made for three lugs on each longitudinal and on each circumferential seam, the bottom longitudinal lug also serving as an additional circumferential support. After cutting, the plates are bent uni-

metal left between is then sheared in the center, and the two pieces of metal forced back to make two 1 1/2x1 1/4-in. lugs. Over these is placed a 5-in. length of 4x4x1/2-in. angle, slotted to fit the lugs and these lugs are then hammered back to grip the angle iron. Half and three-quarter sections are also used, being made from 2x8-ft. and 3x8-ft. plates, the object being to suit the height of the filling in the stope. The end dimensions of these short sections are the same as the ordinary ones, but the central longitudinal lug has to be dispensed with from lack of room on the plate. The different lengths of the slots and lugs on the top and bottom circumferential seams, give the required taper to each section. The top of each section has a minimum inside diameter of 2 ft. 5 in., and the bottom a maximum outside diameter of 2 ft. 4 3/4 in., to allow of fitting together. Three thicknesses of plate are used, 3/8 in. for the first 60 ft. above the level, 1/8 in. from the 60-ft. to the 110-ft. point; and 1/4 in. for the remainder; the cost, complete, of each section, from 4x8-ft. plate, is, respectively, \$19.20, \$18 and \$15.60.

In starting from the level, two 10x10-in. Oregon pine foundation pieces of a length to suit the conditions are first put in, resting on a 2-in. projection of the caps of the level sets, an additional hold sometimes being given by spiking a 4x10-in. piece vertically to the lugs. Two pieces 7 ft. by 10x10 in. are next placed transversely to these and blocked 2 ft. 5 in. apart, and then two 5-ft. pieces parallel to the foundation pieces, similarly blocked 2 ft. 5 in. apart. The starting section is fitted between these, the lugs resting on the top of them, and the whole is made rigid by packing with filling. The chutes are placed 30 ft. apart along the level and in some cases have been taken up 140 ft. above the back of the drift in stopes averaging 30 ft. wide, representing about 15,000 tons handled per chute without any renewals or repairs. Some of the chutes have been lost, but most of these were 16 and 20 in. in size, the rest being ruined by firing with gelignite when clogged. Repairs are difficult, but provided care is taken to avoid sharp bends, which allow the ore to pound out the under side of the bend, and no firing of clogged chutes is permitted, no repairs are necessary where the chutes are properly spaced. When hung up, the ore can in every case be brought down by shooting with a "cannon," made by boring a 2-in. hole in a piece of 5-in. shafting, and using gunpowder to fire a projectile at the mass.

The advantages of these chutes are: (1) Their moderate first cost and great wearing qualities which eliminate renewals and repairs; (2) the small size they can be made without an undue tendency to clog, lessening the chance of accident by falling into them; (3) their adaptability to stopping conditions, as no special care is needed when firing ground on top of them; (4) their impervious nature, which prevents any extremely rich ore from being lost, and also confines sand filling to the stope, a matter cheapness of installing each section, as each tube is made of great difficulty in wet mines; and (5) the ease and to fit the one below. Results on the South Blocks mine show that for the conditions existing there, the steel chute can do its work quite as well as any form of timber chute, and the question of its adoption depends directly on the relative prices of steel and timber.



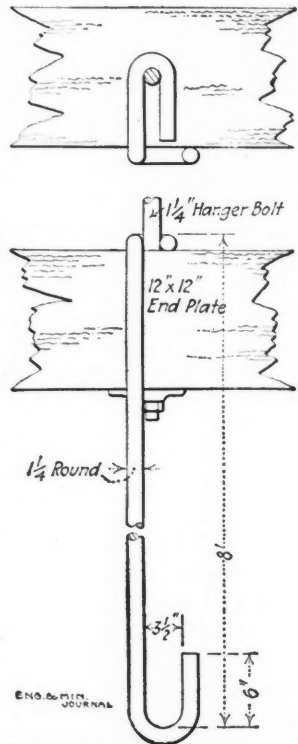
METHOD OF ERECTING AND SUPPORTING THE STEEL CHUTES

formly in the rolls until the opposite edges about touch. The lugs are next bent cold by hand, using a dog consisting of a 3-in. head, having a slot in it 4 in. deep by 1/2 in. wide, and provided with a stout iron handle. The lugs of the longitudinal seams are bent out square in one operation, but those for the annular joints are first bent out square to the axis of the tube; then the hold of the dog is shortened, and they are bent back parallel to the axis. The edges of the longitudinal seams are then pulled up together and riveted.

The first section for each chute, or the "starter," as it is called, has the same longitudinal joint, but the lugs are replaced by 4x4x1/2-in. angle-iron feet, which rest on the chute timbers and form the foundation for the chute. Riveting is again avoided by attaching the feet in the following manner: Three pairs of circumferential slots are punched 2 1/2x1 1/2 in., with 2-in. centers; the 1 1/2-in.

Hangings Bracket for Shaft Platform

In sinking the Bennett shaft on the Messabi range, the device shown in the illustration was used to support a hanging platform, in cases where the ground could be left open for some distance below the timbering and it was therefore impossible to swing a set from the bottom. Four pieces of 1 1/4-in. iron, the same that was used for the hanger bolts themselves, were bent at one end so as to hook around the hanger bolts supporting the lowest end plate and then drop vertically over the side of the end plate. The other ends were bent to form loops of the proper size to take a 3-in. pipe, and in such a plane that the pipe when inserted would lie parallel to the wall plates. On the two lengths of pipe inserted in the four brackets, a plank platform was built on which the men could work in placing the new set. The sets were spaced 5 ft. and the length of the bracket, 8 ft. overall, was sufficient to give plenty of clearance below the new set and room to work.

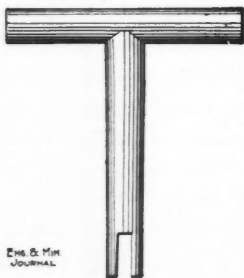


BRACKET SUSPENDED FROM HANGER BOLTS

Tool for Bending Rope Wires in Socket Connection

BY JOSEPH GOLDSWORTHY*

The method of fastening a hoisting rope into a conical socket is well known. The end of the rope is pushed through the socket, bound tight with a fine wire at a sufficient distance from the end, the end untwisted, and the hemp core removed for this distance; the individual wires are then cleaned, the end of each wire bent inward to form a hook, the rope pulled back into the socket, and a short, round, iron wedge inserted in the center; this wedge must not be driven in hard with a hammer, or tight enough to cut or damage the wires, its purpose is to spread the wires to the shape of a funnel. The top of the socket is then well stopped with putty or clay, and some good babbitt is slowly poured in until the socket is full; the ends of the wires should be at least 1/2 in. below the surface of the babbitt. For forming the hooks on the



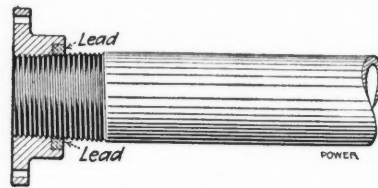
WRENCH FOR ROPE WIRES

*Box 2079, North Vancouver, B. C.

ends of the wires, a piece of round steel, made up in the shape of a T with a slot in the end, as shown, will be found more convenient to use than pliers.

Pipe Joints Soldered at Flanges

At a Hancock, Mich., power plant, a 6-in. steam line is carried about 300 ft. through a yard on posts about 14 ft. high, according to F. R. Maw (*Power*, Dec. 30, 1913).



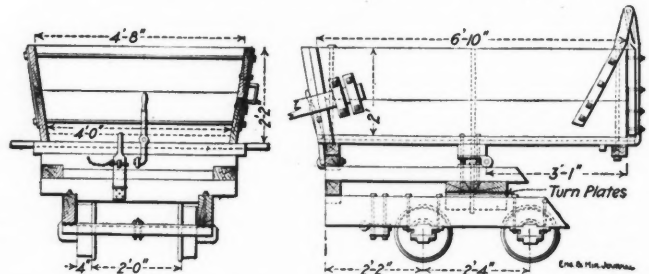
SOLDERED FLANGE JOINT

From time to time, leaks occur in the threads where the lengths screw into the hubs of the flange unions. To take down pipe would be an expensive job, since it would be necessary to cut off pipe and make new threads or substitute new pieces or flanges, as the conditions warranted. To avoid this, flanges are split off with a cape chisel at the bolt holes to inspect the threads. If the thread is poor well within the thread length of the flange the line is spread open enough to permit screwing on a new flange with a recess at the back of the hub, into which lead is poured and the joint calked to insure a tight job. The cross-section of one of these flanges illustrates the method used.

Surface Tram Car

BY WILLIAM WALLACE*

The accompanying drawing shows a not uncommon type of tram car for use on the surface to handle skip-hoisted material. It is of the end-dump, turntable type and is



WOODEN, END-DUMPING TURNTABLE CAR

constructed chiefly of wood; it is rather lower than those frequently used. The socket at the rear end for the insertion of the dumping bar is noteworthy, as is the manner of suspending the door some distance above the top of the car. Such a car is not uncommon for use in stockpiling or in tramping out waste.

Economy in Sand Filling Is Obtained only when operations are continuous, since, if the filling be interrupted for a period of several days or weeks the sand residues must be disposed of on the dump and this possibility entails the maintenance of a special equipment and organization (*"Journ." Chem., Met. & Min. Soc. of South Africa, Sept. 1913*). Hence, if sand filling is to be employed, several depositing sites should be prepared and maintained underground, so that the exigencies of mining will not suspend filling operations.

*Mining engineer, New York.

Details of Metallurgical Practice

Roasting Copper-Nickel Matte

The roasting of copper-nickel matte is discussed by Edward F. Kern and M. H. Merris in the *Columbia School of Mines Quarterly* for November, 1913. The authors experimented with a matte containing 54% Ni, 24% Cu and 16.5% S, and their conclusions were as follows:

The roasting of copper-nickel matte proceeds slowly at temperatures below 600° C.; at temperatures above 730° C., the matte particles become pasty and cake into masses that prevent rapid oxidation. The most rapid and complete roasting of the matte may be obtained by first roasting at 450° to 500° for about an hour with free access of air in order that the particles may become thoroughly coated with a layer of oxide, after which the temperature may be raised to between 675° and 725° C. Vigorous rabbling is necessary to prevent fritting of the matte particles, until they have become coated with a thin layer of oxide.

The roasting experiments were conducted with about 300 grams of the crushed and uniformly sized matte,

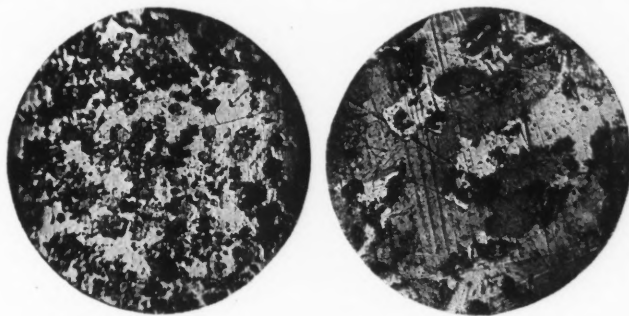


Fig. 1. Mag. 40 diam. Fig. 2. Mag. 220 diam.
PHOTOMICROGRAPHS OF COPPER-NICKEL MATTE

one lot being between 30 and 40 mesh and the second lot between 60 and 80 mesh. The roasting was done in large fireclay roasting dishes, the thickness of the layer of matte being about 1/2 in. The two dishes, containing the respectively sized matte, were placed side by side in a gas-fired muffle furnace, and the roasting was carried on in each case under conditions as nearly identical as possible, with respect to temperature, air supply, and rabbling. The temperatures were determined by means of a Le Chatelier thermo-couple, which was placed between the roasting dishes, readings being taken at intervals of 15 min. At definite intervals during the roasting, samples of the matte were dipped from the dishes, by means of a long-handled iron spoon; they were pulverized to pass through a 100-mesh screen, and analyses were made for nickel and copper as sulphate, oxide, and as sulphide and alloy. The sulphur content was determined on a separate sample.

In regard to the reaction between nickel sulphide and copper oxide, the authors state that when such a mixture is heated a small amount of copper sulphate and nickel sulphate is formed when the temperature is maintained

between 525° and 600° C. Above 650° C. these sulphates do not form, but there is a mutual interaction of the nickel sulphide and the copper oxide, with the formation of cuprous sulphide and mixed subsulphide; the higher the temperature the more rapid the formation of the cuprous sulphide. The results also indicate that nickel subsulphide is a very stable compound; and that when a mixture of nickel subsulphide and copper oxide is heated, no apparent reaction takes place.

The condition in which the copper and nickel existed in raw matte was studied by means of micrographs. Figs. 1 and 2 show a slowly cooled matte containing 55% of nickel subsulphide (Ni_2S), 23% of cuprous sulphide (Cu_2S), 11% metallic nickel and 5% metallic copper. The photomicrograph, Fig. 1, shows a magnification of 40 diameters; Fig. 2 is magnified 220 diameters. These show the eutectic of nickel subsulphide and cuprous sulphide as the light irregular mass which surrounds the excess of nickel subsulphide, and the alloy of nickel and copper saturated with sulphide. The black spots are cavities in the matte, the dark irregular masses are the excess of nickel subsulphide, and the darker masses which have more or less square corners are crystals of the alloy of nickel and copper saturated with sulphide. A small piece of matte polished on one face was etched with a dilute (1:4) solution of hydrochloric acid. The etching served as a means of distinguishing the several constituents of the matte by taking advantage of their different solubility in the dilute acid; the excess of nickel subsulphide was slowly dissolved and assumed a dark-brown color after five to six minutes' treatment; whereas the eutectic of nickel subsulphide and cuprous sulphide was not appreciably attacked but remained as irregular, bright masses of light bluish tinge; and the alloy of nickel-copper, which was not attacked by the acid, appeared as small, bright-yellowish masses having more or less square corners and surrounded by the sulphides.

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Rate of Belt Travel in Magnetic Separators

Among the several adjustments possible in the operation of a magnetic separator of the type employing a traveling belt to bring the ore into the magnetic field, the importance of the rate of travel of this belt is not generally realized. Since the attraction for the magnetic mineral grains must be strong enough to cause them to leave the path in which they were originally traveling, the speed in this direction should be adjusted with reference to the permeability of the grains of ore and to the available magnetic intensity of the field.

In demonstration of this statement may be cited an experiment conducted at a Prussian magnetic separating plant at Mechernich, working on a mixed ore containing strongly magnetic magnetite, feebly magnetic rhodonite, and very feebly magnetic blende. The electric current through the magnets was maintained at 1000 watts, while

the velocity of belt travel was varied at will. At a velocity of 100 m. per min., only the magnetite was attracted; at 70 m. per min., the rhodonite was slightly influenced; at 50 m. per min., the rhodonite was entirely removed; at 40 m. per min., the blende began to be attracted, and at 30 m. per min., the blende was completely extracted. At a belt velocity of 5 m. per min. the blende could be entirely eliminated with the expenditure of as little as 20 watts.

Plunger Type of Tailings Pumps

The use of plunger pumps for elevating pulp or tailings, states C. O. Schmitt, in "A Textbook of Rand Metallurgical Practice," Vol. 2, is not general on the Rand, and, on account of the great expense for maintaining the plant, is not likely to be adopted. There are, however, a few mines which use this type of pulp elevator.

The accompanying illustration shows a general arrangement of the tailings pump of the plunger type. The pump shown has two pump cylinders and is of a single-acting type. The special feature of this pump is the

at the May Consolidated Gold Mining Co.'s works, and has been used since 1898. At this plant the pumping outfit consists of two 15x48-in. double-plunger, single-acting pumps, driven from a line shaft. The work done amounts to lifting about three tons per minute, or 124,000 tons per month, to a height of 85 ft., the efficiency of the pumps being 60%. The power consumption is 24 hp. The total cost of the complete plant was \$7000. The capital charges at 12% per annum per month amounted to \$70, figuring interest at 6%, depreciation at 4% and the redemption of capital at 2% per annum. The capital charges per ton lifted amounted to 0.0542c.; the capital charges per foot-ton of work done amounted to 0.000614c. The power charges being figured at 1c. per horsepower-hour per month, amounted to \$160, the actual cost of power, however, not being available. The power charges at 1c. per horsepower-hour per month per ton lifted amounted to 0.1238c., and the power charges at 1c. per horsepower-hour per foot-ton of work done amounted to 0.001456c. The operating charges over an average of 10 years amounted to \$200 per month; while these charges per ton lifted amounted to 0.1706c., and per foot-ton of

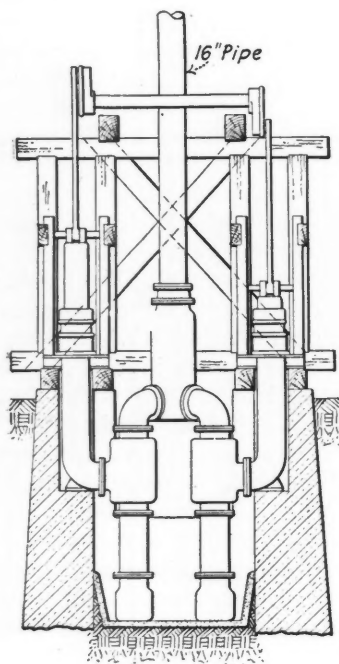


FIG. 1

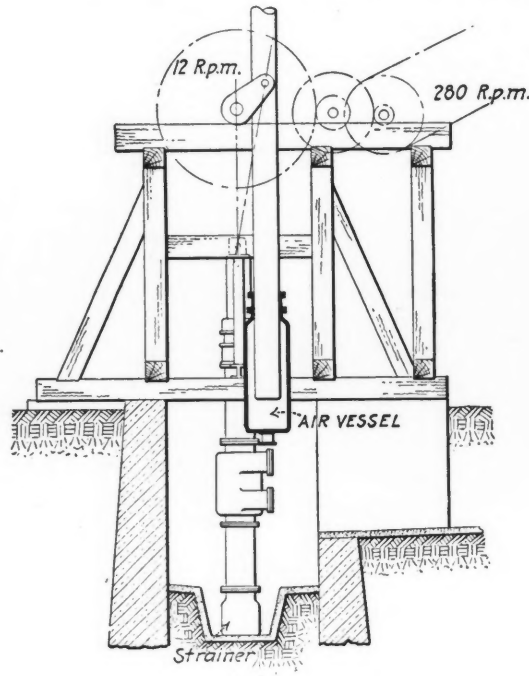


FIG. 2

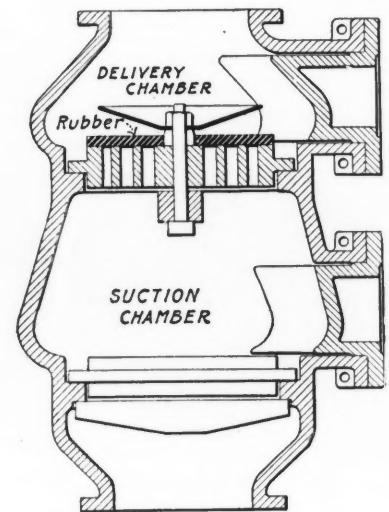


FIG. 3

DETAILS OF PLUNGER-TYPE TAILINGS PUMPS USED IN SOUTH AFRICA

water service to the pumping box of the plunger, so as to prevent wear on the latter. This is shown in Fig. 1. Rubber valves of soft material are generally used which fit on cast-iron gratings. Fig. 3 shows a valve in section.

The chief advantage of the plunger tailings pump is that it can be used for elevating the pulp to a considerable height in one elevation, probably 90 to 100 ft. being within the practical limit. Another advantage is that the height of lift can be varied from time to time without any decrease in the efficiency, although, when elevating to a great height, the cost of maintenance must be expected to rise.

The efficiency of the plunger pump is greater than that of the elevating or tailings wheel, probably exceeding 70%. The most important plant of this type is installed

work done to 0.001934c. The total charges per month were \$430; the total charges per ton lifted were 0.3426c., and the total charges per foot-ton of work done were 0.004004 cents.

Magnetic Separators

Removing iron particles from ground scrap rubber in the reclamation plant of a rubber mill and extracting the metallic iron from crushed slag in the steel plant are two new applications of Cutler-Hammer magnetic separators that have recently been made says the *Iron Trade Review*. The separating is effected by simply passing the ground or crushed material on a belt over the magnetized pulley, which picks out the metallic particles and allows the remainder to be cast forward to a conveyor or chute.

Mining & Metallurgical Machinery

The Knox Tractor for Mining Work

The tractor system possesses several important advantages over the ordinary motor truck for mining work, according to its manufacturers. Considering first the difference in investment cost, a tractor with wagon costing about \$425 per ton of capacity will do at least twice the work of a motor truck, costing approximately \$750 per ton of capacity. The tractor will haul 10 tons or more to the motor truck's five tons at each load and by using interchangeable bodies the capacity of the tractor can be still further increased.

Where adverse road conditions exist the tractor has a decided advantage, for its arrangement and construction give protection to the vital parts of the mechanism against damage while starting heavy loads, hauling up grades, etc. This feature has been carefully worked out by using rear tractor springs of such flexibility that they absorb the excess shock of starting, so that enormous loads

lumber or other supplies with a different type of body in the afternoon; in other words, it can be kept constantly busy earning a return on its investment cost.

A Nevada mine has used two Knox tractors with an ingenious form of body, having two separate side-dumping compartments, here illustrated, hauling a total of 15 tons at each load. It also uses the machine in connection with several other types of bodies, one a tank for hauling oil, another a regular truck type for general merchandise, etc. The change from one type of body to another is made in about four or five minutes.

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North Butte Hoisting Plant

The North Butte Mining Co. has awarded to the Westinghouse Electric & Manufacturing Co. the contract for what will be the largest electric hoist in the two American continents, and one of the largest of its kind in the world, to be installed at the Granite Mountain shaft, Butte, Montana.



KNOX-MARTIN TRACTOR HAULING 15 TONS OF ORE IN SPECIAL DUMPING BODY



TRACTORS HITCHED TO DIFFERENT TYPES OF BODIES

can be hauled with little danger of trouble from this source.

In the tractor system over half the load is carried on the rear wagon wheels which are shod with comparatively inexpensive steel tires, while under favorable traction conditions steel tires have also been successfully used under the front driving wheels instead of the tremendously expensive rubber.

A third important advantage of the tractor system lies in the ease with which it can be attached to various types of bodies, it being merely necessary to pack up the body at the front end and remove the king pin in order to uncouple the tractor. Thus, where considerable time is necessary for loading and unloading, the tractor can be worked to much better advantage, one body being loaded while another is being hauled. This arrangement results in a greater earning capacity for the tractor, as against the motor truck which must stand idle while being loaded and unloaded. By this arrangement also the tractor can be used in the morning, for instance, for hauling ore with one kind of body and sent after a load of

The hoisting drums, which will be 12 ft. in diameter, will be driven by a direct-connected electric motor running at about 71 r.p.m. Power will be supplied to this motor from a motor-generator set equipped with a 50-ton flywheel to secure elimination of the peaks that would be drawn from the power line during period of starting and acceleration.

Hoisting with this equipment will be done in balance, but the equipment is large enough to take care of unbalanced hoisting. Each skip will have a capacity of 7 tons of ore. Round rope $1\frac{5}{8}$ in. in diameter will be used and the equipment is designed for a normal rope speed of 2700 ft. per min. with a maximum of 3000 ft. per min. The capacity of the hoist will permit 300 tons per hour being hoisted from the 2000-ft. level or 200 tons per hour from the 4000-ft. level.

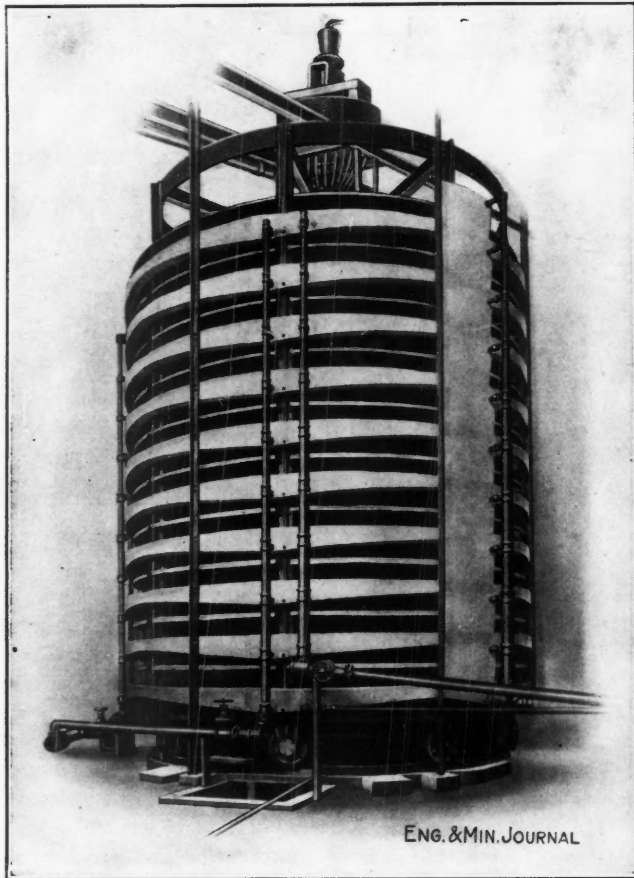
The system of control and power equalization used will be the Ilgner modification of the Ward-Leonard method, in which a flywheel driven by the motor-generator set is permitted to give up some of its stored energy to supply the peak load drawn by the hoisting motor. In order to re-

duce the flywheel losses to a minimum, the flywheel will be encased in a smoothly finished steel housing and provided with special type of self-lubricating bearings.

High economies have been guaranteed on this installation and it will be watched with interest, with a view of comparing its economy with that of the pneumoelectric hoisting system, designed by Mr. Bruno Nordberg, being used at 10 of the Anaconda mines.

Anaconda Slime Concentrator

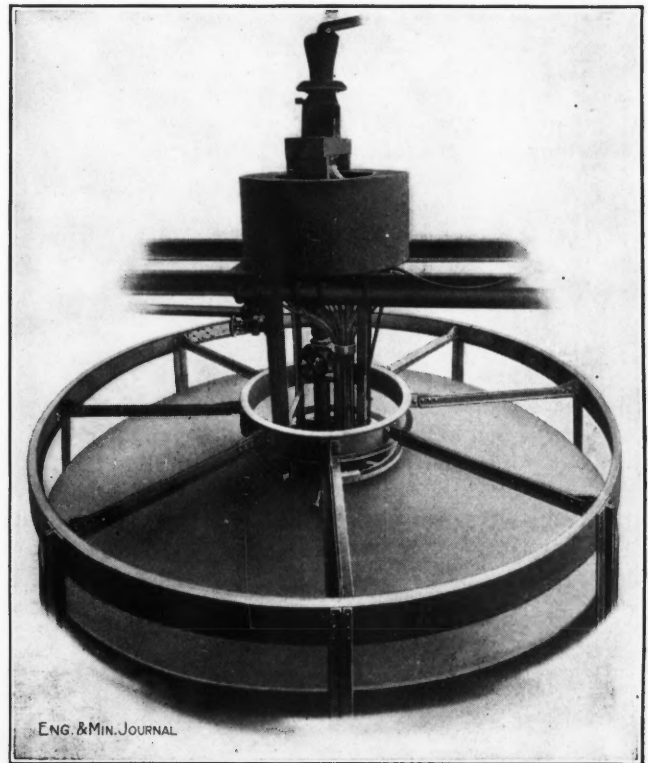
The accompanying engravings show two views of the multiple-deck slime concentrator, developed at Anaconda, Mont., and now being manufactured by the Traylor Engineering & Manufacturing Co., of Allentown, Penn. These concentrators will be built with five, 10 and 20 decks, the 20-deck concentrator having been adopted for the new slime-concentration plant of the Anaconda Copper Mining Co. The decks of this machine are conical in shape, the diameter at the base of the cone being 19 ft. and the slope varying from $1\frac{1}{8}$ to $1\frac{3}{8}$ in. per foot, depending upon the particular ore to be treated. The sur-



THE 20-DECK ANACONDA SLIME CONCENTRATOR

face of the decks, which are 1 ft. apart, are of concrete, the roughness depending upon the work to be done and may extend to riffling, when necessary. The concrete is laid on sheet-steel decks supported on a steel ring around the periphery, this ring being attached to eight steel columns and the whole being carried on a steel ring at the bottom. The bottom ring is supported on wheels which run on a circular track and the entire framework carrying the decks is thus free to revolve at a speed best

adapted to the ore in question; the speed of one revolution is usually made in from three to 10 min. A 3-hp. motor is supplied to rotate the 20-deck table and automatic distributor; the motor is placed beneath the lower deck, the power being applied to the framework by means of gears meshing with the rack at the bottom of the deck structure.



TOP VIEW, SHOWING DISTRIBUTOR, FEED AND WATER PIPES AND LADDERWAY

There is an opening, 4 ft. in diameter, in the center of the deck structure, in which is placed a stationary steel shaft or tower, 30 in. square, carrying a ladderway. The feed- and wash-water pipes and distributors are carried on this tower so that the valves or other means of adjustment are readily accessible to a man passing up or down the ladderway. As the entire structure is composed of steel and concrete, the life of the table is indefinite and the repair costs slight.

The feed is usually distributed over about 60 or 75% of the total surface, and tailing can be made on 60 to 80% of the total surface. Where a multiple-deck table is used, middling may be returned to one or two decks, thus eliminating any other secondary machine. The collecting launders are hung on the steel columns around the periphery of the tables, one set of launders serving two decks.

A feed, containing from 8 to 12% of solids, can be satisfactorily treated on the Anaconda multiple-deck concentrator, thus requiring a minimum of dewatering equipment. It is estimated that the concentrator will treat from five to 10 dry tons per deck per 24 hours, or from 100 to 200 tons per day for a 20-deck machine. The total concentrating area per deck is 270 sq.ft., which would indicate a concentrating capacity of one ton per 24 hours from 27 to 56 sq.ft. of deck surface. The net floor space required by the Anaconda slime concentrator is a circular area 20 ft. in diameter, which is equivalent to 314

sq.ft. The total floor space required, allowing for walkways and assuming the area to be square, instead of circular, is 480 sq.ft. and the overall height, including the pulp distributor, is about 35 ft. for a 20-deck machine and about 20 ft. for a five-deck machine. The tons treated per square foot of floor space, for a 20-deck table, would be from 0.2 to 0.4 ton per day.

The concentrate is removed by a strong jet of water, applied near the center of the deck, about six gallons per minute per deck being required for this purpose. About three gallons of water per minute per deck are required for dressing purposes. When a steady feed is secured for the table, and the speed of rotation of the table is once determined, there remain but few adjustments which the operator is required to make. In consequence, one man can attend to at least five 20-deck tables. There will be supplied with the table an automatic feed distributor, so as to give all decks a proportionate amount of the total feed.

It is proposed in all installations to send a preliminary machine, either a one- or two-deck table, together with a Dorr thickener, and to determine from actual operations the slope and character of deck surface required and the speed of rotation, so that the ultimate commercial installation shall be based upon the actual feed that is to be treated.

An Improved Crucible

A new form of crucible is being made by the Joseph Dixon Crucible Co., of Jersey City, N. J., and is offered for use by smelters of precious metals. As is shown by the accompanying illustration, the improvement consists of a bridge under which the melt is poured off, the slag and foreign substances, coke, charcoal, etc., being held back. The capacity of the crucible is not reduced by the



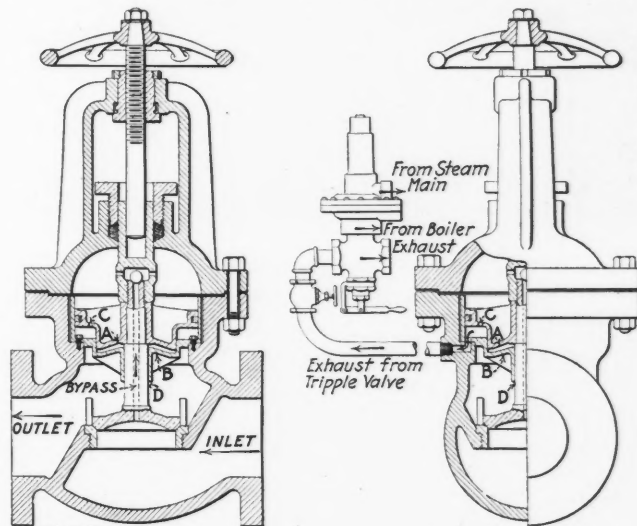
ENG. & MIN. JOURNAL

SELF-SKIMMING CRUCIBLE

new device, nor does the bridge interfere with stirring or adding fresh material while in the furnace. It ought to be of use for melting precipitates in cyanide plants. The inventor of the improvement is Henry Weisbrodt, an employee of the Dixon company.

Emergency Trip Valve

Pressing a button or throwing a switch shuts off the steam, stopping a runaway engine and preventing disaster from breaking of a steam pipe. This essentially safety device is an emergency trip valve, shown in the accom-

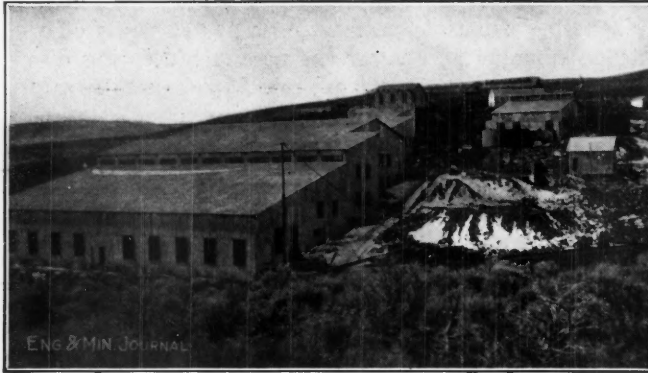


SECTIONS OF AN EMERGENCY STEAM VALVE

panying sketches, and made by the Golden-Anderson Valve Specialty Co., Fulton Building, Pittsburgh, Penn. It is known as the Golden-Anderson double-cushion, quick closing, emergency trip valve, and is either electrically or hand operated from a point of remote control, which may be any part of the plant.

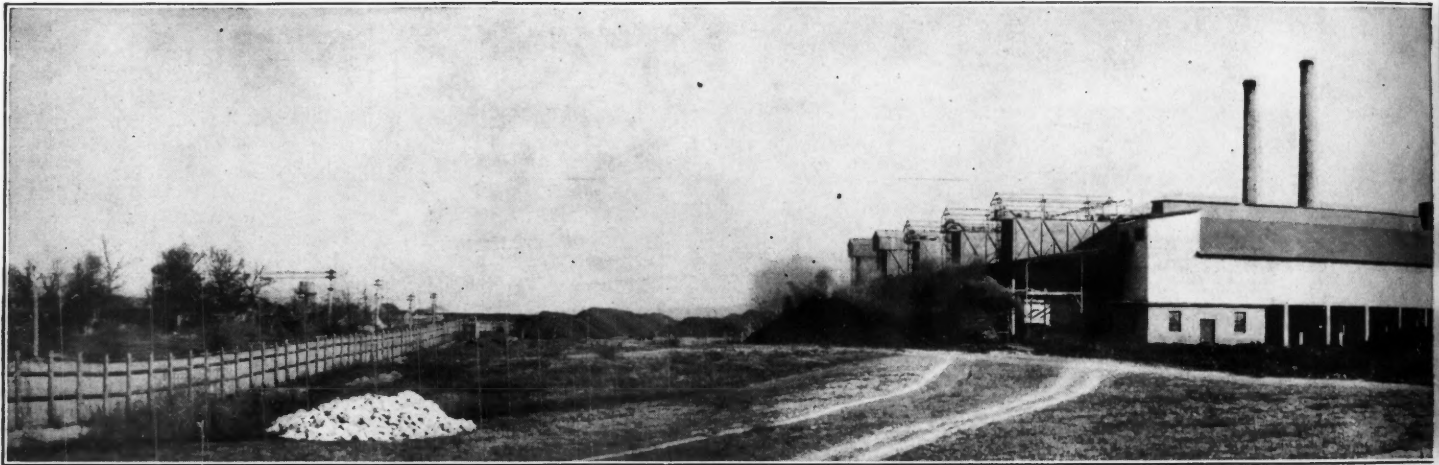
The accompanying sectional views show the Corliss double-dashpot method of cushioning this valve, occupying the full area of the upper portion of the body, absolutely insuring a positive cushion in the opening and closing of the valve and perfect alignment with the seat at all times regardless of position. The sectional views show the inside dashpot *A* attached to the valve spindle *D*, while the outside dashpot *B* acts as a bronze cylinder, which is held firmly in place by the cap bolts. The sectional views show the bypass which admits the full boiler pressure above and underneath the inside dashpot at *C*, therefore, it is balanced. A connection is made to exhaust port in the side of the valve, which communicates with the space between the two dashpots, leading to the pilot valve. Tripping the pilot valve or opening the small branch pipe, permits the pressure to escape from between the two dashpots, allowing the trip valve to close, cutting off the flow of steam. In such closure, the double-cushion feature gives instantaneous drop to within 1/8 in. of the seat, and then closing easily under control of the secondary dashpot. By turning the handwheel, the stem may be run down on to the top of the valve stem, making a steam-tight joint and causing a permanent closure of the valve. The manufacturers claim that the Steel Corporation is using about 1200 of these valves in its various works.

Photographs from the Field

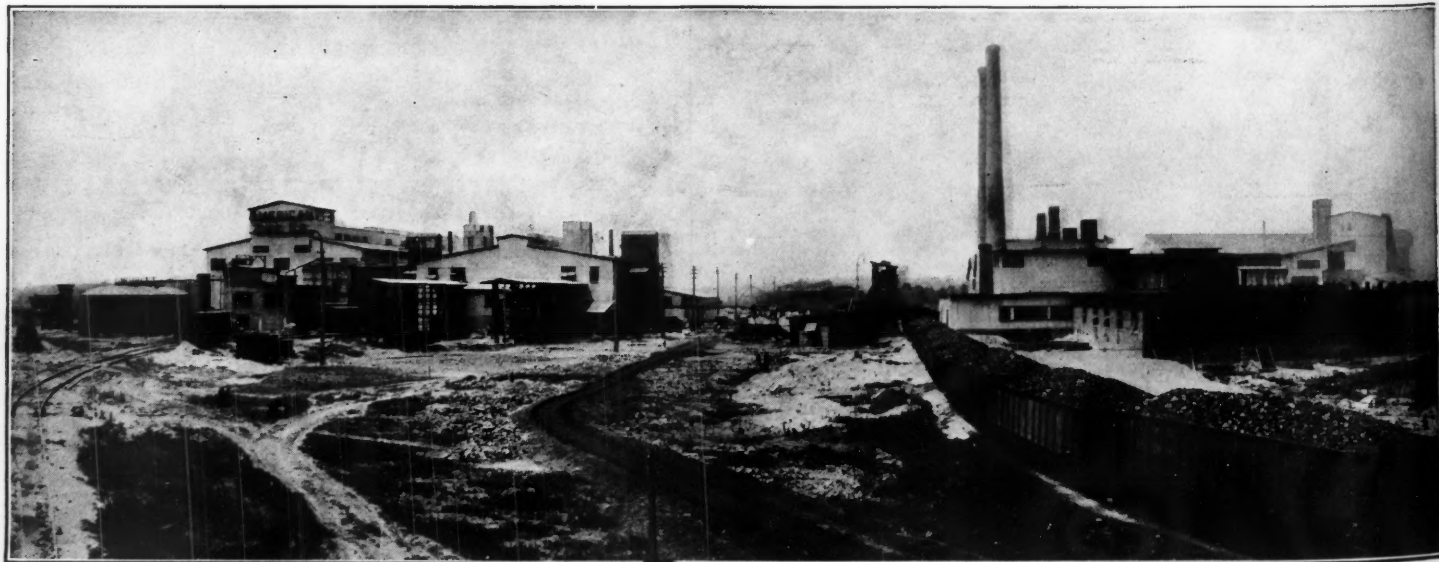


NEW 400-TON MILL OF THE BUCKHORN MINES CO., AT BUCKHORN, NEV.

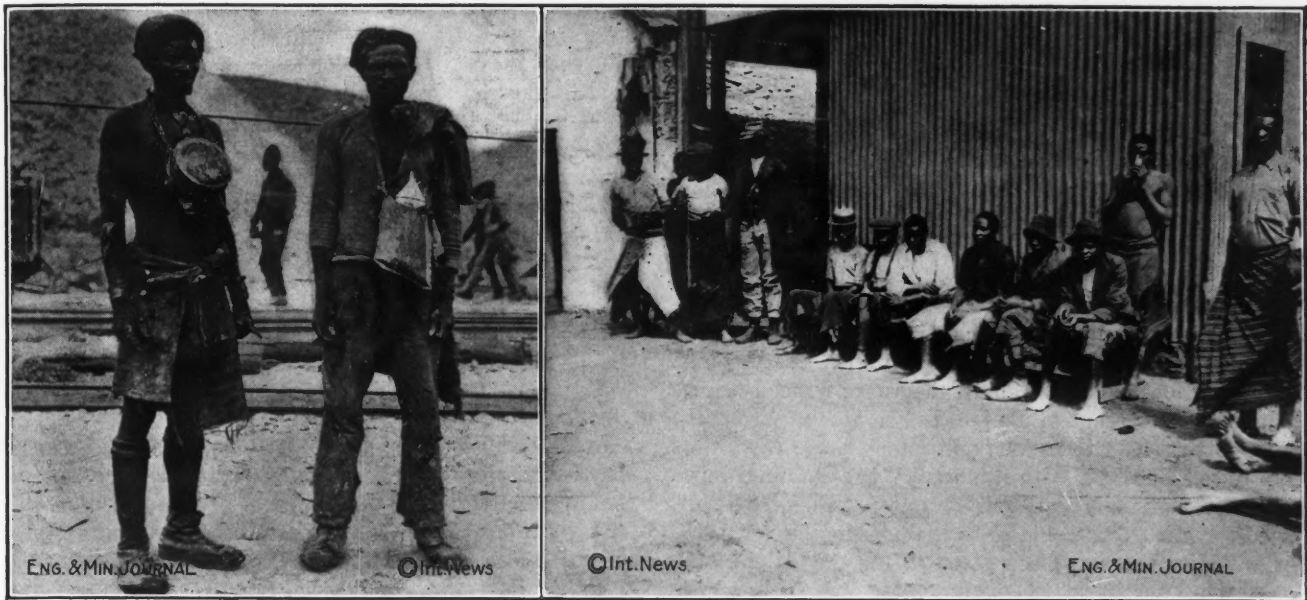
The low-grade ore is crushed by rolls, etc., instead of stamps, and cyanided; mill lately began operations.



GENERAL VIEW OF THE ZINC SMELTING PLANT OF THE
The American Zinc Co., of Illinois, is a subsidiary

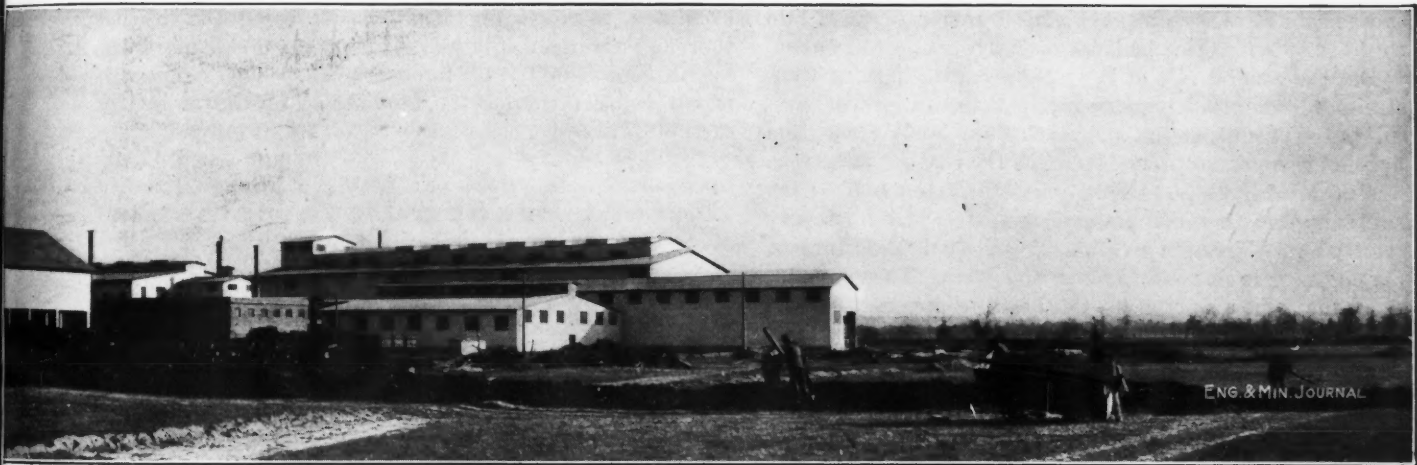


ANOTHER VIEW OF THE ZINC SMELT-
Operations were begun at this



TYPES OF BLACK BOYS EMPLOYED IN SOUTH AFRICAN MINES

In the recent labor trouble at Johannesburg a rising of blacks was feared for a time.



AMERICAN ZINC Co., OF ILLINOIS, AT HILLSBORO, ILL.
of the American Zinc, Lead & Smelting Co.



ING WORKS AT HILLSBORO, ILL.
plant in November, 1912.

Liability for Accidents in the Shaft

BY A. L. H. STREET*

The rule that although a mining company is bound to use due care to avoid injury to an employee through fall of an object into a shaft, he may be made partly responsible for his own safety, is illustrated by a recent decision of the Tennessee Supreme Court, in the case of American Zinc Co. vs. Smith, 161 *Southwestern Reporter* 494. Decedent, a machinist employed by the company, was ordered to accompany his foreman and another machinist to repair a pump in the company's mine. As the men were being lowered in the shaft, they were warned to give a signal, by rapping on a pipe, before coming from the pump to the shaft to make their ascent, since carpenters were lining the shaft with lumber. When the machinists had completed their work on the pump, the foreman directed them to go with him into the hoisting basket, without any signal having been given to the carpenters, and, as decedent was in the act of doing so, he was struck by a falling board and killed. On these facts, the court held that there could be no recovery against the mining company; decedent having no legal right to assume that it was safe to ascend, although his foreman directed him to do so, when notice had not been given the carpenters.

But the general rule of law which requires mining companies to maintain signaling apparatus in proper condition for prompt action and service was lately recognized by the Michigan Supreme Court in the case of *Panela vs. Castile Mining Co.*, 144 *Northwestern Reporter* 528; the suit being one in which plaintiff seeks recovery for injury received in blasting operations, attributed to failure of the engineer to respond to hoisting signals. The court applied the same principle to the hoisting apparatus itself, holding that the company was bound to have both the signaling and the hoisting apparatus inspected often enough to ascertain that it was in proper working order.

Government Radium Plans

WASHINGTON CORRESPONDENCE

Feeling strongly the strength of the opponents of government operation of radium mines, Secretary Lane himself has taken the field in behalf of the plan to segregate radium-bearing lands and to extract the mineral. He appeared on Jan. 26 before the House Committee on Mines, arguing that it was the government's duty to break up the monopoly in the metal and to do so not by withdrawing the lands from exploitation but by insuring the working of the ores. Secretary Lane said his plan was to divide up radium-bearing lands into tracts of 360 acres, then to allow the issuance of exclusive licenses to prospectors, and when radium was found, to take 20 or 25% for the government. He thought that the Government should not be confined to any single area, but that all lands should be withdrawn and the prospectors told to go ahead and develop the mineral with the understanding that the Government would buy the ore at a fair price and then extract the radium itself. Mr. Lane stated that with the aid of Chairman Foster, of the Mines Committee, he was preparing a new resolution which would give the

right to the Department of the Interior to buy all radium ores and to extract their contents. Mr. Lane further said that the number of demands made by hospitals in need of the radium for immediate use was greater than could be supplied from present resources and he thought that something should be done to meet the situation. Opponents of the plan protested against government withdrawal but conceded that the Government might retain the exclusive right to buy the ore and develop it.

Ontario Eight-Hour Law Suspended for Iron Mines

TORONTO CORRESPONDENCE

In accordance with the provisions of the provincial Mines Act, the Ontario government has decided on suspending the section of the act providing for an 8-hr. day for mine workers as regards the Moose Mountain, Helen and Magpie iron mines of northern Ontario. During the investigation before the passage of the act it was found that the conditions which generally made a short-hour day necessary, did not apply with equal force to iron mines, and it was accordingly provided that they might be exempted from its operation on its being shown that thorough arrangements had been made to safeguard the health and comfort of the workmen. The inspector's report being favorable the application of the mines for exemption was conceded.

Recent Braden Developments

Cable advices from Consulting Engineer Pope Yeatman give the ore reserves of Braden on Dec. 31, 1913, as 78,039,900 tons, divided as follows: Developed ore, 34,786,700; probable ore, 19,015,100; possible ore, 24,238,100 tons. The distribution of the ore reserves is as follows: Developed ore in Fortuna, 15,030,000 tons of 2.41% ore; Teniente, 16,753,000 tons of 3.18% ore; Regimiento, 2,948,500 tons of 2.85% ore; Bornite, 55,200 tons of 2.64% ore. The probable ore is distributed as follows: Fortuna, 2,625,000 tons of 2.20% ore; Teniente, 14,374,000 tons of 3.01% ore; Regimiento, 1,792,000 tons of 2.67% ore; Bornite, 121,800 tons of 2.64% ore; Centenilla, 102,300 tons of 2.20% ore. Possible ore is distributed as follows: Teniente, 22,446,100 tons of 2.74% ore; Regimiento, 1,792,000 tons of 2.67% ore. According to the assay maps, the average grade of the 78,000,000 tons is 2.80% copper, but Mr. Yeatman estimates the mining grade as 2.50% copper, on account of insufficient development in the possible and probable reserves in Teniente, and of the admixture of waste rock from the capping and the edges of the orebodies. Experiments are being continued in the treatment of the flotation concentrate; results indicate that a satisfactory sintered product can be made, but if the experiments at the Butte & Superior mill with the Kelly filter press prove successful filter pressing may be tried. The flotation concentrate contains about 68% moisture.

British Guiana Produced 62,098 oz. Gold during the year ended June 30, 1913, according to the report of the Institute of Mines and Forests. The previous year's production was 49,607 oz. The diamond industry showed an increased activity, the production for the year amounting to 75,479 stones weighing 7578 carats.

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Correspondence and Discussion

The Disseminated Lead District of Southeast Missouri

The disseminated lead district of southeast Missouri is now producing annually from 10 to 12 millions of dollars in pig-lead values. No other lead district of great commercial importance has been developed anywhere in the world during this generation. For 40 years there has been a constant increase in the consumption of this useful metal, not only in the United States, but in the world at large, of 10% annually, the consumption of each decade being approximately double that of the preceding decade. The world's future supply of lead must come from extensions of present known fields or from sources now unknown. No expert has yet estimated a much greater store of lead in the southeast Missouri district, as now developed, than will permit the present rate of production to continue for a period longer than another generation. A generation is a short time in any consideration of the needs of civilization.

The probability of the extension of the occurrence of these great unique deposits known, locally, as "disseminated" orebodies, beyond the limits of present operations in St. Francois County into the area where identically the same geological conditions exist, in Washington County, is of importance to the lead world generally, and of particular importance to Missourians.

Great but, I think, undeserved importance has been given to an ill-considered statement of the late Dr. E. R. Buckley, formerly Director of the Missouri Bureau of Geology and Mines, which if it were correct, might give color to an impression that the limit of the occurrence of these valuable deposits is the immediate neighborhood of the present developed area.

The statement to which I object is the one quoted as authority for the erroneous belief, apparently existing, that it is necessary for the strata known as the Davis shale to have been eroded in a given locality before a condition could exist favorable to the deposition of these disseminated orebodies. Of course, for aught anyone knows to the contrary, there may be an area of many square miles in Washington County where the shifting currents of the Cambrian seas may have locally eliminated this alleged barrier to lower ore deposition. But let us assume that this bugaboo still exists in Washington County, what of it? Does its existence, or non-existence, have any effect on the existence or non-existence of the disseminated orebodies in the Flat River district? Assuredly not. The opinion of no geologist, living or dead, is of great importance when other geologists, equally fitted by education and experience to form opinions, hold to the opposite opinion, and when the given opinion is, palpably, an erroneous conclusion from admitted premises, then it should be of no importance whatever. When the erroneous conclusion appears, however, in a document published by a state bureau, one created and sustained for the single purpose of furthering the industrial development of the resources of a

state; when such publications contains a valuable collection of observed phenomena of ore occurrences in lead mines—perhaps the most complete ever published; when the author is one whose sincerity of purpose and love of truth is undoubted; when reference is constantly made to such publication by everyone contemplating investment in lead mining; then this erroneous conclusion becomes of great importance and its correction a matter of grave concern.

The effects of such an error, discouraging further explanation as it does, are too far-reaching for the error to be long ignored. If it be an error, Dr. Buckley, if living, would be the first to correct it.

This conclusion of Doctor Buckley is held to be an error by the following well known geologists and mining engineers, all of whom are technically equipped and all of whom had had much actual experience in that particular field: Walter J. Jenney, Wm. B. Potter, William Bullock Clark, Arthur Thacher, H. A. Wheeler, William M. Chauvenet, and R. D. O. Johnson. These gentlemen are all able to maintain a technical argument, but statements like this of Dr. Buckley are made not only for the use of technical geologists, but are published by the State for the use of ordinary miners and prospectors as well.

I hope the gentlemen mentioned will attack this error in technical theses. Meanwhile, mindful of my deficiencies, may I give a layman's reasons for believing that this statement and the conclusions commonly drawn from it are erroneous?

The language of Dr. Buckley is: "My investigations indicate that the Davis shale overlying the Bonneterre must have been removed, in part at least, prior to the introduction of the major lead-bearing solutions."¹

This language is far from clear. It is generally assumed that Dr. Buckley meant that the Davis shale must have been entirely eroded vertically for some parts of the horizon once occupied by it in order that the descending solutions could find access to the Bonneterre formation lying below.

This statement can have no force unless one believes that the lead-bearing solutions could enter the lower horizon of the Bonneterre formation only by descending through fissures in the Bonneterre formation after the impervious shale is eroded. The statement, as construed, presupposes the absence of all fractures in the Davis shale through which the solutions might descend. It eliminates from consideration all possibility of access through channels existing vertically between the sedimentary formations and the abutting igneous rocks. It assumes as non-existent the possibility of deposition by solutions circulating in the almost limitless open area where the limestone rests upon the La Motte sandstone, in the immediate neighborhood of which the disseminated lead deposits have actually been formed.

The conclusion is proved incorrect by a dozen facts recorded in the same volume by Dr. Buckley himself. The

¹"Geology of the Disseminated Lead Deposits of St. Francois and Washington Counties," Vol. IX, Part I, p. 235.

most important of these recorded facts, and the one conclusively negating the correctness of this loose and unfortunate expression is that three-fourths of the disseminated orebodies in the lower horizon of the Bonneterre formation actually exist where the Davis shale is not eroded, and several of them have not only the uneroded Davis shale still lying above the Bonneterre formation, but have, still higher up, the Potosi formation, classified as residual material. The shaft for mine No. 8 of the Federal Lead Co.² was sunk through 100 ft. of Davis shale; shaft No. 2 of the St. Louis Smelting & Refining Co.³ passed through 30 ft. of Davis shale; shaft No. 9 of the Federal⁴ passed through 135 ft. of residual material and 114 ft. of Davis shale; shaft No. 10 of the Federal⁵ passed through 72 ft. residual material and 144 ft. of Davis shale; shaft No. 10 of the St. Joseph Lead Co.⁶ was sunk through 40 ft. of Davis shale; shaft No. 12, reaching perhaps the most valuable of the deposits of the St. Joseph Lead Co. passes through 120 ft. of Davis shale, and other instances might be given.

FACTS PROVE BUCKLEY'S CONCLUSIONS ERRONEOUS

These facts are alone sufficient to prove this conclusion as printed in this book to be erroneous, and this erroneous conclusion is the only reason ever advanced against the reasonable expectation that intelligent prospecting will disclose profitable disseminated orebodies to the west where the conditions are really identical with those of the developed area.

The general geology of this region, as Dr. Buckley and all others agree, is simple. The igneous rocks surround with their yet uneroded peaks and underlie the region; the sedimentary formations, of sand, lime and shale of the Silurian and Cambrian ages are here undisturbed by violent eruptive influences, and have been, both in the stages of formation and erosion, subject, of course, to fracture by seismic disturbance and the cooling of the earth's surface, each strata subject to such influences particularly and all, generally, to such influences as occurred after all were formed. The formations are: At the bottom, the igneous rocks; next, the La Motte sandstone; next, the Bonneterre limestone; next, the Davis shale; next, the Doe Run and Derby formations, the latter being more massive beds of dolomite, and, at the surface, where not eroded, a bed of cherty, siliceous dolomite called the Potosi formation and distinguished by its cavities and the presence of drusy quartz therein.

It is said by Buckley: "The source of the original metallie minerals of this area is undoubtedly the igneous rocks. Upon this point evidently all writers agree." "When the Cambrian Sea first encroached upon these mountains of igneous rocks the lead was removed in solution."

Buckley believes in the descensional theory of ore deposition as accounting for the present location of the orebodies. He defines the disseminated lead as the occurrence of a lead sulphide as a metasomatic replacement of the dolomite. He describes a series of fractures extending from the La Motte sandstone upward toward the top of the Bonneterre, and ending at the top of the Bonneterre and another series of fractures extending downward from the surface of the Bonneterre.

"Some of these fractures or zones of fracture continue through the thickness of the formation although many of them are relatively short and are confined to the upper, or lower, portion of this formation."

"The disseminated orebodies were in part the result of the abstraction of lead from waters circulating along channels and bedding planes in their journey from the surface to the sand, and in part from solutions under hydrostatic pressure, which rose along channels which extend upward into the dolomite from the underlying sandstone." Does not this last clause disprove the correctness of the statement objected to?

There are several well verified phenomena of ore occurrence, the relations of which to the respective ore occurrences in the Potosi and Bonneterre limestones are not satisfactorily explained by any single theory, whether ascensional or descensional. Note the differences between the two formations.

The Potosi formation has been but little explored except to a depth reached by the early miners, with primitive methods, of less than 100 ft. So far as explored, within zones of fracture, it has been remarkably productive of galena, occurring always in openings, or caves, or a series of caves along joint planes—the galena always associated with barite and the galena always crystallized.

The lead in the Bonneterre dolomite formation occurs in an entirely different form, the particles of lead appearing in the dolomite, near the base of the dolomite and as minute replacements of the dolomite. Barite is not associated with this occurrence usually, and neither is there any occurrence of the large crystals of galena so common in the Potosi limestone, except in the openings or channels directly connected with the surface.

Now if these two occurrences were coincident or were made by a common descensional process, why was the barite not carried down to the lower part of the Bonneterre formation? Why was there, absolutely, no metasomatic replacement in the Potosi formation? If the erosion of the Davis shale is a necessary condition to the deposit by the descensional method in the Bonneterre formation of the disseminated deposits at the base of the Bonneterre, how were the deposits of disseminated ore made which now exist at no less than eight valuable ore chutes in the Flat River district, the shafts to which were sunk through the Davis shale?

If there were no means of access to the base of the Bonneterre dolomite for the lead which may have been above and was then in solution, until this impervious Davis shale was eroded, where were these solutions until that auspicious moment when this Davis shale was completely eroded, and why is this lead not now found at the base of the Davis shale at points where erosion has only proceeded thus deep?

Solutions have always circulated and are still circulating in the great catchment area extending over the whole of Southern Washington County and the present Flat River district, where the Bonneterre limestone lies upon the La Motte sandstone. Solutions now, and always, have had the greatest opportunity for circulation: the sandstone is limey, and the limestone sandy, and the effect of corrosion being there general, are not these solutions the most likely direct source of the ores existing as metasomatic replacement, at such points where precipitation was possible in zones where the fractures concentrated the flow of the solutions?

²Loc. cit., p. 119; ³p. 123; ⁴p. 120; ⁵p. 120; ⁶p. 159.

As stated above, many shafts have been sunk in the Flat River district through the Potosi formation and the Davis shale to profitable orebodies existing at the base of the Bonneterre dolomite. The Potosi formation has been proven to have no other relation to the disseminated orebodies in the Bonneterre formation below than an extra roll of crust would have to the fruit in an apple pie. The Davis shale may have some effect in confirming the flow of upward solutions to the Bonneterre dolomite; though this does not decrease, but rather increases, the probability of finding disseminated lead deposits below.

As Jenney well says: "The Bonneterre formation is barren of disseminated lead deposits except in the fissure zones." Of course these fissure zones are not always readily discoverable at the surface, and any given fissure zone in the Bonneterre formation may or may not extend through the Potosi formation to the surface. Each series of the sedimentary strata both in the period of formation and erosion was subject to fracture peculiar to the particular strata, and all of the strata subject, with varying effect upon each, to a common fracture. There are, however, marked fissure zones now discoverable by the most casual investigation, throughout the whole region of the southern part of Washington County. There have been a thousand barren drill holes sunk in St. Francois County and in the neighborhood of orebodies, for the orebodies lie in chutes, and chutes exist only in the fissure zones. There have been less than 20 drill holes sunk in Washington County—omitting those drilled adjacent to the St. Francois County line. At least four of these drilled in the interior of Washington County encountered some disseminated ore. They were sunk through the Potosi formation and the Davis shale. The condition for the discovery of valuable disseminated orebodies in the southern part of Washington County appear much more favorable than the conditions appeared when the first drilling was begun in Flat River, a generation ago.

WASHINGTON COUNTY A GREAT FIELD FOR INVESTIGATION

I am confident that the application of one-tenth of the energy once expended in St. Francois Co., if applied to Southern Washington County, will reveal equally as great a field as the Flat River district. Fortunately, the early explorations in the Flat River District were not affected by any adverse expression in any official publication, and I sincerely hope that the gentlemen who are fitted by technical training to discuss these questions will either refrain from expressions which may deter timid capital from exploring this most favorable field, or will confine their theories to legitimate conclusions from admitted facts. The early prospectors had but few guides to the orebodies which they discovered. They bored near where lead had been discovered at the surface; they believed that the lower bodies of disseminated ore existed only in areas traversed by fissure zones, and while there might or might not be a connection between the surface lead and the lead beneath, and the two deposits might or might not be separated by a fractured or unfractured impervious shale, yet both the deposits above and the deposits below were formed in broken ground, and the existence of the lead above certainly indicated broken ground above and indicated broken ground at the other side or bottom, of the sedimentary formation. It seemed to be just as effective reasoning in producing results as that contained in the publication above, previously men-

tioned. At any rate, it encouraged activity, instead of discouraging it.

It may be remarked that the early geologists in Missouri, that is, those of ante-bellum days, predicted the discovery of great bodies of lead and copper sulphides at the base of the limestone near the La Motte sandstone. After many years, their predictions are beginning to be verified, and before another generation passes I venture to say that the vagaries (?) of Shumard and Van Cleave Phillips will be re-read with veneration and respect.

Now it is only fair to Dr. Buckley to say that he may never have intended this statement as to the effect of the erosion of the Davis shale to apply to the deeper disseminated deposits at all, but may thus have intended to account for the rare instances of lead occurrence in the upper part of the Bonneterre limestone; for, on p. 229 he says: "It is significant that the shallow mines rarely occur in the Bonneterre except where the overlying Davis shale has been removed. It is also noticeable that these mines are chiefly near the contact of the Bonneterre dolomite and Davis shale." . . . "The crystallized galena occurring near the surface of the Bonneterre dolomite was in aggregates of crystals attached to the roofs of caves and the walls of crevices." . . . "From these facts we are forced to conclude that the removal of the Davis shale has been an important factor in determining the location of the shallow orebodies."

If the statement be limited to the shallow deposits in the Bonneterre limestone (these occurred, of value, as disseminated deposits, if anywhere, only at Bonneterre), then that should be made plain, and the above statement of Dr. Buckley should cease to be quoted as authority for the ridiculous assertion, made by some, that there is no chance for disseminated lead deposits to be found in Washington County or where the Davis shale is not eroded.

It is worthy of note that Van Hise and Bain, of the National Bureau, based upon their own observations and those of Arthur Winslow, formerly State Geologist of Missouri, accounted for the respective upper and lower deposits by the theory of two concentrations. They say:

"It appears perfectly clear that these facts indicate two concentrations. The first was effected by a deep circulation mainly between the shales near the bottom of the Cambro-Silurian limestone and the Devonian-Carboniferous shales. At the time of this deep circulation the disseminated ores in the limestone and shales were deposited. The reducing and precipitating agents were clearly the organic matter of the limestone and especially of the shales. It is notable that the deposits in which there is evidence of a first concentration, with comparatively little effect by a secondary concentration, occur in the district in Missouri in which there has been the deepest mining." It may be added that when deep mining, preceded, of course, by deeper boring, is ventured upon in Washington County, the deposits of this period of concentration will still be found unaffected by the Davis shale lid, which may have been put on after the deposits were formed.

There are many phenomena yet to be observed before final conclusions should be drawn as to the exact process by which these present deposits were formed. The noting of the existence of the nickel, cobalt and copper sulphides in great quantities only in close proximity to the igneous rocks; and their absence, in quantities of com-

mercial importance, at distance from the igneous rocks, the presence of zinc north of the Valle mines fault and the absence, generally, of this mineral to the south; the absence of barite from the disseminated deposits; careful analyses of all of the limestones and shales; and the duplication in the laboratory of all of the assumed conditions and processes that are now possible to be reproduced, might properly precede dogmatic dissertation and the formulation of theories of ore deposition, in official publications. Let me conclude this by quoting William Bullock Clark, of Johns Hopkins University, who devoted as much time to the study of Washington County as any Missouri geologist has. After examining all the phenomena observable, and all of the theories of ore deposition, he said:

"Whether disseminated ore in proportionate quantities will ultimately be found in Washington County cannot be with certainty determined, although the surface indications strongly point in that direction, while a few widely separated drill holes have shown that the disseminated ore actually occurs. Much more prospecting will be required before the extent of the ore can be finally determined. However that may be, the deposits of surface, pipe, and stock-work lead are of great extent and value and can be worked with profit even if the deeper ore is not found in large quantities, which seems hardly probable will be the case; in fact, the indications point to Washington County rather than St. Francois County as the center of the disseminated ore belt."

H. J. CANTWELL.

St. Louis, Mo., Dec. 8, 1913.

Lake Superior Wages, Etc.

In the JOURNAL of Dec. 13, there is an editorial headed, "Lake Superior Wages," which clearly shows that the JOURNAL is not well advised, either as to the labor conditions in this district prior to the beginning of the present strike or with what has been done by the companies to date. It is a long story, and I am too prejudiced a party to undertake to give it, but I think that the ENGINEERING AND MINING JOURNAL, which is the leading representative of our calling, should try to give a reasonably accurate and reliable account of our troubles whether or not it undertakes to place the responsibility for them.

Wages have remained exactly where they were before the calling of the strike except in the case of our own tramming rate, which was formerly \$2.31 a shift and is now \$2.50, and no minimum-wage rate has been established by any company in this district. Wages for the same work varies according to the conditions in each mine. For instance, there are tramming rates of \$62, \$65 and \$71 for 26 shifts, and also tramming is done on contract where earnings are higher than any of these. In our own mines tramming is done by day's pay and the rate is \$2.50 per shift, while the rate for miners working on one-man Leyner machines is \$3 per shift, which latter rate is the same as before the strike. Beginning Dec. 1, an eight-hour schedule was inaugurated underground and at the stamp mills and a nine-hour day was given to surface and shop forces. Agitation for this eight-hour day dates back to last winter when the State Legislature was in session and a bill for an eight-hour day was introduced but died in the hands of committees. We, who are in charge of mining operations in this district, believe

that the rates of pay, hours of employment and living conditions are the best of any mining district in the United States and would be willing to leave the justification of this opinion in the hands of any unbiased person or persons.

The simple fact is that the Western Federation of Miners has been working to establish a foothold in this district for several years, and with the assistance of the socialistic and discontented element which existed here as in all other communities, tried to complete their grip upon us by inaugurating the present strike. Their methods have been the same as they have employed elsewhere, the rankest kind of intimidation, even to cold-blooded murder. As you know, it is extremely difficult to fasten these crimes upon an organization in a manner that will convict in courts of law.

In addition to all of the usual support which such an organization receives at the start from local officers of the law and others, they have had the assistance of the Secretary of Labor. This Federal office has shown clearly by the attitude of its representatives who have been on the ground that it has but one object and that is the furthering of the interests of this organization. No effort whatever has been made by the Department of Labor, even though requested by us to do so, to investigate in any way the performances of the W. F. M., the number or character of its membership before the calling of the strike, or anything else that in any way might discredit it in the public's estimation. We asked the Department to investigate the conditions of the miners in Butte, where the W. F. M. is in supreme control, but it told us it knew nothing about the conditions in Butte. The simple truth of the matter is that the present strike is a powerful and concerted effort on the part of this organization to graft itself upon this district against the opposition of the companies, the leading citizens and a large majority of the employees.

Today, in importing men we have to guard them from the time that they are collected until they arrive, and we have had parties of such men openly attacked and slugged in the large railway stations of Chicago and on the streets of that city. Between 40 and 50 per cent. of our old employees left the district during the first week or two of the strike and they are now having difficulty in getting back, as they are molested at all points in the vicinity of Chicago and at places near-by. We are fighting to maintain possession of our property and in spite of the terrorizing and murdering that have taken place, our old employees are gradually returning and getting sufficient courage to resume work and our output is steadily increasing.

I agree with you in your estimate of the value of altruism, as with virtue, it is strictly its own reward, but I differ altogether with you in stating that economics was against us, but on the contrary claim that it is simply because economics is with us that we are defeating this murderous organization.

OPERATOR.

Painesdale, Mich., Dec. 20, 1913.

[The report of the granting of an eight-hour day and \$3 minimum wage was published widely in the newspapers and we had, as we supposed, confirmation of it from official quarters. However, the causes and conclusions of the Lake Superior troubles are matters respecting which opinions will probably differ.—EDITOR.]

Editorials

The World's Production of Spelter

Henry R. Merton & Co., Ltd., with its usual promptness, has issued its report of the world's production of spelter in 1913 under date of Jan. 13, 1914. Its total is 990,850 long tons. This agrees closely with our own total reported on Jan. 7, 1914, viz., 1,001,100 metric tons, or 985,300 long tons.

We have previously discussed the great increase in the American production. The European production also showed a large increase, which would have been larger had not the curtailment, prescribed by the Convention in certain countries, come into play in the latter part of 1913.

The interesting features of last year's statistics are connected with relatively minor parts of the production, viz., the increase in Australia from 2260 to 3665 tons, and in Sweden and Norway from 8000 to 17,000 tons. The latter is wholly electrically smelted spelter, the product of one works in Sweden and two, or more, in Norway. The major part of it is, we believe, the result of resmelting dross and scrap, but some of it is derived directly from ore.

✽

Taxing Mineral Output

Now comes a renewal of the old proposal, strongly indorsed by the Michigan granges, to tax the copper output of Michigan per pound, this time the idea being a tax of $\frac{1}{2}$ c. per lb. If one will study the reports of the Michigan companies, it will be seen that this is a most admirable measure (for the farmers) as it bids fair to increase the supply of farm labor.

The Michigan mines, if we except the prosperous Calumet & Hecla, which haunts Secretary Wilson's dreams, and about four others, say Quincy, Ahmeek, Copper Range and Osceola, have not been prosperous. Their assessments exceed their dividends. The mines are growing deeper, the copper tenor lower, the cost of labor higher. It is doubtful, even though Moyer and other disturbers could be eliminated tomorrow, whether the Michigan mines could regain their normal output in 12 months. Moreover, during the strike, consumers have discovered that they can use electrolytic copper equally with Lake. We believe that to a great extent, the price differential between Lake and electrolytic copper will disappear in the smoke of the present strike, and that Michigan copper will sell on a direct competitive basis with electrolytic hereafter.

To us, it appears doubtful whether certain small Michigan prospects can stand the expense of reopening. Add to the disadvantages now inherent, a direct tax of about 3 to 4% of the normal sale price of the product, and it certainly spells extinction for many mines. Pennsylvania has a monopoly of anthracite. A tonnage tax can be passed on to the trained and obedient consumer. Mich-

igan has to compete with the copper of the world. A bullion tax will rest with the producer.

The idea, of course, is that the copper production is a depletion of the natural resources of the state, and should inure to the benefit of all. It is seldom considered that agricultural exports mean soil exhaustion. Potash, phosphate and nitrogen have been taken from the soil. We advise a tax of $\frac{1}{4}$ c. per bunch of celery sent out of Michigan, but somehow we do not expect to see the granges blow up with enthusiasm over the idea.

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Progress or Decadence?

In the rejuvenation of a process or system formerly used, but replaced by one supposed to be better, some critics claim to discern the decadence of an art. Only recently the metallurgical world has been accused of this crime because of the reacceptance of some of the older methods, such as sand leaching and slime decantation in the cyanide process. Nothing, however, could more strongly indicate the opposite of decadence than these very examples of the present trend of opinion. Each one represents a distinct step forward; progress of the better kind.

When sand leaching began, it was believed to be the only method of cyaniding ores, and the sand was required to be in a condition now recognized as coarse. The change to all-sliming went to other extreme, and while it has been found suitable to many ores, there are others to which its application is unreasonably costly. Experiments have shown that extremely fine sand can be successfully leached if it is thoroughly cleaned of slime, and also that light, natural slime is cheaply agitated when it contains no heavy sand. Hence, the step in advance consists of somewhat finer grinding and a clean separation. It is not a retreat to an older method, but an advance to a better one. The same is true of decantation. It is the continuous, counter-current system, which is coming into use; not the old single-tank intermittent process. It has been successful enough to replace filtering, even in some mills where expensive filtration plants had already been installed. The advance is as clearly marked. In common with all valuable treatment schemes, neither of these is of universal application, but they both represent progress, not decadence.

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Ocean Freight Rates

At different times we have referred to the high rates which have prevailed in the ocean-freight trade, and its more or less direct effect on the cost and price of metals. The boom in freight rates has lasted for nearly three years, and for most of that time the profits of ship owners have been large; so large, in fact, that tramp steamers are said to have paid for themselves in two or three years' work. The high rates were not confined to any particular line, or special trade, but extended all over the commercial world.

The end of this boom has come now, and more quickly than was expected. The high profits made by vessels naturally stimulated shipbuilding; British and other European shipyards have been turning out new ships with almost unexampled activity. And about the time that this new tonnage was coming into the market, there was a collapse in the industrial activity of nearly all the exporting nations. A smaller tonnage was to be divided among a much increased number of ships, and the result has been the rapid collapse of rates.

As an example it may be noted that the rates from Cardiff to South American ports within two or three weeks have fallen 33%; to India 20 to 25%, and to other countries 25 to 30%. From other British ports equal reductions are reported.

The reduction has not yet reached trans-Atlantic rates, and the combined lines are still keeping up their charges. It is altogether probable that they will not be able to combat the conditions long, and a reduction may be expected before long. In fact, there are already reports of a war in rates between the chief German lines, in which the British lines may take a hand.

The situation is not promising for ship owners, as during the boom operating costs have increased and the seamen of nearly all the chief maritime countries have secured advances in wages which they will not be disposed to give up. It will take a big revival in general trade to fill up the new tonnage and bring rates back to where they were two years ago.

An Advance in Stockpiling

Along with steam-shovel mining, the caving system and sinking through soft water-bearing formations, stockpiling is an operation distinctive of the Lake Superior iron ranges. This enforced rehandling of great tonnages as a regular part of mining operations is somewhat astonishing to the engineer visiting the region for the first time. No less astonishing is the fact that the literature on this subject is extremely scanty. Considering that it requires probably an annual expenditure of almost half a million dollars, and that of a mine cost averaging well under \$1, it represents from 2 to 5c., some description would seem to be well justified. The article by Mr. Haight, in this issue, therefore is of more than ordinary interest, as helping to fill a long existing vacancy in mining literature.

Stockpiling for a good many years went on about the same. Recently three distinct steps in advance have been made; namely, the construction by the Cleveland-Cliffs company of a permanent steel and concrete trestle, the installation by the Penn Iron Mining Co. of a more convenient and flexible endless-rope haulage system, and the development at the Harold mine of a side-swung, side-dumping system, involving certain definite economies. Mr. Haight's detailed description of this last method, his comparison with the older method, and the approximate costs which he includes—it is like drawing teeth to get costs from the iron-range operators—are worth careful reading. Our greatest mining company, the Oliver, like its gigantic parent, the Steel Corporation, has often been accused of conservative, if not reactionary, tendencies. It is not perhaps unfair to say that the motto of the company has read, "Better be safe than Sorry." A fair consideration, however, of the many great improvements that the company has contributed to mining technique will refute any

charge of undue conservatism. The development of an economical and practicable system of concentrating non-magnetic iron ores and the building of the Trout Lake washing plant is the greatest feather in its cap. Among the many other less important improvements, this new stockpiling system must be included. Its adoption by other companies is the proof of its success. It is a fact that, whatever new feature the Oliver company introduces into mining, it makes stick.

Gold to India

The absorption of gold by India continues at a heavy rate, though last year showed a rather smaller demand than its predecessor. In large measure the gold exports to India are a matter of recent years. In part they supplant some of the silver which has been taken by that country, but in part also they are an entirely new growth from recent prosperity. So far as they take the place of silver, they affect that market directly, by decreasing the demand for it. This is a serious proposition, since the supply of silver is quite sufficient, and is likely to increase and not to decrease. It is produced so largely in connection with other metals that a reduction in the demand does not necessarily mean any diminution in the supply.

On the other hand, the gold requirements of India decrease the amount available for commercial purposes. A large part of the gold sent to that country is in bars, which are taken for the manufacture of jewelry and generally for hoarding purposes. The coin exported is a floating supply, most of it remaining in the circulation reserve, or being re-exported; but the bars stay in the country.

The absorption of the precious metals in the East is a question which has been discussed for many years, but without altering the fact. The absorption still persists, the only change being in the substitution of gold for silver, which is now attracting attention.

The Invisible Supply of Copper

It has been a common idea that the invisible supply of copper and spelter at the end of 1913 was less than at the end of 1912, but the report of the American Brass Co. has been referred to as pointing the other way. On Dec. 31, 1913, it inventoried \$6,481,866 in "merchandise, raw, wrought and in process." On Dec. 31, 1912, its inventory was \$6,254,238. However, the business of this company has been increasing constantly and its inventory of merchandise has been larger at the end of each year since 1907 than at the end of the previous year. Manifestly, no very firm deductions can be drawn from those figures. We have heard of several big copper manufacturers who at the end of 1913 had no stock worth mention and in one case we know such to be the fact from our own observation.

As anticipated, the gold production of the Transvaal shows a considerable decline in 1913; this was even greater than estimated, since the small December production of 672,815 oz., was 103,591 oz. less than that of December, 1912. In that year the gold won in the Transvaal reached a total of 9,124,599 oz. fine, or \$188,599,260. In 1913 the total as now officially reported, was 8,794,824

oz., or \$181,789,012; the decrease being \$6,810,248, or 3.6%. This is not a considerable decrease, allowing for the strike of the miners and other causes; but the fact that it is not an increase gives some concern to investors in Transvaal mines. The gains year by year since the general resumption of mining after the Boer war have been so steady and considerable, that the suspension of an increase at all gives rise to some questions as to whether the Transvaal has not reached the summit of its production. This is hardly to be determined, however, by the experience of a single unfavorable year.

BY THE WAY

A paragrapher has suggested that if this radium agitation does not end, the name of the State will have to be changed to Coloradium.

We have reserved a parlor-car seat in the Utopia limited for the metallurgist who begins a historical article without a reference to Tubal Cain.

In a mining report lately received occurs the following classic: "The ore is flinty in nature and would be called a quartzite quartz, and is full of specular iron sulphides and henatite of a pitch blend nature, very little understood."

Dr. Isaac A. Hourwich, secretary of the Cloakmakers' Union, has lately been the subject of some criticism, it having been said that he is obstinate, unwilling to listen to advice, etc. It is a far cry from the affairs of such a labor union to those of the mining industry, but it is the fact that the same Doctor Hourwich conducted the last census of the mining industry of the United States.

Testimony before Congressional committees is apt to consist of half-truths, even when given by persons who know, as witness many statements in tariff hearings of former days. In the radium matter, Joseph M. Flannery, of Pittsburgh, knows a good deal and whether or not he told all he knew, his remarks were interesting. He said that his company had spent in three years \$650,000 to produce two grams of radium. This cost \$480,000, he estimated, and brought in \$240,000. In April, he said, the company would be producing one grama month. "There is enough radium ore in Colorado to supply the world five times over," remarked Mr. Flannery. "Only 200 grams are needed for the whole United States. I will undertake to deliver to the government in five years, from Jan. 1, 1915, 200 grams of radium at a maximum price of \$80,000 a gram."

Reports have come out of Mexico from time to time that the rebel forces were operating mines that had been closed by owners who found it impracticable to operate under the conditions prevailing. Now comes a dispatch from El Paso that the "gold and silver mines in Chihuahua are being looted of thousands of tons of rich ore, which had been stored at the mines for shipment when railway communication was reopened. To prevent the exportation by Villa of the rich ores, mine owners have

combined to establish agencies at ports of entry in rebel territory to warn American customs officials when the stolen ore is brought to the border and to protest against its entry. Twenty thousand tons of rich ore have been taken from the Naica mine, in Chihuahua, and other mines have been as heavily looted, it is claimed." Doubtless there has been much exaggeration as to the extent of rebel operation of existing mines, but such as has been done will be one of the delicate questions for post-revolution adjustment. Shall it be at "three times the gross," for willful trespass?

Arthur D. Little, in his presidential address before the American Chemical Society at Rochester, N. Y., Sept. 9, 1913, remarked that the Gayley invention of the dry-air blast in the manufacture of iron involves a saving to the American people of from \$15,000,000 to \$29,000,000 annually. A modern furnace consumes about 40,000 cu.ft. of air per minute. Each grain of moisture per cubic foot represents one gallon of water per hour for each 1000 cu.ft. entering per minute. In the Pittsburgh district, the moisture varies from 1.83 grains in February to 5.94 grains in June, and the water per hour entering a furnace varies accordingly from 73 to 237 gal. In a month a furnace using natural air received 164,500 gal. of water, whereas with the dry blast it received only 25,524 gal. A conservative statement, according to Professor Chandler, is that the invention results in a 10% increase in output and a 10% saving in fuel.

The prevailing scarcity of jobs and abundance of engineers will not have escaped the notice of many of our readers. The general exodus from Mexico is, of course, largely responsible. As a sign of the times a recent "want ad" in a New Mexico paper and one of the answers are significant. The advertisement was as follows:

Wanted—A competent man for shift boss to work in a wet shaft. Must understand pumps and gasoline engines. Spanish speaker preferred. Only experienced man need apply. Salary \$75 per month.

The significant answer was:

Dear Sir—I read your advertisement in the "Bugle" for a shift boss at your mine and noting the qualifications necessary I feel confident that I can fill the position. I am 32 years old, a graduate of Boston "Tech.," served several years as a mechanic, and have spent the last 10 years in Mexico and Arizona as shift boss and foreman of Mexicans. The only qualification I lack is the ability to swim and if the water is too deep I may not be able to hold the job.

With even plain shift bosses at \$75 in the Southwest, let alone technical graduates, almost any mine should be able to afford a full set of foremen and a staff of engineers.

The Wisconsin Steel Co. built itself a fine new concentrator near O'Brien Lake on the Mesabi range. Although only one unit, it will wash 8000 tons of ore per day. The tailings are discharged into a pond and the overflow enters the lake. The company has carefully sewed things up so that no complaints would come from owners of the shore line; and it was expected that little material would get to the lake anyhow. But the hematite in the tailings seemed possessed of a wanderlust. Not only did it flow into O'Brien Lake, but proceeded on down to Swan Lake, it is said, into which O'Brien Lake drains. Now the red coloring power of a little hematite slime is equaled only by the green-staining ability of oxidized copper. Swan Lake, it is stated, soon began to assume the color of that slow poison known as "Dago

red." Certain publicans of Hibbing had summer cottages on Swan Lake and these publicans declared they were dismayed and disgusted by the discoloration of their formerly pellucid water. Just why publicans should have been displeased at such a color transformation, is not clear; perhaps they found it tantalizing; possibly they saw a chance for profit. At all events, they or their lawyers are said to have sued the Wisconsin Steel Co.—who shall say in such cases whether lawyer or client be the real plaintiff?—alleging infinite damage to their valuable property holdings. Somehow to the company this action bore the earmarks of a holdup; nor did it care to be held up. It seems that O'Brien Lake is fed by two small streams, both on one side, with the outlet to Swan Lake at one end. So the company put a steam shovel to work and is digging, ditching and diking in such a way that the bays on the side of the lake where the streams enter will be diked off, the points cut through and at the end a large ditch excavated to enter the outlet stream some way below the lake. Thus the clear entering water will be confined to a new channel and conveyed to Swan Lake safe from contamination, and most of O'Brien Lake shut off as a stagnant pond.

✽

"Speaking of precision," writes in a Western assayer, "I am reminded of the mental gymnastics of the manager of an alleged mine at which I was once employed. Being 'spiritually' advised (at about \$5 per seance, I guess) that his property was rich beyond the dreams of a Croesus and that its very richness gave rise to a complexity of compounds, due to the abundance and diversity of rare elements present, which defied hitherto developed scientific methods of determination, he engaged in extensive original research absolutely unhampered by any knowledge of the commonly accepted tenets of chemical science. One of the startling results of his industry was that what we had mistakenly called marcasite, or white iron pyrites, became platinum. Of course, there were a few associated elements to the number of 15 or 20, such as osmium, iridium, radium, etc., which, I suppose, made it appear like marcasite to our conventional minds. But, of course, it was platinum and hence the manager one day had several hundred pounds of 'ore' brought to the assay office. This ore was crushed to about 80 mesh, and he spent a couple days panning it, securing possibly half a pint of concentrates. Addressing me, he said, 'Now, I know this is platinum, but you are so d——n skeptical, etc. (or words to that effect), that we will call it silver.' Under the circumstances, I could not see what good it would do me to object even though he might have called it peanut candy, so silver it was, and he proceeded to weigh it. For this purpose he rejected the pulp scales or any of the several counter scales around the plant on account of their lack of precision and chose the button balances which I had but recently adjusted to their maximum sensibility. The operation of weighing naturally took the better part of a day as he weighed each panful to the hundredth part of a milligram, but the total weight was finally secured. 'Calling this silver and figuring it at 50c. per oz., he said, 'I find that it is worth \$16,500 per ton.' Clearly this was a remarkable concentrate which could be of greater value than an equal weight of the pure metal, which was alleged to be its most valuable constituent.

However, it was a mere arithmetical blunder of absolutely no consequence, as was rather caustically pointed out to me, particularly in view of the absolute precision observed in the weighing operation and the large margin of safety allowed by calling platinum silver."

✽

A well known engineer sent his friends this year a card of New Year greetings, in which were the following verses, presumably by himself:

MODERN ORE DRESSING

It's Sink or Swim This Year 1914

Our fathers told, oft and again,
Of dressing ores with water;
In jig, in buddle, on inclined plane,
To free the minerals sought for.
The varying densities required each time,
Were seldom quite remote;
Ores were preferred that made no slime,
For slime, alas, would float.

The ores of slimey equidensity
Our forebears sorely tried.
In sinking slime and raising gangue,
Good men from worry died.
Then air was tried to do the work
Say, zinc to free from lead;
No losses here in slime could lurk,
Yet metal's lost instead.

Magnets, both strong and weak we use,
Machines where static currents meet;
These, grains repel, attract, diffuse,
But dust not one could treat.
Magnetic fields and puffs of air,
Have filled no leading part,
In dressing ores. With saving fair,
Ore dressing is an art.

Carrie¹, our city's wise daughter,
The scripture read with vim;
Knew fresh cut wood cast on water
Caused an iron ax to swim.²
This first flotation's not understood,
The Elisha's words are clear;
Was it oil of cedar, or eucalyptus wood,
Or the crude oil so near?³

Carrie whipped oils, thin and thick,
Animal, vegetable and fish;
Acid she added to make the oil stick,
Then fed ore onto the dish.
Dense minerals floated on froth,
Slime settled out of the ore;
Fine mineral reached the top of the broth,
Slime gave trouble no more.

Thus now at will we sink or swim
Minerals of near gravity,
Depending on our choice or whim,
Or on the ore's depravity.
That ancient bugbear slime's benign
Now aids us in the art,
With acid, oil, air blended fine,
Helps float the ores apart.

¹Carrie J. Everson, a Denver school teacher, an original flotation patentee.

²Second Kings 6:6.

³On the plains of the Jordan, Dead Sea. Gen. 19:28. Isa. 3:9-10.

The technical accuracy and humor of the above remarks meet with our appreciation and approbation, even if Pegasus occasionally gives signs of being lame in his feet. We expressed this opinion to our friend. He replied: "Pegasus certainly went lame in several verses, but look at the words he had to deal with. No muse ever had a worse series of technical words."

Zinc Production of the World

Messrs. Henry R. Merton & Co., of London, have issued their statement of the production of zinc or spelter for the calendar year 1913. We give below the statement for three years past, the figures being in long tons:

| | 1911 | 1912 | 1913 |
|--------------------------|----------------|----------------|----------------|
| Belgium..... | 192,020 | 197,045 | 194,590 |
| Holland..... | 22,375 | 23,555 | 23,940 |
| Germany—East..... | 153,715 | 166,425 | 167,440 |
| Germany—West..... | 92,735 | 100,370 | 111,055 |
| Great Britain..... | 65,900 | 56,330 | 58,215 |
| France and Spain..... | 63,210 | 71,025 | 69,905 |
| Austria and Italy..... | 16,610 | 19,295 | 21,300 |
| Poland..... | 9,780 | 8,625 | 8,500 |
| Norway..... | 6,575 | 8,000 | 17,000 |
| Total Europe..... | 622,920 | 650,670 | 671,945 |
| Australia..... | 1,700 | 2,260 | 3,665 |
| United States..... | 263,260 | 309,560 | 315,240 |
| Total..... | 887,880 | 962,490 | 990,850 |

Production for 1913 shows an increase over 1912, of 28,360 tons, or 2.9%; over 1911 of 102,970 tons, or 11.6%. In the 10 years, 1904-1913, the production of spelter grew from 615,290 to 990,850 tons; a gain of 375,440 tons, or 61%. The production of the United States grew from 163,220 to 315,240 tons, an increase of 152,020 tons, or 93.2% in the ten years.

Petroleum Lands for the Navy

WASHINGTON CORRESPONDENCE

For some days past conferences have been in progress between members of the administration and the chairman of the House Naval Affairs Committee, as well as others with respect to a plan for government ownership of oil lands and pipe lines for furnishing the navy with its own fuel. Experts in the employ of the Navy Department have furnished the committee a statement, describing the scheme and making detailed recommendations. Senator Gore has also urged upon the Interior Department a measure providing for a pipe line from Oklahoma to the Gulf of Mexico. It is claimed that the price of oil has increased about 50% during the past year and that at this rate it will not be possible to continue the policy of using oil as a fuel in the new naval vessels. Hence the desire to follow out the plan sketched in Secretary Daniel's annual report where he called for a scheme of government ownership. The lands that are apparently in view for government exploitation are in Oklahoma and California, with a possibility of some in Alaska. The ones favored are those in Oklahoma. Lieutenant-Commander Boyd reports that the saving possibly to be made would be \$1,000,000 annually. He suggests an appropriation of \$500,000 to lease a quarter section of land, with additional provision for drilling and with authority to the navy to sell oil if it has a surplus. Last year 400,000 bbl. of oil were used by the navy and it is expected that 700,000 will be used next year. The statement filed with the committee goes on to say: "Under war conditions there might be periods when we would be using at the rate of five or six times that quantity. We are paying \$1.39 a barrel for oil at Port Arthur, and the best information obtainable points to a further increase in price."

The time is not yet ripe for any recommendations for producing in California. The titles of lands in the navy petroleum reserves are not clear, and the outcome of the suits for recovery of lands therein from the Southern Pacific cannot be foreseen. Moreover, the status of lands will be influenced by the future decision in the Mid-West Oil Co.'s

case, which will determine the status of claims at the date of the order of withdrawal from entry of these lands.

No complete investigation of claims has yet been made by the General Land Office, which must be done before the Navy Department can, with justice, begin any operations therein. Again, much of the oil lies deep in the ground, which imposes an unfavorable and highly speculative condition. Probably the most logical method of beginning operations in California is to await the outcome of the present suits for recovery of oil lands, and, in case of decision favorable to the Government, to take over the developed lands which may revert to the Government, as additional portions of the navy petroleum reserves.

The U. S. Steel Corporation

The preliminary statement of the United States Steel Corporation for the fourth quarter of 1913, shows that the net earnings over ordinary working expenses and renewals were: October, \$11,430,461; November, \$7,392,166; December, \$4,213,722; total for the quarter \$23,036,349. The following shows the result for the quarter and for the year 1913, taking the sum of the preliminary statements as made at the end of each quarter:

| | Quarter | Year 1913 |
|------------------------------|---------------------|---------------------|
| Net earnings..... | \$23,036,349 | \$137,133,363 |
| Depreciation, reserve, etc.. | \$4,067,989 | \$25,915,272 |
| Interest and sinking funds. | 7,311,962 | 29,247,850 |
| Adjustment of credits..... | ..... | 796,224 |
| Total charges..... | \$11,379,951 | \$55,959,346 |
| Surplus..... | \$11,656,398 | \$81,174,017 |
| Dividends paid..... | 12,658,700 | 50,634,802 |
| Balance..... | Def. \$1,002,302 | Sur. \$30,539,215 |

The usual dividends of 7% on preferred and 5% on common stock were paid. An appropriation of \$15,000,000 for new construction was made, leaving a balance of \$15,539,215 surplus for the year. As compared with 1912 the net earnings for 1913 show an increase of \$28,955,056; there was a considerable gain for three quarters, in part offset by a loss of \$12,149,208 in the fourth quarter. This result fully corroborates the course of the steel business for the year, as given in the weekly reports. The total net earnings for 1913 have been exceeded only three times, in 1906, 1907 and 1910.

The unfilled tonnage on the books on Dec. 31, 1913, was 4,282,108 tons, a decrease of 3,650,056 tons from Dec. 31, 1912. The tonnage was the lowest reported since Sept. 30, 1911.

Copper for Firebox Stays

In a paper published by the Institute of Metals, in London, August, 1913, F. Johnson gives results of his experiments to improve the properties of copper used in firebox construction. As is well known, the presence of arsenic counteracts this tendency of copper to absorb gases; hence the problem was to produce an arsenical copper free from oxygen, by the addition of a suitable agent which should be cheap, should not form a harmful combination with arsenic, and should not detract from the other desirable qualities of the metal.

Silicon, added in the form of ferrosilicon, was found to fulfill the requirements. It was introduced into the copper by forming a special alloy of copper with a 60 to 65% ferrosilicon; the iron was found to have a good effect on tensile strength. As an example, a bar containing Cu, 98.56; As, 0.35; Si, 0.80; Fe, 0.21%; O, none, was found to have a tensile strength of 18.25 tons per sq.in., or 22% greater than one containing 0.089% oxygen, with no arsenic, silicon or iron.

PERSONALS

A. E. Drucker has gone from Italy to Algiers.

J. V. N. Dorr has left New York for a three-months' business trip in the West.

E. V. Burns, of the firm of Simonds & Burns, has returned to New York from abroad.

B. C. Austin has been appointed manager of the Flint Mines, Ltd., at Flint, Idaho.

Lieut. Col. R. G. Edwards Leckie has returned to Vancouver, B. C., from a visit to Great Britain.

James L. Bruce, general manager, of the Butte & Superior Copper Co., Butte, Mont., is visiting New York.

John L. Malm, of the Malm-Wolf Co., and S. A. Ionides, of Denver, have gone to the Cœur d'Alene District on professional business.

Harry R. Miller, who has been inspector of the mines of the Pittsburgh Coal Co., on the Monongahela River, is appointed district manager of those mines.

James E. Harding, until recently foreman of the Mina Santa Francisca at Asientos, Aguascalientes, Mexico, is now with the National Copper Co., at Mullan, Idaho.

E. Jacobs has returned to Victoria, B. C., from a month's trip to interior mining camps, including Boundary, Rossland, Sloecan, and a short visit to the Cœur d'Alene district of Idaho.

Capt. Harry Johns, superintendent for the British Columbia Copper Co., in Kootenay district, has been seriously ill at his home in Nelson. At last accounts his condition had improved.

William S. Mann is superintendent of the construction and installation of an all-sliming cyanide mill for the Socorro Gold & Silver Mines, Ltd., of London, at Vale de Angeles, Honduras.

The following have been elected to membership in the Mining and Metallurgical Society of America: Walter Maynard Drury, E. A. Cappelen Smith, Alexander P. Rogers and Julius H. Susmann.

H. Cecil, representing English capitalists, who has been in the northern Ontario mining camps for the past year, has sailed for England in connection with the purchase of several claims in the Kirkland Lake district.

Robert Sticht, general manager of the Mount Lyell Mining & Railway Co., of Tasmania, is on a 12 months' holiday, which began in November last. Before his departure from Tasmania a handsome presentation was made to him by his friends and employees.

Prof. H. C. H. Carpenter, who has succeeded Professor Carlyle in the chair of metallurgy of the Royal School Mines, London, has arrived in New York and is about to begin a tour of the metallurgical districts of the United States and Canada, which will be of about five months' duration.

Prof. J. D. Irving, of New Haven, Conn., lately returned from Leadville, Colo., where he completed his study of the geology of that district in behalf of the U. S. Geological Survey, a work that has occupied him during 15 years. He expects to make his final report within a few months.

H. B. N. Douthitt, formerly manager of mines on the Monongahela River for the Pittsburgh Coal Co., has resigned to become general superintendent of the Vesta Coal Co., owned by the Jones & Laughlin Steel Co., of Pittsburgh. He succeeds E. B. Drum, who retires after an active service of more than 25 years.

OBITUARY

James D. Sword, a well known mining engineer of British Columbia, met death by drowning on Jan. 14. He was going in a small launch from Valdez Island to Quathiaski Cove to record assessment work on some mining claims. A heavy sea was running at the time and it is supposed Mr. Sword lost his balance in the rocking of the boat and was thrown overboard. The body has not been recovered. He had the reputation of being an expert metallurgist in British Columbia and was a man of strict integrity and sound judgment. Mr. Sword was about 45 years of age and was one of the first members of

the Canadian Mining Institute. He was born in Staffordshire, England.

F. E. Woodbury, vice-president and general manager of the Schlesinger interests, of which the Newport Mining Co. is a part, was instantly killed on Jan. 21, at the Newport mine at Ironwood, Mich., on the Gogebic range. He was underground making an inspection of the workings in company with the superintendent and one of the mining captains, and was standing in the ladderway, when he looked up the shaft and was struck by an approaching skip from below being caught between the skip and the steel sets. He was 53 years of age and had been connected with mining in the Lake Superior country the greater part of his life. He was born in the copper country and worked at the mines there for several years, then moving to the Menominee range, where he was mining engineer at the Chapin mine under James McNaughton, who is now in charge of the Calumet & Hecla. Later he returned to Calumet and assisted in the management of the C. & H. properties with his father-in-law, the late Captain John Duncan. He left that company to go with the Schlesinger concern. In addition to being connected with mining companies, he was at the head of the Woodbury Refining Co. and president of the Milwaukee Gas & Coke Co. at Milwaukee, Wis., where his residence was.

SOCIETIES

American Institute of Mining Engineers—The annual meeting of the Montana Section for the election of officers will be held Feb. 6, at the Silver Bow Club, Butte, Mont. The business meeting will be held immediately after the dinner and will be followed by the reading and discussion of the following papers: 1. "The Drumlummon Mine," by C. W. Goodale; 2. "Reverberatory Smelting with Low-Grade Coal," by C. E. Demond; 3. "The Labor Crisis in Chile," by Bancroft Gore.

American Electrochemical Society—The next meeting of the New York Section will be a joint one with the New York Sections of the American Chemical Society and the Society of Chemical Industry, at the Chemists Club, 52 East 41st St., New York, Feb. 6. The subject of the evening will be "Undeveloped Elements" by which is meant those elements which are available as byproducts or otherwise in excess of present demand. Some are dead, such as tellurium; some are comatose, such as selenium and cadmium; some are very limited in their applications, such as bromine. The papers for the meeting are: "Opening Up the Field of Unused Elements," by Dr. Chas. Baskerville; "Cobalt," by H. T. Kalmus; "Boron," by Dr. E. Weintraub; "Tungsten," by Dr. R. W. Moore. Discussion will not be limited to the papers presented.

Institution of Mining and Metallurgy—This society formally opened its new permanent quarters, in a substantial building at No. 1 Finsbury Circus, E. C., London, on Jan. 14. The ceremony was brief. Bedford McNeill, the president, welcomed the Lord Mayor in a felicitous speech on behalf of the Council and the 2400 members of the Institution. He referred to their definite decision to petition the King-in-Council for a Royal Charter. A souvenir of the event was presented to the Lord Mayor in the shape of a gold key, the wards of which were the letters "I. M. M." Edgar Taylor, the treasurer of the Institution, and Dr. Hatch, the president-elect, proposed a vote of thanks. After the formal opening the Lord Mayor and the numerous members and guests inspected the building, which contains capacious Council and secretarial rooms, a well-stocked library, writing and smoking rooms, etc. At the evening meeting of the Institution the following papers were submitted for discussion: "The Bereozovsk Gold Deposit, Ural District, Russia," by C. W. Purington, and "The Outlook for the Mineral Industry in Canada," by J. M. Bell.

INDUSTRIAL NEWS

The Traylor Engineering & Manufacturing Co. has moved its general offices from 30 Church St., New York, to its works at Allentown, Penn. A New York sales office will still be maintained at the Hudson Terminal Building, under the supervision of F. W. Hopkins.

The Wheeler Condenser & Engineering Co., of Carteret, N. J., has opened an office at 122 Board of Trade Building, Montreal. This office will be under the management of Joseph McKay, Jr., who has been for several years New York manager of the Wheeler company.

Editorial Correspondence

DENVER—Jan. 23

The Strike Situation in the Coal Fields of Colorado has not changed materially within the last week or two. The strike appears to be wearing itself out. The leaders of the labor side are now vigorously demanding the removal of General Chase, who is in charge of the National Guard and who has spent his time in the southern field. The demand upon Governor Ammons includes the removal of not only General Chase but also three officers. The militia are furthermore asked to prevent new workmen being taken into any strike mine no matter whether they come from other camps in the state or from outside of Colorado. The Federation committee that is forcing this demand accuses General Chase of conducting affairs as though a state of war exists, whereas, the report continues, "There has been neither war, invasion nor rebellion. Much, however, has been done and is being done daily by the militia to incite the miners to fight." It is not probable that Governor Ammons will accede to the demand, for Chase's record has been clean before the public. If any real shortcomings can be found in the behavior of the militia, they can most likely be traced to the inexperience of the recruits and not to any sanctioned acts of the commander. In connection with this strike matter, there comes a well authenticated, but unpublished, interesting phase of the proceedings of the investigations that were made during the visit, some weeks ago, of Secretary of Labor Wilson. Secretary Wilson was selected by President Wilson for this position in the Cabinet because of his known affiliations with labor movements and his broad-minded views. His visit here was expected to bring out some rather trying positions for the Secretary, but he left the state with the enviable goodwill of both sides. It now develops that before leaving the state he advised the Federation leaders to abandon the strike, for the present, inasmuch as the strikers had committed so many serious offenses as to have created an adverse public sentiment, and this would not be overcome by any long-drawn-out strike that will only make the general public still more provoked. It was his opinion that the miners deserved several of their demands but that the politic thing to do now is to quietly resume work and at some subsequent time start fresh and with a clean record. Evidently the leaders of the strike will not accept this advice.

Revival of Interest in Colorado Mining seems to have come in with the new year. Companies that heretofore operated outside of this state are securing large interests here, one being the Tonopah Mining Co. The Guggenheim interests have taken over large mining properties in the Rico district and is planning extensive productions that will go to American Smelting & Refining Co. smelting plants. The representatives of exploration companies are scouting in many camps and have intentions of closing options on a number of old as well as new properties. The coming summer season will permit the investigation of several large, low-grade copper and gold deposits that will prove the foundations for extensive operations on such scales as have been developed in other states but which have not thus far been introduced into Colorado. Litigation has prevented the operation of many properties in the state, but there seems to be a trend toward the settlement of such strife by compromises or consolidations and 1914 will undoubtedly witness the resumption of production in mines that have not been heard of for years. Again, men in the East and North are writing to friends and engineers in Colorado, making inquiry for desirable small properties, it being their desire to start private mining operations on modest scales and without special publicity. If the promoter and crook can be kept away from these sincere investors, the mining industry will thrive. Such camps with many little mines instead of a few large ones require more surveyors, assayers, miners, machinists, mechanics and laborers of all sorts to produce. The costs per ton may be higher than in the highly organized, large-scale districts, but the community exhibits more prosperity. Therefore if small capital is willing to accept this larger cost, the mining districts owe it to themselves as well as to the capitalists to guarantee that all transactions leading up to the beginning of such operations be absolutely square. Heretofore several Colorado mining districts have apparently openly winked at the manner in which "suckers" have been played.

BUTTE—Jan. 21

The Local Electric Lighting Rates findings of the public service commission have been appealed against by the City of Helena, Frank J. Edwards, and Fred Naegel, members of the commission, and the Helena Light & Railway Co., being made defendants in the action. It is alleged by the plaintiffs that under the findings of the commission, the rates of the Helena Light & Railway Co., are excessive, unreasonable, and unjustly discriminatory, and that too large a return is rendered to the defendant on the money invested, and on the physical valuation of the plant.

Northern Pacific Ry. Seeks to Oust Miners from lands it claims in Meagher County. Suit has been brought in the federal court to have declared invalid an exception in patent received from the government, reserving to itself mineral lands, and for an injunction to restrain certain miners from mining on the disputed ground and attempting to file on the land under the mining laws of the U. S. The patent for the tract involved contains the following exception: "Excepting from the grant all lands, mineral in character, now known or hereafter discovered to be such, but this exception shall not be construed to include coal and iron lands." The lands involved being mineral, it is claimed that no title was conveyed to the company but that the title still rests with the U. S. and the land is therefore open to location as mining claims. The company complains that the miners went upon the land, dug holes, built buildings and now claim right of occupancy and are ruining the tract for grazing purposes.

Renewed Activity in the Saltse District is apparent in the work being done on a number of well known properties on Packer Creek. The Last Chance, a few miles up Packer Creek, which has produced upward of \$200,000 in high-grade silver ore, is being put in condition for operations. On the Hemlock, one mile from Saltse up Packer Creek, surface indications point to the presence of galena ore. The prospect is being developed by a tunnel, now 300 ft. long and a shaft 100 ft. deep. From the bottom of the shaft a crosscut is being driven which, it is believed, will reach the vein within 30 ft. of the station. On the Richmond considerable development work has been done; a car of ore shipped from this mine recently, netted the company \$2870. Regular shipments will be made from the mine in the future. At the Tarbox mine where the forest fires of three years ago did great damage to property and equipment, a new hoisting and compressor plant will be installed and the shaft will be sunk 300 ft. deeper. The discovery on the 500-ft. level of a 12-ft. ore shoot and of a 30-ft. vein on the 600-ft. level are said to have caused the owners to consider building a mill. At the Bryan mine, on the west side of Packer Creek, indications of a strong silver bearing vein have prompted the owners to make plans for extensive development next spring.

SALT LAKE CITY—Jan. 22

Annual Expenditure of \$30,000,000 for labor and supplies is made by the various mining companies within a radius of 100 miles from Salt Lake City according to a statement made at a meeting of Utah mining men held Jan. 17. The committee which had the matter of the proposed state organization in charge reported that the final plans had not yet been completed. A meeting is to be held Feb. 7 when definite action will be taken. An address on greater co-operation among mining men, and what Salt Lake and Utah owe to the mining industry was given by W. W. Armstrong, president of the National Copper Bank. Mr. Armstrong called attention to the fact that those engaged in other lines of business worked together, but that for the mining industry there had never been a successful coöperative plan or proper organization. Attention was called to taxation, which is greater than should be borne by operating companies, and to the fact that there is no organization among mining men to combat unfair legislation. Coöperation among operators was urged for an enactment of more favorable state and federal laws. Mr. Armstrong took exception to the recently published statements that the days of the prospector had gone by, and said that mining would continue to progress in this region for a long time to come. Judge W. U. King addressed the meeting and declared mining to be the greatest single factor in Utah's prosperity, and that in his opinion the Interior Department in Washington intends to give broader con-

struction to the laws. He called attention to the mineral sections of Utah which are still undeveloped, making especial reference to the Deep Creek region near the Nevada line. Organization among mining men was urged in that it would do much to develop the state.

BRainerd—Jan. 24

Activity on the Cuyuna Range makes it the center of activity in the Lake Superior iron region this winter. More exploration is in progress in this new field than in any other district. In addition much development work is being done. Reports of ore discoveries are frequent. The Northern Pacific, with which the Soo Line shares the Cuyuna traffic, is under contract to build an extension from the Cuyuna-Mille Lacs mine, west of Iron-ton, to the Duluth Brainerd property. The latter is in course of development and will send out some ore this year. The Iron Mountain company's property, in the same locality, also will make its initial shipment the coming season. Water has hampered development work, but now stockpiling is in progress. Railroad facilities have already been provided and recently a sample consignment of two cars of ore was sent to Pittsburgh. Adjacent to the mine a townsite has been platted by the Steelton Land & Townsite Co. The Soo Line has been extended to the site and the Northern Pacific will reach it with its extension from the Cuyuna-Mille Lacs mine at Iron-ton. The Armour No. 1 mine of the Rogers-Brown company is not in commission this winter, but the Armour No. 2 is operating with full shifts. Electric haulage is in use both underground and on surface. The Armour No. 1 is destined to become an open pit, like its neighbor, the Pennington mine of Tod, Stambaugh & Co., which adjoins it on the west. Both properties are opened on the same orebody. The Pennington has the distinction of being the first Cuyuna mine at which stripping was attempted, the work being started last year and shipments being made before the close of the season of navigation. The overburden averaged 70 ft. in depth. Mining with steam shovel will be carried on until it becomes unprofitable, after which the milling system will be adopted and, finally, underground work entirely. Between the steam shoveling and the milling, probably 120 ft. of ore will be removed. Exactly the same methods will be employed at the Inland Steel Co.'s Thompson property, in the same part of the range. The Thompson originally was opened as an underground mine and the workings had attained a depth of 250 ft. when it was decided to strip the 70-ft. overburden. This season the Thompson will be worked with a steam shovel. The mine is provided with a concrete shaft, one which was made necessary because of the excessive flow of water, and the shaft is surmounted by a steel headframe, as are those at the two Armours. The Thompson shaft is used only for drainage purposes at present, but eventually it will become the avenue through which much of the ore will be hoisted. The Longyear Exploration Co., which was granted an option on the Crow Wing County poor farm, east of Brainerd, is already testing the tract with two drills. The property is in Sec. 33, 45-30. The contract provides that in the event merchantable ore is discovered, the Longyear interests will have the privilege of obtaining a 50-year lease at a royalty of 30c. per ton, 10,000 tons to be mined, or at least paid for, the first year, 20,000 tons the second year, 30,000 the third year and 40,000 annually thereafter. Drilling is reported to have shown the existence of a large deposit of ore, with little overburden. Within the city limits of Brainerd, the Brainerd-Cuyuna company is preparing to develop an orebody of good size. The shaft is making considerable water. The flow is, however, easily handled by two Cameron sinking pumps. Springs in the vicinity have ceased to produce. One of the best equipped mines on the Cuyuna is the Adams property at Oreland. A concrete shaft is down 210 ft. and from that depth lateral development is in progress. A good-sized stockpile will be available for the initial shipment in the spring.

TORONTO—Jan. 24

The Iron Mines in Northern Ontario, which are the Moose Mountain, Helen and Magpie, have been exempted from the provisions of the 8-hr. day which came into force on Jan. 1. Following the report of the minister of mines, the management has decided that the section of the mines act providing for an 8-hr. day for underground workers be suspended in the case of these three mines. An investigation of these properties showed that the conditions as regarding safeguards and arrangements for protecting the comfort, safety and health of the miners was of much higher standard than in the other mines of the province.

Canadian Venezuelan Ore Co. bondholders at a meeting held in Montreal Jan. 20 passed a resolution asking the committee recently appointed to serve the trustee with notice of default on bond coupons due at the beginning of the month. The

trustee for the bondholders is the New York Trust Co. This step is regarded as preliminary to a winding-up proceedings. By the trust deed, the property would revert to the bondholders 60 days after the serving of the notice unless arrangements were made by the company to pay the overdue interest. There was no discussion of any plan to provide the company with additional funds to relieve its present indebtedness. As the stockholders and bondholders are practically identical, it is probable that liquidations proceedings will be allowed to take their course and that when the property has reverted to the bondholders, a decision will then be made as to the future. A serious drop in the grade of the ore, together with a decrease in the market price is responsible for the company's financial difficulties.

New Financing of the Canadian Coal & Coke Co., it is understood, is making good progress. The company will shortly be in a position to complete development work on the various properties and put them on a profitable basis. Temporary financing is practically completed and will provide funds for the payment of outstanding liabilities and for putting three of the properties in full operation. The permanent financing will take the form of \$3,000,000, 14 year, 6% serial bonds dated Dec. 1, 1913. To retire these bonds a sinking fund will be started in 1915 sufficient to redeem the entire issue by 1927. The bonds will constitute a first mortgage against all the properties of the consolidation. Independent engineers reporting for the bankers who are undertaking the financing, have placed a total value on the plant and properties of the Canadian Coal & Coke Co. of \$17,900,000. The proceeds from the bond issue will be utilized to redeem the temporary financing and to provide funds for extensions of plant and new working capital. After the plants have been put in an efficient condition to produce a maximum output at a minimum operating charge, it is estimated that the company will have \$250,000 new capital to put into the business and an emergency fund of \$350,000. At the present time, the collieries are producing 1200 tons per day but with the new development and the new equipment now being installed, the output can be increased up to 8000 tons per day.

QUEBEC—Jan. 24

The Asbestos Industry of Quebec which furnished approximately 80% of the world's classified grades of fireproofing materials, shows signs of recovery. Following the reorganization of the Canadian Asbestos Co. and the Black Lake Consolidated Co., efforts were made to serve the respective markets while restoring prices which were demoralized by ruinous competition preceding the failure of these companies. As a consequence, the production of asbestos and asbestic in 1913 shows an increase of 20% over the figures of 1912, when asbestos to the value of \$3,059,084 was mined. Of the total production for 1913 amounting to 111,175 tons, a total of 88,008 tons valued at \$2,349,353 were exported, the greater proportion going to the United States. The prices obtained for the 1913 output were about 5% higher than for the preceding year. Advanced prices for asbestos may be looked for in the future, as the various companies are standing firm. Conditions in Russia have resulted in decreased production and the utilization of practically all the supply within the confines of that country, and as a consequence, Canada and Cyprus have practically a clear field in the European market and foreign buyers are looking more and more to Canada for supplies.

OTTAWA—Jan. 24

The New Oil Regulations which have been prepared by Doctor Roche have been approved by the cabinet council. There are several clauses of an imperial nature designed to conserve the oil resources of Canada for the use of the British Admiralty in time of war or emergency. One regulation requires that any company holding the lease shall at all times remain a British company, registered either in Great Britain or Canada and having its chief place of business within His Majesty's dominions. The chairman of the company and the majority of the directors shall also be British subjects and the company shall not at any time be or become directly or indirectly controlled by foreigners or a foreign corporation. This is to enable the Crown to retain in time of war a reliable supply of oil fuel when most needed and also to prevent speculators from taking advantage of an emergency to put a prohibitive price in force. Another section of the regulations gives the Crown power to assume control in time of emergency of any lease of works and to operate and maintain it. The compensation in such a case is to be fixed by the exchequer court. A further proposed clause prohibits all exports of oil from Canada in time of war. This clause however, will necessitate a change in the export act by parliament and this legislation will probably be passed this session.

The Mining News

ALABAMA

Jefferson County

DAVIS COAL & COKE CO.—Operations at Rock Castle mine, where explosion occurred Jan. 11, were resumed Jan. 17.

S. A. HOBSON OIL & GAS CO. (Birmingham)—Within a few weeks drifting for oil and gas will be begun near Tuscaloosa.

AMERICAN STEEL & WIRE CO. (Fairfield)—The \$3,500,000 mill, after being under construction for two years, is in operation.

ALASKA

FIRE RECENTLY DESTROYED boiler houses of both H. Hilty and Woods & Piper below Cleary Creek.

KENNICOTT MINES CO. (Kennicott)—Survey for aerial tram from Jumbo mine, near Chitina, to railroad has been completed.

CACHE CREEK MINING CO.—James Murphy, of Seward, and others have taken over holdings of company and are planning installation of a dredge next season.

ARIZONA

Gila County

INSPIRATION CONSOLIDATED (Miami)—A portion of Joe Bush ore dump is ready for caving and within a short time ore from this stockpile will be taken out for test mill. Drift from Colorado orebody on sixth level to incline shaft is advancing at rate of about 150 ft. per month. Raises are continually being lifted under Joe Bush ore dump and it is expected ore on this dump will be drawn rapidly when that work is commenced. Scorpion hoist is hoisting about 700 tons of ore per day at present. However, it is estimated that this hoist could easily raise 1200 tons per 24 hr. if operated continuously, but lately it has been greatly handicapped on account of test mill not requiring ore as fast as hoisted and there being no storage room except in dump cars. During first fortnight of January hoisting through Scorpion shaft amounted to practically 2000 tons of ore, through Colorado shaft about 8500 tons of ore and waste, and through incline shaft about 4600 tons of waste, all of which was taken from about 2700 ft. of development work. However, it is estimated that if underground operations were allowed to proceed at working faces which are in waste as well as ones driven in ore, an advance of 3000 ft. could easily have been made during last half of January. Work continues in the main east shaft enlarging and putting in "pony" sets. New test mill continues to operate three shifts daily. As object of this mill is to test out various kinds of machinery and to determine which is most suitable for this method, an Oliver filter has been installed and is being tested, while a Trent filter now in course of erection will also be given a thorough test. It is also possible that more filters will be given a trial.

Yavapai County

WYMAZONA (Dewey)—A carload of ore from mines in Cherry Creek district was recently shipped to Hayden smelter. Ore came from a 55-ft. shaft recently sunk. Lower-grade ores are being treated successfully in a mill.

CHAPARRAL MINING CO. (Chaparral)—Unwatering of 700-ft. shaft on Jessie claim has been begun. It is expected that it will take about three weeks to complete this work. Meantime camp is being rehabilitated and numerous improvements made about property.

HENRIETTA (Prescott)—Mill on this property, which recently acquired by Copper-Gold Zone Mines Consolidated, is in operation. Mill was overhauled recently and changed to be operated by electricity supplied by Arizona Power Co. from its Fossil Creek plant. Pumps and other machinery are also operated by electricity.

CALIFORNIA

Amador County

PLYMOUTH DISTRICT IS IMPROVING since announcement of proposed building of a new mill by Plymouth Consolidated. A new concrete hotel building and other improvements in town of Plymouth are in progress.

LITTLE ILLINOIS (Drytown)—It was expected to renew mining and milling in first week in January.

KENNEDY (Jackson)—A miner died Jan. 15 from injuries received previous day in 3400-ft. level or from shock on operating table. Loose rock fell on man while in mine.

BUNKER HILL (Amador City)—Usual dividend of 2½¢ per share was declared Jan. 15. Gross production is said to be about \$25,000 per month. Ore now averages \$4.50 per ton. It is expected deeper development will disclose ore of higher grade.

ARGONAUT (Jackson)—Removal of 40-stamp mill to a higher elevation and increase in number of stamps is contemplated. Removal of mill will facilitate handling of tailings, which will be disposed of by flume to ground owned by company.

CLINTON CONSOLIDATED GOLD MINING CO. (Jackson)—Notice has been filed with county recorder that on Jan. 30 state of California will apply for a deed to Original, Paugh and Union quartz mines and 286 acres of adjacent land, under an act of last legislature affecting delinquent property. Taxes,

including penalties, since 1893 amount to \$5958. Owner may redeem prior to Jan. 30.

PLYMOUTH (Plymouth)—A subsidiary corporation of California Exploration Co., Ltd., which is now being formed in London, but not yet named, will build an amalgamating and concentrating mill with a capacity of 300 tons per day, at an estimated cost of \$78,000. The general managers of the California Exploration Co., are Bewick, Moreing & Co., and Albert Bureh is consulting engineer in charge of operations. The mill is being designed by Gelasio Caetani of San Francisco, and orders have been placed for a part of equipment, but mill plans are still incomplete and ground will probably not be broken before end of February. It is expected that mill will be completed about end of June. A cyanide plant for treatment of concentrate is under consideration, but will probably not be built at this time.

Butte County

A CAVE-IN AT A FORBESTOWN MINE is reported to have killed one miner and another are believed to have been fatally injured. Name of mine is not reported.

NORTHERN CALIFORNIA MINING CO. and Lawrence Gardella have asked for privilege of operating gold dredges within town of Oroville, agreeing to reclaim land and make a park site and build a street through tract. Gardella operates dredges just outside town limits and Northern California Mining Co. owns 40 acres of dredging ground within town limits.

Calaveras County

RAILROAD FLAT DISTRICT will make a good showing in the 1914 season. The 10-stamp mill at Comet is running steadily on good ore. Keystone is extracting good ore; 9-stamp mill was recently repaired and eight stamps are dropping. Petticoat and Petticoat Extension have been bonded to J. E. King and Eastern men; development will be resumed this spring. At Doe the 2-stamp mill is working on good ore. Poorman is equipped with a good hoist and ore is being extracted; a stamp mill is contemplated. Haley has been bonded to Boston men who are driving a tunnel on vein. There is abundance of timber and water in district; three sawmills are running and lumber is cheap.

EMERSON (San Andreas)—A gasoline hoist is being installed at this mine on Stockton hill.

GOLD CLIFF (Angels Camp)—Greenstone of unusual hardness has been encountered in drift being driven to connect with Gross shaft of Utica. It is stated that a two-man drill made only one foot in an 8-hr. shift.

Kern County

PINMORE (Randsburg)—Osdiek and Miller, lessees, contemplate building a 50-ton cyanide plant. Electric power has been installed at the Phoenix mill running on Pinmore ore.

Inyo County

MYRICK GEM MINES—F. M. Myrick is reported to have given a purchase option on a portion of his holdings to New York men.

Placer County

SOUTHERN CROSS (Alta)—Reconstruction of mill destroyed by fire last summer is contemplated.

COLORADO

Clear Creek County

BELLEVUE-HUDSON—Bryant & Co., lessees, are drifting on vein 900 ft. from portal of Rochester level. Vein is 2 ft. wide and sorted product assays \$50 per ton. A raise is being lifted to connect with eighth level. This opening is following a small streak of smelting ore. Some small pockets of high-grade silver ore are being found.

GEM—On Von Tilborg lease, about 700 ft. east of Gem shaft on Newhouse tunnel level, a winze has been sunk 70 ft. in pay ore. Drifting is in progress from bottom of winze and results are encouraging. Recent shipments of ore mined from development return \$40 per ton. These operations are approximately 2300 ft. below outcrop of vein.

SUN & MOON—J. P. Olsen & Co. are developing this property under lease. Drifting is in progress on Sun & Moon vein on Newhouse tunnel level, 2000 ft. below outcrop. A 6-in. streak of bornite has recently been opened, assays running up to \$100 per ton in gold and silver. Lessees are planning extensive development and expect to spend \$1000 per month in the work.

Lake County

HENRIETTE (Leadville)—This, one of the early famous shippers, is being put into shape to resume shipment of iron-silver ore.

ADAMS MILL (Leadville)—Tailings have been worked over by Horrying Bros., who are shipping about 75 tons per day of zinc concentrate to New District mill.

LORD CLYDE (Leadville)—This claim that has remained unworked since 1880 is being reopened by F. J. McNair. Claim was formerly known as Uncle Sam and pioneer owners developed a fine body of heavy sulphide ore, but under then existing smelting rates it could not be worked at a profit.

WOLFTONE (Leadville)—Output of zinc-carbonate is maintained from workings that were generally presumed to be exhausted. Large pillars were left in first working and these are now being pulled. New smelting rates make it pos-

sible to ship ore running as low as 18% zinc, so owners of this mine will proceed to remove large reserves that are known to average around 20%, but that were avoided formerly.

YAK TUNNEL (Leadville)—A new scheme is being tried in stoping enormous replacement masses of sulphide ore in limestone of the Cord mine. Square sets have heretofore been used, but innovation contemplates maintenance of "slides" that are constructed close up to working faces and upon which ore falls as it is blasted and from which, without any shovelling, it slides directly into chutes, whence it is delivered directly to cars and hauled to surface. Another important move toward economy in mining has been inaugurated in this property, viz., the filling of stopes with rock from other workings along this tunnel. Through a winze from tunnel this rock is dropped down to lower levels where it is trammed and dumped into old stopes, thus curtailing heavy cost of timbers and their placement. A Prescott electric pump has just been installed at bottom of Cord mine and is raising water up to Yak level.

Teller County

GRANITE (Victor)—New vein of granite ore has been struck on 1100-ft. level. Vein is 2 ft. or more in width, and assays 3 oz. gold.

PORTLAND (Victor)—A night shift of 50 men was started to work Jan. 18 in addition to day shift. Two shifts are working in each shaft.

GOLDEN CYCLE (Goldfield)—All leases have been canceled, with exception of that held by Oxford Leasing Co. Understanding is that a new system of leasing is about to be inaugurated.

JO DANDY (Cripple Creek)—Mine was recently sold for \$100,000, to a syndicate consisting largely of St. Louis men. Property is now under lease to Frank R. Marsh, of Colorado Springs; Charles Ridpath, of Cripple Creek, being in charge of mining.

EL ORO MINING & MILLING CO. (Elkton)—Weather permitting work will be started on 300-ton mill in middle of March, under supervision of W. H. Kritzer. Correspondence invited with companies desiring to take contract on specifications in full or in part.

IDAHO

Clearwater County

CLEARWATER GOLD & COPPER MINING CO.—Work has been suspended and no definite announcement has been made when work will be resumed. Plans were being worked out to finance property on a new basis. While some of the principal stockholders are confident that Northern Pacific will eventually build Lewiston-Missoula cutoff, which would pass a few miles below property, time of its construction is so uncertain that company is considering a plan to handle ore independent of a railroad on that side of divide. It is proposed to construct an aerial tramway, capable of delivering 24 tons per hour, connecting Clearwater property with Amador branch of Northern Pacific at Amador mine, a distance of 12 miles. This tramway would necessarily cross Bitter Root divide between Montana and Idaho. Company has developed property to extent of 4000 ft. of tunnels, crosscuts and shafts, and this work represents an expenditure of \$80,000. Copper-gold-silver ore has been developed that will assay \$17 per ton. Vein ranges in width from 18 to 35 feet.

Cœur d'Alene District

SUIT AGAINST JONATHAN BOURNE, JR., of Oregon, brought by Stewart Mining Co. for orebodies beneath surface of Ontario claim, has been dismissed by Judge F. S. Dietrich. Properties of Ontario company involved in this action are valued at \$400,000, and action was virtually a suit for control of Ontario, as an adverse decision would have meant that the most valuable part of property would have passed to Stewart company. Plaintiff in action owns several claims adjoining Ontario, the latter being owned by Bourne. Some of the richest veins in the Cœur d'Alenes are within these claims and it was admitted in course of trial that same veins run through Ontario claim that are found to be so rich in claims of Stewart company. There are various faults on Stewart fraction claim. The question which courts had to decide was whether fault constituted a part of apex of vein, which extended across both Stewart and Ontario, or whether it was only a side or edge of the vein. Court holds that it is no part of apex and complaint is, therefore, dismissed. Properties contested for are considered among the richest in the Cœur d'Alene section, and case has been bitterly contested. It is considered one of the most important mining cases in northern part of the state.

MINNESOTA

Cuyuna Range

BRAINERD-CUYUNA (Brainerd)—Shaft down 75 ft. About 400 gal. of water per minute now being pumped.

DULUTH-BRAINERD (Crosby)—Three-compartment shaft down 72 ft. Ore encountered at 57 ft. Drifting will begin at 150 feet.

CANADIAN-CUYUNA ORE CO. (Brainerd)—A shaft will be started soon on company's property seven miles east of Brainerd. Deposit is estimated at 5,000,000 tons. An output of 350,000 tons per annum is planned, beginning with 1915.

Vermilion Range

SOUDAN (Tower)—Base of crushing plant has settled considerably and so it has been decided to rebuild it. Two of the three crushers are still in operation and are crushing about 1000 tons of ore per 10 hours.

SOUTH CHANDLER (Ely)—This property is being developed for mining, and at a depth of 157 ft. ore of regular Chandler quality and structure was located. It is of bessemer grade, running a little better than 65%, and low in phosphorus.

VERMILION & MESABI IRON CO. (Ely)—Shaft was down 255 ft. last week, and going down in decomposed rock in which seams of iron ore occur. Formation indicates a change, and prospects are that ore will be found before a depth of 300 ft. is reached. Upper orebody was developed on three

levels down to 210 ft. A station will be cut at 300 ft. and crosscuts and drifts will be driven for exploration purposes.

McCOMBER (Tower)—Remarkable progress has been made in opening up this new Vermilion range property. It was only nine months ago that Mutual Iron Co. took hold and commenced exploring, and it will be only a few days now before actual mining will be started. Ore was originally located by test pits where it came to surface of rock, then a shaft was sunk 50 ft. and a crosscut driven 49 ft. through ore. Sinking was then resumed to a depth of 100 ft., where orebody was again cut by a drift. Whether Mutual Iron Co. will work property or lease it has not been determined thus far. Lands of company were explored prior to time that new concern took hold and property was considered worthless by many.

MISSOURI-KANSAS-OKLAHOMA

Joplin District

A TENT COLONY HAS SPRUNG UP AT TIPTON FORD, south of Joplin, Mo., where prospectors are opening rich calamine mines. Five shafts in ore, others being put down. Miners from surrounding camps flocking to new field.

SUIT HAS BEEN FILED against Glick Mining Co., at Galena, Kan., by heirs of Taylor Foster, seeking to regain deed to rich mining tract. Plaintiffs allege Foster was not mentally capable of conducting own affairs when he sold land. Injunction asked to prevent Glick company from further operations. Much ore has been produced on tract since death of former owner.

BONITA (Thoms Station, Mo.)—Company has promising mine on 40-acre lease. Shaft down and drift has been cut into ore. J. W. Griffin & Co., of Joplin, are operating tract.

HALLOWE'EN AND DELTA (Spring City, Mo.)—Both mines now are producing heavily. Hallowe'en concentrator has been idle some time, but will resume operations.

GRANBY MINING & SMELTING CO. (Joplin, Mo.)—A revival on Lone Elm tract results from draining ground, after years of idleness. Shallow properties last week produced large masses of zinc ore.

DAVIE LAND (Webb City, Mo.)—Rich sheet-ground prospect opened by O. W. Sparks of Galena, Kan. Four drill holes completed, each showing good ore. Richest strikes at 180-ft. level. Lease of 40 acres in virgin territory.

MORNING STAR (Yellville, Ark.)—Operations resumed after several months' shutdown. Ore is in a hill and is removed through tunnel, several hundred feet long. Orebodies proving richer. Concentrator of Joplin type, 250-ton capacity, operated.

FRANKLIN PLAYTER is developing a good mine on Riddle tract near Galena, Kan. A 44-ft. face of lead ore was encountered by drill. A drift has been cut to drill hole from an old shaft and rich ore is being hoisted. Mine is near Annie Rooney, once a big producer.

MONTANA

Broadwater County

RAILROAD TO RADERSBURG will probably be built soon, according to Senator Muffy, who is interested in mining enterprises at Winston. Chicago, Milwaukee & St. Paul R.R. will take up project for a railroad from Three Forks to Radersburg this spring. Keating, Ohio-Keating and other mines at Radersburg have felt need of a railroad for a long time and construction of such a road would result in a great revival of mining and other industries in Radersburg and in Broadwater County generally.

KEATING (Radersburg)—Sinking shaft from 800- to 1000-ft. level is going on steadily. As soon as this level is reached a station will be cut and crosscutting commenced. Regular wagon shipments are being made.

RENA-RADERSBURG GOLD MINING CO (Radersburg)—Operations have been commenced at this property adjoining Keating and Ohio-Keating. Mine when operated formerly had a large flow of water to contend with, but deeper workings adjoining, have drained it off to a considerable extent.

Jefferson County

BASIN CONCENTRATOR TAILINGS are to be reworked according to a rumor to effect that a company has been formed for that purpose. Last work carried on in that mill was concentration of Butte & Superior zinc ore. This was discontinued upon completion of new mill at Black Rock mine at Butte.

Madison County

CORBIN COPPER CO.—Operations at Blowout mine have been suspended temporarily due to an immense flow of water encountered recently while driving crosscut on 1500-ft. level. Mine and shaft were filled with water in an incredibly short time to within 200 ft. of surface, combined capacity of all pumps proving insufficient to stem flow of water and prevent it from causing considerable damage by caving workings and part of shaft. To handle water company is making preparations to install pumps with a capacity of at least 800 gal. per min. Showing at mine has been promising so far. Ore encountered in crosscuts in various levels assays from 5 to 7% copper besides some gold and silver. On 300-ft. level a vein has been cut which is 160 ft. wide. Operations will be resumed as soon as provisions for handling water are perfected and a new shaft will be sunk, if necessary.

Missoula County

LAST CHANCE—At this silver mine on Packer Creek, in Montana section of Cœur d'Alenes, operations have been started again after a shutdown of several years, prior to which time about \$200,000 worth of ore was mined. Operators have begun to develop property through Ben Hur tunnel.

Silverbow County

BUTTE MINERS' UNION has recently sent \$10,000 to striking miners in Calumet, Mich. This brings total of donations to date from local union to men in Michigan to \$83,000.

GAMBRINUS (Butte)—Another payment on purchase price of this property was made Jan. 17 by Corbin Copper Co. Shaft sinking is still in progress and considerable development work is being done.

EAST BUTTE MINING CO. (Butte)—At Pittsment mine a boiler exploded Jan. 14, putting hoisting engine out of commission for some time. Outside of destroying brickwork in which the boiler was incased, little damage was done. Accident was due to a defective tube and took place at a time when no one was in boiler room. With completion of plant enlargement at an expense of more than \$100,000 company will soon be in position to produce 20,000,000 lb. of copper yearly, an increase of 4,000,000 lb. over previous output. Ore mined on sixth, eighth, tenth and twelfth levels runs better than 5% copper. Shaft is being sunk to 1800 level.

BUTTE & BACORN (Butte)—A special meeting of stockholders was scheduled to be held Jan. 23 in Augusta, Maine, to organize a new company under name of Great Northern Copper Co. to succeed Butte & Bacorn Copper Co. New company is to resume operations on properties in extreme northern part of Butte district, which have been idle for years. New company shall assume indebtedness of Butte & Bacorn and in consideration thereof become lessee of all its property except the Anna, Laura and Mayflower claims for 30 years. Rental is to be \$1 per year and a royalty of 8% on all ore extracted. It shall offer to Butte & Bacorn stockholders right to exchange stock at a valuation of 8c. per share for Great Northern stock at par, whatever that will be.

BUTTE DULUTH (Butte)—Company is building a mill of 1000 tons daily capacity with an estimated output of 40 tons per day of electrolytic copper. A portion of this business has been placed with Hallidie Co., of Spokane, a portion with Symons Bros., of Chicago, and a portion with Colorado Iron Works Co., Denver. Electrolytic equipment for this plant is entirely on order with General Electric Co., of Schenectady, N. Y. Cost of plant will approximate \$130,000. Present capacity of mill is 150 tons per day. It is said that recently improvements have been introduced in leaching plant resulting in larger recovery of copper and decrease in operating expenses. This has been brought about chiefly by substitution of Dorr classifiers for original leaching tanks into which ore was dumped and allowed to stand for 24 hours. This involved a more or less intermittent operation requiring excessive time and attention. Dorr machines, by bringing ore into intimate contact with acid, have made it possible to do in about three or four hours what formerly required 24 hr. So successful did these machines prove in operation and saving of time, labor and acid, that a new battery of five of twice the width of those already installed has been ordered.

NEVADA

Esmeralda County

DARMS COAL MINING CO. (Coaldale)—A 14-in. seam of coal has been cut in shaft at depth of 300 ft. Coal is high in carbon and low in ash, and is equal to best Rock Springs coal shipped in. Shaft sinking will be continued; two more seams will be cut, it is expected.

Humboldt County

PEERLESS NO. 6 (Rochester)—This group has been purchased by the Knight-Kittie coal interests of Utah. Development work will be started at once.

HINES-BALDWIN (National)—Further development has proved vein recently discovered to be about 3 ft. wide and to assay \$15. In white talc on one wall are pockets of high-grade gold ore; in vein pockets of silver sulphides are found. This strike was made in main Workman-Wheeler tunnel about 800 ft. from portal.

Lander County

CHRISTENSEN-DAHL (Copper Cañon)—This placer mine has increased its output; costs have been reduced.

PEART (Copper Cañon)—Property at head of Copper Cañon was sold recently to Big Four company of Rochester. Chief value is in placer deposits. Two pay-streaks have been cut in 40-ft. shaft to bedrock. Four more shafts will be sunk.

Lyon County

BOVARD-KNIGHT (Pumpkin Hollow)—Good-grade gold ore is being sacked for shipment.

RAMSTORF (Bucklin)—Development work is being done on this group north of Yerington-Bullion.

BURLINGTON-NEVADA (Mason Pass)—Shaft sinking is being continued, and grade of ore improves with depth.

NEVADA-DOUGLAS (Ludwig)—Report from Boston office on leaching tests at Denver state that three tests were made at 10-ton plant. Copper was dissolved by sulphuric acid and precipitated electrolytically. Current density of 4.6 amperes per sq. ft. was used, and copper was deposited in sheets $\frac{1}{4}$ in. thick. A 90% extraction was made on 2% ore. Estimated cost of mining, crushing and leaching, 9c. per pound.

Mineral County

AURORA CONSOLIDATED (Aurora)—It is stated that \$800,000 has been expended, \$600,000 on the mill and \$200,000 in development; 1,000,000 tons of \$5 gold ore have been developed, it is claimed.

EXCELSIOR MOUNTAIN MINING CO. (Excelsior Mountain)—Development work is being continued and a large tonnage of ore is blocked out. It is planned to build small railroad next spring.

WAGNER AZURITE COPPER CO. (Luning)—Development on 50- and 100-ft. levels has proved continuity of oreshot; 100-ton ore bin, 25-ton waste bin, new headframe for incline shaft, bunk house, boarding house and houses for married employees have been built. Hoisting will be done in skip, self-dumping into bins. Water system has been installed; water is pumped from well on flat to tank above mine, from which it is fed by gravity. Ground for 100-ton leaching plant has been broken. Sulphuric-acid solution with precipitation on iron will be used.

Nye County

TONOPAH PRODUCTION FOR DECEMBER was as follows: Tonopah Belmont, 14,603; Tonopah Mining, 11,890; Tonopah Extension, 4958; Montana-Tonopah, 4581; West End Cons., 4869; North Star, 398; MacNamara, 2110; Jim Butler, 1971; Merger, 585; Midway, 150; Total, 46,115 tons.

WAR EAGLE MILL (Manhattan)—Foundations for 10-stamp addition and new tube mill are in place. Mill will have daily capacity of 250 tons when addition is completed.

AMERICAN CARRARA MARBLE CO. (Carrara)—Derrick and compressor have been installed at quarry No. 2. First floor has been channeled. Varieties of marble produced are: Nevada Pavazzano, American Sienna, rose-tinted white and Nevada Formosa. Finishing is done at quarry. Commercial sample blocks, 12x12-in., have been shipped to Los Angeles.

NEVADA CHIEF (Golddyke)—Company has secured bond and lease on property of M. L. Butler, which was scene of recent gold strike. Ore was discovered in raise from 230-ft. level from shaft, and is narrow seam in wide vein of low-grade rock. Assays have run from \$1500 to \$5000. Luning, 30 miles southwest, is nearest shipping point.

NORTH STAR (Tonopah)—Raise from 1130- to 1050-ft. level has been completed, entire distance being in ore. East drift on 1130-ft. level is being driven in low-grade ore. West drift is being driven, and crosscut has connected with raise from 1250-ft. level. Raises in foot-wall vein show it to be faulted 20 ft. above level. Raising from 950-ft. level to Martha vein is in progress. Drift has been advanced 40 ft. in C. E. K. vein in good-grade ore. Stopping will be done on this shoot when MacNamara mill is ready to receive shipments.

Storey County

YELLOW JACKET (Virginia City)—Mill has been shut down on account of severe storms; will operate again as soon as weather changes. Ore is being produced from surface-tunnel level.

CONSOLIDATED VIRGINIA (Virginia City)—Work has been resumed on southwest drift which will be driven to 600-ft. point. East and west crosscuts will then be driven to thoroughly explore territory.

COMSTOCK PUMPING ASSOCIATION (Virginia City)—No. 1 Starret pump has been lowered to 180-ft. point in Consolidated Virginia winze, and No. 2 pump will shortly be lowered below 2700-ft. station. This level will probably be drained in near future. Pumping in Crown Point and Belcher incline is holding water at 25 ft. below 2500-ft. station, while 2500-ft. levels of adjoining properties are being drained. When this is accomplished, water in incline will be lowered. Pumps are giving satisfactory service.

Washoe County

TOHOQUA MINING CO. (Leadville)—Company's royalties on shipments of silver-lead ores during quarter ended Dec. 31, 1913, were \$12,460.

PEAVINE MINING CO. (Reno)—Shaft sinking is now being done. Boarding and bunk houses and blacksmith shop have been built. Road to property has been constructed.

NEW MEXICO

Grant County

EMPIRE ZINC CO. (Pinos Altos)—A force of 20 men is doing development work on Cleveland mine, recently purchased by company from George H. Utter.

CHINO, COPPER CO. (Hurley)—Largest pay roll in history of Santa Rita district was paid week before last. Development work on claims adjoining Chino ground has revealed good ore in last few weeks.

PHELPS-DODGE (Tyrone)—Regular passenger trains are now running into Tyrone over Phelps-Dodge branch line from Whitewater N. M. Grading is being done near Tyrone for a large boarding house and also for experimental mill.

Otero County

GOLD IN SAN ANDREAS RANGE has been found by prospectors who are reported to have made some excellent finds and fine specimens of rich float have been brought to Alamogordo.

Socorro County

LINCOLN MINING & DEVELOPMENT CO. (Mogollon)—Part of new equipment has been delivered at mine and rest will arrive within a few days. Machinery includes a gasoline hoist, compressor and air drills. Plant is being assembled as rapidly as possible.

MAUD MINING CO. (Mogollon)—A contract was let on Jan. 1 for sinking main shaft an additional 160 ft., completion of which will have attained a depth of approximately 700 ft. Developments to date are most encouraging, producing ore which is shipped regularly to custom works.

DEADWOOD MINES (Mogollon)—A large consignment of lap-welded pipe has just been received at plant and will be laid to a point about one mile up gulch from mill to carry water over numerous open crevices in ledge, which has been source of much trouble in mine in past by flooding.

NORTH CAROLINA

Montgomery County

COGGINS (Eldorado)—Three men were killed last week by falling 200 ft. after being dumped from an overturned skip.

IOLA (Candor)—The manager's residence and office was completely destroyed by fire in early hours of a recent morning. Occupants escaped in their night clothes and none of the mine records or papers were saved.

UWARRA MINING CO. (Candor)—New fine grinding and cyaniding mill, using rolls for stage crushing between the rock breaker and the tube-mill, has just been started. Extraction obtained first week was over 90% and is now a fraction over 95%, which is being easily maintained. The 400-ft. station underground has been completed and drifting to Iola and crosscutting to Montgomery veins has been started. Sinking from this level was resumed this week; the next station will be at 500-ft. level.

OREGON**Baker County**

GEM (Baker)—Among other improvements to be made at this mine early in present year is addition of electric power, which will greatly facilitate operations.

Douglas County

NICKEL MINES & SMELTING CO.—Articles of incorporation of this company, capitalized at \$300,000, have been filed. Incorporators are C. D. Edwards, Clark C. Foster and J. Oren Thomas, all of Portland, where the principal office will be. Company owns nickel deposits near Riddle in the southern part of county, and on which much development work has been done.

Jackson County

NELLIE WRIGHT (Gold Hill)—Modern mill of 75-tons capacity which was recently built on this mine will soon be in operation.

BILL NYE (Galls Creek)—After an idleness of several years this mine has taken on new life and owners, Frenchmen, are now developing it. New buildings are being erected, new equipment is being added and management is working two shifts in mine.

BRADEN (Gold Hill)—This mine, two miles south of Gold Hill, is one of the oldest producers in the district. Mine is now owned and operated by Ray company, which is working three shifts and greatly increasing output. New tunnels are being driven opening up much good ore.

DOWDEN FALLS DREDGE (Gold Hill)—Operation of dredge to recover gold from the rich bars near here is awaited with interest. Prospecting led to organization of a company of Tacoma men and purchase of nearly a quarter section of dredging ground, including the Lyman orchard, one of the best paying fruit farms in the valley, which will for a time produce gold instead of Spitzenberg apples. It is the intention of the dredging company to replace the trees as rapidly as ground is worked over.

Josephine County

ORIOLE (Metaline)—The new 10-stamp mill is being set up, and it is hoped to have plant in operation within 60 days, which will enable this company to treat its entire output of ore.

ALMEDA CONSOLIDATED MINES CO. (Galice)—John Ross, who is in charge of development work under Receiver Burley, states that tests being made to determine kind of concentrators to be installed are about completed and prospects are favorable for early resumption of operations.

UTAH**Beaver County**

REVENUE (Newhouse)—Silver-lead ore is being mined from Cliff claim. This is being sacked and accumulated for a shipment early in spring.

MOSCOW (Milford)—New shaft is down 315 ft., and station is being cut. At a depth of 750 ft. drifting is to be done to connect with workings at present furnishing greater part of output.

Juab County

TINTIC SHIPMENTS for the week ended Jan. 16 amounted to 153 cars.

IRON BLOSSOM (Silver City)—During December earnings were about \$53,000 or \$20,000 greater than rate required for regular quarterly dividends.

BECK TUNNEL (Eureka)—At a recent meeting it was stated that there was over \$15,000 in treasury. This sum is being added to through royalties from lessees.

TINTIC ZINC (North Tintic)—This property adjoins the Scranton on the south. A tunnel is in 300 ft., and crosscutting has been started to reach one of the main fissures.

LEHI-SCRANTON (North Tintic)—Development work is being done at this property north of the Scranton in search of the Scranton vein. There is a tunnel in about 30 feet.

COLORADO (Silver City)—At a recent directors' meeting it was decided to lease northern end of property, and various blocks of ground have been taken. It is thought that there are good chances of opening some ore to east or west of main ore channel.

TINTIC STANDARD (Eureka)—A new boiler is being installed and work will be resumed in near future. Ore taken from winze on 1000 level, which was recently shipped, brought \$1585 for 40 tons.

SCRANTON (North Tintic)—Shipments of 50 tons weekly are being made. Much attention is being given to development, and on 600, lowest level in new shaft a good showing of low-grade ore is reported. A new tunnel is being driven for same vein a few hundred feet to south.

YANKEE (Eureka)—An unusually good showing has been made on 1700 level, where a large body of quartz has been cut. Drifting is being done on 2000-ft. level also, and on 200. Work on latter level is reaching interesting territory, where there are chances of cutting continuation of Beck Tunnel vein.

EAGLE & BLUE BELL (Eureka)—Station on 1550 level is completed, and drifting has been started for ore shoot opened by winze from 1350. Ore recently cut on 1000-ft. level north of shaft, has been developed enough to indicate a good-sized shoot of shipping grade. This ore is thought to be independent of other shoots opened.

BLACK JACK—(Mammoth)—Arrangements are being made for mining low-grade ore in southern part of mine. Some repairs will be necessary before old stopes in Star Consolidated section can be opened. Outlet will be by 200 tunnel, which connects workings with railroad. There is a large tonnage of low-grade material in old workings as well as on dumps.

Tooele County

LION HILL (Ophir)—Company continues to develop its property. Arrangements for facilitating handling of ore have recently been made.

CLIFF (Ophir)—Shipments at rate of one car per day are being made. Ore is coming from development, and from older orebodies. Prospecting is being done on 850 and 1000-ft. levels of Tony incline.

CANADA**Alberta**

SEGUR SYNDICATE—A syndicate headed by Ira E. Segur, of California, operating in Calgary oil field, has reached a depth of 2000 ft. and has struck natural gas and oil-bearing sand.

CALGARY PETROLEUM PRODUCTS CO.—Drilling operations by this company, which were begun early in winter, have shown that geological formation is much broken and as a consequence oil field may be considerably disturbed, and may not yield oil in paying quantities.

British Columbia

GRANBY CONSOLIDATED (Anyox)—Manager Williams has been quoted to the effect that he intended to blow in the Hidden Creek smelter Jan. 25 or 26. However no announcement that a furnace is in blast has been made officially at New York.

AUPEAS (Hope)—A temporary cable from mine to camp is being put in. Good progress has been made in raise from south drift. Work in north drift has resulted favorably, vein now being continuously exposed for over 200 ft. in drifts. It is apparently uniform in character and grade.

BULLION (Cariboo)—This big hydraulic mine, owned for some years by the Guggenheims, has been staked by John Hopp, of Seattle, because of failure on part of owners to take out a provincial mining license. Property was on point of being sold to E. T. Ward, of Vancouver, and because of Hopp's action there is a question as to ability to deliver title. Ward is bringing before provincial executive an appeal which will go into whole merits of case. Mining men claim a change should be made in law so that it will be impossible for an employee to involve his employers in losses by letting a license lapse for a few days. Several millions have been spent in development of Bullion in preparation for bringing water from Spanish Lake. These gravel beds are 300 ft. or more in height, lying on bedrock about 60 ft. above Quesnel River. Last work done was by John B. Hobson, who some time before his death cleaned up \$35,000 in a 22-days run.

Ontario

COBALT PRODUCTION FOR DECEMBER 1913 was as follows: Crown Reserve, 21.99 and by Dominion Reduction Co., 63.65 tons or 85.64 tons; Coniagas, 95.08; Cobalt Comet (Dummond), 63.08; Cobalt Townsite, 203.24; Cobalt Lake, 153.17; Kerr Lake (By Dominion Reduction Co.), 24.25; La Rose, 515.53; McKinley Darragh, 284.55; Nipissing, 307.42; Peterson Lake (Seneca Superior), 43.50; Peterson Lake (Gould), 9; Penn Canadian, 32.79; O'Brien, 95.56; Right-of-Way, 43.15; Tretheway, 44.49; York Ontario, 21.49; Casey Cobalt, 71.79; Miller Lake O'Brien, 27.60; Total silver ore shipments, 2121.33 tons.

HURONIAN (South Porcupine)—An order has been placed for an additional five stamps and the other necessary machinery.

WETTLAUFER (Cobalt)—Profits for 1913 were \$38,042 as against \$320,249 for preceding year. Practically all the ore has been extracted and mine closed.

TOUGH-OAKES (Swastika)—It is understood that a bond issue amounting to £600,000 has been subscribed for in England in order to purchase this property.

SENECA-SUPERIOR (Cobalt)—A bi-monthly dividend of 10% and a bonus of 2½% payable Feb. 14 has been declared. With this dividend company will have paid a total of 90% within a year.

HUDSON BAY (Cobalt)—Production for December was 49,721 oz. A meeting of stockholders of Dome Lake Co. which is controlled by Hudson Bay, will be held Feb. 9 to ratify a by-law increasing capital from \$750,000 to \$1,000,000.

LA ROSE (Cobalt)—Net profits for 1913 amounted to \$953,000 as compared with \$1,022,690 in 1912 and \$1,269,086 in 1911. Total production for year was 2,334,000 oz. having a gross value of \$1,550,000. Surplus on Dec. 31 amounted to \$1,864,434.

HUNTOON (Swastika)—This property, together with Horne and Stevenson claims in Kirkland Lake district, has been optioned to English interests identified with Kirkland Lake Proprietary. It is stated that these men now control 53 claims in this section.

PERU

CERRO DE PASCO MINING CO. (Lima)—Advices dated Dec. 29, 1913 state that trials made of the operation of new 12,000 hp. hydro-electric plant have been highly satisfactory and that the work of installation is practically completed. This is the first time that any effort has been made, on a large scale, to utilize the water power of the mountain rivers. The total cost of the new plant is stated to be in excess of £200,000. The power utilized is taken from the Mantaro River, a 17-km. ditch and pipe line affording the necessary connection and furnishing in excess of 200 second-feet of water with an effective fall of 750 ft. In the plant proper six Pelton wheels are connected, in sets of two, with three dynamos, each of 3000 kw. Costly dam construction was avoided by the selection of the intake site. The power station at Oroya is about 70 miles from the smelter and mines at Cerro de Pasco. The transmission line has also been extended to Morococha, 15 miles from Oroya, for Morococha Mining Co. The coal formerly consumed by steam plants will now be diverted to coke plant, making company independent of foreign coke, which is a considerable item in cost of smelting.

VENEZUELA

CANADIAN VENEZUELAN ORE CO. LTD.—It is reported from South America that company discontinued operations Dec. 24, 1913, due to lack of ore and high costs.

The Market Report

METAL MARKETS

NEW YORK—Jan. 28

The metal markets have shown rather more activity and fluctuations in price have been inclined upward, though not great in amount.

Copper, Tin, Lead and Zinc

Copper—The market has been more active. There has been a good demand from day to day for export, and there has also been some business done for home trade. The bulk of the business was for export and aggregated millions of pounds. Producers' books are now fairly well filled, and there is a tendency to raise prices as the demand develops. On the other hand buyers generally, and particularly those in this country, are supposed still to need a considerable quantity of copper for delivery within the next 60 days. On Jan. 28 sales were made on an advancing scale up to 14% c., delivered, usual terms and one of the principal producers advanced its asking price to 14 3/4 cents.

The average of the quotations for electrolytic for the week is 14.354 cents.

The London standard market has been active and strong. On Thursday, Jan. 22, spot was £65 1s. 3d. and three months £65 7s. 6. On Jan. 23 it was about 5s. higher. On Monday, Jan. 26, it reacted to £65 2s. 6d. for spot and £65 7s. 6d. for three months. On Jan. 27, the market started upward again, spot advancing to £65 12s. 6d. and three months to £65 17s. 6d. at which the market closes on Jan. 28.

Base price of copper sheets is 20 1/4 c. per lb. for hot rolled and 21 1/4 c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15% @ 16c., carload lots at mill.

Exports from New York for the week included 10,886 long tons of copper. Our special correspondent reports the exports from Baltimore for the week at 2638 tons copper. Imports at New York for the week included 1740 tons bars, 45 tons matte and 5670 tons ore.

In its circular of Jan. 20, the National Conduit & Cable Co. says: "We fully expect to see larger quantities of copper going into home consumption each month before long, and in the coming weeks we look for more active buying. It is not probable, however, that manufacturing activity will be immediately resumed at approximately full capacity, but it is reasonable to assume that consumption will gradually reach a more normal basis within the first half of this year provided fundamental conditions are favorable.

Tin—The improvement in this market has made further progress. On Thursday of last week the market advanced £3 10s. in London, only to decline again on Friday to the extent of about £2 10s. This reaction induced consumers and dealers in this market to become very active, and business late on Friday as well as on Saturday assumed very large proportions. In fact, bids were made on Saturday, on which day the London and New York metal exchanges are closed, which were almost £2 higher than the close on Friday. The London market on Monday reflected the large orders placed from here, and again advanced. Then, however, profit-realizing sales were made in this market and tin was freely offered at below the importation basis, with the result that the highest level was not maintained. The market had a slight reaction, but closes strong at £179 5s. for spot, and £180 10s. for three months; 39 3/4 c. for February tin here.

Lead—The leading producer has continued to supply lead at 4.10c., New York, but at St. Louis the price advanced, as high as 4.02 1/2 c. being realized, the average of the business reported being at about 4.01c. The sales aggregated a rather large tonnage, especially on Jan. 23. The market is firm and active and an advance in the New York price is anticipated.

The London market is quiet but firm, Spanish lead being quoted £20, and English lead £20 10s. per ton.

Spelter—There has been a better demand, and fair quantities of the metal have changed hands at higher prices.

The London market is unchanged. Good ordinaries are quoted £21 10s.; specials 5s. higher.

Base price of zinc sheets was reduced 1/4 c. per lb. on Jan. 22, and is now \$7.25 per 100 lb. in carload lots, f.o.b. Peru, Ill., less 8% discount. Extras and discounts unchanged.

Other Metals

Aluminum—Business is a little better, but still not especially active. Quotations are unchanged, at 18% @ 19c. per lb. for No. 1 ingots, New York. Futures are quoted about the same.

Antimony—The market is stronger and steady. There has been little or no change in prices, though the tendency is firmer. Cookson's is quoted at 7.30 @ 7.40c. per lb.; Hallett's,

DAILY PRICES OF METALS

NEW YORK

| January | Sterling Exchange | Silver | Copper | | Tin | Lead | | Zinc | |
|---------|-------------------|--------|--------------------|----------------------------|--------|------------------------|-------------------------|------------------------|-------------------------|
| | | | Lake, Cts. per lb. | Electrolytic, Cts. per lb. | | New York, Cts. per lb. | St. Louis, Cts. per lb. | New York, Cts. per lb. | St. Louis, Cts. per lb. |
| 22 | 4.8645 | 57 1/2 | *14 1/2 @ 15 1/2 | 14.25 @ 14.35 | 38 1/2 | 4.10 | 3.97 1/2 @ 4.02 1/2 | 5.25 @ 5.27 1/2 | 5.10 @ 5.12 1/2 |
| 23 | 4.8615 | 57 1/2 | *14 1/2 @ 15 1/2 | 14.30 @ 14.35 | 38 1/2 | 4.10 | 4.00 @ 4.02 1/2 | 5.25 @ 5.30 | 5.10 @ 5.15 |
| 24 | 4.8610 | 57 1/2 | *14 1/2 @ 15 1/2 | 14.30 @ 14.35 | 38 1/2 | 4.10 | 4.00 @ 4.02 1/2 | 5.25 @ 5.30 | 5.10 @ 5.15 |
| 26 | 4.8615 | 57 1/2 | *14 1/2 @ 15 1/2 | 14.30 @ 14.40 | 39 | 4.10 | 4.00 @ 4.02 1/2 | 5.25 @ 5.30 | 5.10 @ 5.20 |
| 27 | 4.8615 | 58 | *14 1/2 @ 15 1/2 | 14.35 @ 4.40 | 39 1/2 | 4.10 | 4.00 @ 4.02 1/2 | 5.25 @ 5.35 | 5.15 @ 5.20 |
| 28 | 4.8585 | 57 1/2 | *14 1/2 @ 15 1/2 | 14.40 @ 14.50 | 39 1/2 | 4.10 | 4.00 @ 4.02 1/2 | 5.32 @ 5.37 1/2 | 5.17 @ 5.22 1/2 |

*Nominal.

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. 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. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. 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, 15c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16 @ 17 1/2 c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Trieste, 22c.

LONDON

| January | Silver | Copper | | | | Tin | | Lead | | Zinc | |
|---------|--------|-----------|--------------|--------|------------|---------|---------|-----------|--------------|-----------|--------------|
| | | £ per Ton | Cts. per lb. | 3 Mos. | Best Sel'd | Spot | 3 Mos. | £ per Ton | Cts. per lb. | £ per Ton | Cts. per lb. |
| | | Spot | Spot | Spot | Spot | Spot | Spot | Spot | Spot | Spot | Spot |
| 22 | 26 1/4 | 65 1/4 | 14.14 | 65 1/2 | 70 1/2 | 177 | 178 1/2 | 20 1/2 | 4.43 | 21 1/2 | 4.70 |
| 23 | 26 1/2 | 65 1/4 | 14.20 | 65 1/2 | 70 1/2 | 174 1/2 | 175 1/2 | 20 1/2 | 4.40 | 21 1/2 | 4.70 |
| 24 | 26 1/4 | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| 26 | 26 1/4 | 65 1/2 | 14.15 | 65 1/2 | 70 | 176 1/2 | 178 | 20 1/2 | 4.37 | 21 1/2 | 4.70 |
| 27 | 26 1/2 | 65 1/2 | 14.26 | 65 1/2 | 70 1/2 | 178 1/2 | 179 1/2 | 20 1/2 | 4.37 | 21 1/2 | 4.67 |
| 28 | 26 1/2 | 65 1/2 | 14.26 | 65 1/2 | 70 1/2 | 179 1/2 | 180 1/2 | 20 | 4.35 | 21 1/2 | 4.67 |

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 latter 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 = 2.17 1/2 c.; £15 = 3.26 c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21 1/2 c.

7@7½c.; while 6@6¼c. is asked for Hungarian, Chinese and other outside brands.

Quicksilver—Business is improving and is on a fair scale, with prices unchanged. New York quotation is \$38@39 per flask of 75 lb. for large lots. Jobbing price is 54@55c. per lb. San Francisco, \$38.50 per flask for domestic orders. London price is £7 10s. per flask, with £7 quoted from second hands.

Bismuth—Quotations at New York are \$1.80 per lb. for imported metal and \$1.72 per lb. for metal from domestic ores. The London price is 7s. 6d. per lb. The price is still controlled by the European Syndicate.

Cadmium—German quotation is 750 marks per 100 kg.—equal to about 81c. per lb.—f.o.b. works in Silesia.

Magnesium—The current quotation for pure metal is \$1.50 per lb. for lots of 100 lb. or over, at New York.

Nickel—Quotations for ordinary forms—shot, blocks, or plaquettes—are 40@45c. per lb., according to size or order and quality. Electrolytic nickel is 5c. per lb. higher.

Selenium—For large lots, 100 lb. or over, \$3@3.25 per lb. is quoted; while \$5 per lb. is paid for retail orders.

Gold, Silver and Platinum

Gold—There was no especial demand the past week, and prices remained as usual on the open market in London, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. In New York, an additional lot of \$2,000,000 was taken for export to Paris.

The gold production of Rhodesia, now reported for the full year, was \$13,286,821 in 1912, and \$14,243,759 in 1913; an increase of \$956,938, or 7.2%, last year.

Samuel Montagu & Co. say in their circular for Jan. 22: "Although the import of gold of all descriptions into India during 1913 decreased by about £9,000,000, the import of bar gold alone, £9,916,924, shows an increase of over £1,800,000, or 22%. As bar gold is used mostly for manufacture into jewelry, this fact is a remarkable evidence of the power and disposition of the Indian people to invest in articles of luxury, which, in this case, are also of substantial intrinsic value."

Iridium—Current demand is rather quiet and prices remain about the same as they have been, \$75@78 per oz., New York, being quoted.

Platinum—There is no special change in the market, which continues rather quiet. Quotations are unchanged, \$43@44 per oz. being asked for refined platinum, and \$46@49 per oz. for hard metal.

Silver—Prices have been maintained very well. Fresh arrivals in London are somewhat restricted owing to Mexican troubles, but there seems to be sufficient bullion on hand, including what was taken over by the syndicate from the Specie Bank holdings, to meet the commercial demands. When this supply is disposed of a large inquiry for bullion from any quarter might produce a sharp rise.

Shipments of silver from London to the East for the year from Jan. 1 to Jan. 15; as reported by Messrs. Pixley & Abell:

| | 1913 | 1914 | Changes |
|------------|-----------|-----------|--------------|
| India..... | £ 756,500 | £ 180,000 | D. £ 576,500 |
| China..... | 10,000 | 10,000 | ..... |
| Total..... | £ 766,500 | £ 190,000 | D. £ 576,500 |

Imports of silver at New York for the week were \$205,888, from the West Indies, Mexico and South America. Exports were \$638,598, chiefly to London.

Zinc and Lead Ore Markets

JOPLIN, MO.—Jan. 24

Zinc blende sold as high as \$43, the assay base ranging from \$41 to \$40, the metal base from \$39 to \$37 per ton of 60% zinc. The calamine base is \$20@23 per ton of 40% zinc. The average of all grades of zinc is \$38.98 per ton. Lead ore sold as high as \$53.50 on a base of \$50 per ton of 80% metal content, and the average of all grades is \$50.56 per ton.

SHIPMENTS WEEK ENDED JAN. 24

| | Blende | Calamine | Lead | Value |
|--|------------|-----------|-----------|-------------|
| Total this week | 9,893,580 | 335,810 | 2,087,700 | \$252,230 |
| Total this year | 40,980,930 | 2,089,540 | 7,968,390 | \$1,037,875 |
| Blende value, the week, \$195,490; 4 weeks, \$817,910. | | | | |
| Calamine value, the week, \$3950; 4 weeks, \$21,875. | | | | |
| Lead value, the week, \$52,790; 4 weeks, \$198,090. | | | | |

PLATTEVILLE, WIS.—Jan. 24

The base price paid this week for 60% zinc ore was \$40 per ton. Sales of 80% lead ore were made at \$50 per ton.

SHIPMENTS WEEK ENDED JAN. 24

| | Zinc ore, lb. | Lead ore, lb. | Sulphur ore, lb. |
|------------|---------------|---------------|------------------|
| Week | 3,189,170 | 220,000 | 835,520 |
| Year | 10,468,820 | 357,140 | 3,756,610 |

Shipped during week to separating plants, 3,087,350 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—Jan. 28

The late accounts from the iron trade are encouraging, and indicate a revival of trade at an early date. Already new orders are becoming more frequent and mills are extending operations, increasing working forces and generally preparing for a heavier business. New construction is evidently on the increase, with a correspondingly greater demand for material.

Pig iron also is more active and the demand for basic iron is an evidence of more general activity. Foundry iron inquiries are increasing at a fair rate.

FOREIGN IRON NOTES

German Foreign Trade in Iron and Steel, 11 months ended Nov. 30, in metric tons:

| | Exports | Imports | Excess |
|---------------------|-----------|---------|----------------|
| Iron and steel..... | 5,918,565 | 573,255 | Exp. 5,345,310 |
| Machinery..... | 513,599 | 82,213 | Exp. 431,386 |
| Total..... | 6,432,164 | 655,468 | Exp. 5,776,696 |
| Total, 1912..... | 5,932,855 | 685,230 | Exp. 5,247,625 |

The increase over 1912 in exports was 499,309 tons, or 8.4%. There was a decrease of 29,762 tons, or 4.3%, in the imports.

Pig Iron Production in Belgium for the year ended Dec. 31, in metric tons:

| | 1912 | 1913 | Changes |
|------------------------|-----------|-----------|------------|
| Foundry iron..... | 46,950 | 27,665 | D. 19,285 |
| Forge iron..... | 95,795 | 92,825 | D. 2,970 |
| Steel making iron..... | 2,155,265 | 2,356,040 | I. 200,775 |
| Total..... | 2,298,010 | 2,476,530 | I. 178,520 |

On Jan. 1, 1913, there were 61 blast furnaces in Belgium, 55 of them being in blast and six inactive.

Fuel Production in Germany 11 months ended Nov. 30, in metric tons:

| | 1912 | 1913 | Changes |
|-----------------------|-------------|-------------|---------------|
| Coal mined..... | 162,209,627 | 175,945,462 | I. 13,735,835 |
| Brown coal mined..... | 75,218,408 | 79,741,825 | I. 4,523,417 |
| Coke made..... | 26,435,461 | 29,470,168 | I. 3,034,707 |
| Briquettes made..... | 22,291,103 | 25,030,526 | I. 2,739,423 |

Of the briquettes reported in 1913 a total of 19,470,168 tons were made from brown coal or lignite.

PITTSBURGH—Jan. 27

The steel market has undergone further improvement in the past week. Bookings, as a rule, have increased, and here and there a distinct advancing tendency is displayed in prices. Predictions are made that next month prices on many commodities will move up \$1 a ton.

The steel mills are operating at fully 60% of capacity, and in several instances are doing better than this. The blast furnaces which were banked over the holidays are now all in operation again and very few furnaces are now blowing out.

Last Thursday afternoon the American Sheet & Tin Plate Co. advanced its prices to the following basis: Blue annealed, 1.45c.; black sheets, 2c.; galvanized sheets, 3c.; tin mill black, 1.95c. The action involved advances of \$1 to \$3 a ton. Several of the independents have since advanced their prices to the minimum of the leading interest, while others have advanced part way. Wire products, which advanced \$1 a ton early in January, are expected to advance another dollar a ton in the near future, and there is a report that some advances may be made in tubular goods. Bars, plates and shapes have stiffened to such an extent that they are generally quoted at 1.20c. for first quarter and 1.25c. for second quarter, while tonnage is coming in at such a rate that predictions are made there will be a definite advance of \$1 a ton in these products before the end of February.

Pig Iron—The market shows no material change, except that furnaces are less disposed to sell for extended deliveries at current prices. Basic is strong at \$12.50, Valley, and some important producers are quoting above this. Bessemer, on the other hand, is only moderately steady at the old quotation of \$14, Valley, and inquiry for a round tonnage might bring out

a lower figure. Foundry iron is quoted at \$13, Valley, but some tonnage has been sold at \$ 3.65, Pittsburgh, although the valley quotation mentioned would make \$13.90, Pittsburgh. Scottsdale furnace is being blown out.

Ferromanganese—The English producers of ferromanganese have reduced their quotation from \$45 to \$40, Baltimore, making rather a spectacular reduction. The measure is obviously directed against the Carnegie Steel Co., which about a month ago entered the market and sold a round tonnage on contract to July 1, on the basis of naming prices monthly at a spread below whatever should be the price of the English makers. Ferromanganese has declined a total of \$10 a ton since Oct. 1, apart from the \$2.50 decline, which occurred by reason of the tariff coming off. The Carnegie Steel Co. has withdrawn as a seller, but is making prices to its contract customers in relation to the reduced price of the foreign producers. The high point on ferromanganese was \$65, a year ago, since when there has been a total decline of \$25, \$2.50 of which was due to the removal of the tariff last October.

Steel—Following the withdrawal of the Carnegie Steel Co., some 10 days ago, as a seller of sheet bars, other mills, which had been selling openhearth sheet bars at \$20, mill, advanced the price to \$21, which they had been quoting regularly on bessemer bars, and the market is now firm at \$20 for billets, \$21 for first-quarter sheet bars and \$22 for second-quarter sheet bars. The bulk of the consumption, at least for first-quarter, had been covered before the advance.

IRON ORE

Shippers and vessel owners are not anxious for the season to start, and a late opening of the ore season may be accepted. Nothing has been done as to sales and prices of Lake ore so far. A few reservations of ore have been made, the contract prices to be fixed later.

COKE

Coke production in the Connellsville region for the week was 268,357 tons, of which 95,852 tons were made by the merchant furnaces. Shipments were 264,784 tons. Production in upper Connellsville and Greensburg districts was 33,749 tons.

Connellsville Coke—The market is quiet and not overly firm, according to some indications, since it is believed one furnace interest has picked up considerable prompt coke at \$1.75. It is possible that this was not standard. The market is generally quoted at \$1.90 for prompt and \$1.90@2 for contract. There is very little inquiry but a fair-sized tonnage is expected to be purchased next week by furnaces which recently covered only for their January requirements.

British Fuel Exports year ended Dec. 31 were as follows, in long tons:

| | 1912 | 1913 | Changes |
|-------------------|------------|------------|---------------|
| Coal..... | 64,444,395 | 73,400,118 | I. 8,955,723 |
| Coke..... | 1,010,650 | 1,233,936 | I. 223,286 |
| Briquettes..... | 1,580,803 | 2,053,187 | I. 472,384 |
| Steamer coal..... | 18,291,370 | 21,031,507 | I. 2,740,137 |
| Total..... | 85,327,218 | 97,718,748 | I. 12,391,530 |

Imports are insignificant, only 191,768 tons in 1912, and 24,029 tons last year.

German Foreign Trade in Fuel 11 months ended Nov. 30, in metric tons:

| | Exports | Imports | Excess |
|------------------|------------|------------|-----------------|
| Coal..... | 31,551,019 | 9,749,773 | Exp. 21,801,246 |
| Brown coal..... | 55,078 | 6,458,160 | Imp. 6,403,082 |
| Coke..... | 5,945,636 | 549,351 | Exp. 5,396,285 |
| Briquettes..... | 2,859,047 | 132,349 | Exp. 2,726,698 |
| Total..... | 40,410,780 | 16,889,633 | Exp. 23,521,147 |
| Total, 1912..... | 36,136,650 | 16,947,948 | Exp. 19,188,702 |

The exports in 1913 included 64,527 tons of coke sent to the United States.

CHEMICALS

NEW YORK—Jan. 28

The general market is rather quiet with moderate business only reported.

Copper Sulphate—Sales are on a fair scale. Current quotations are \$4.80 per 100 lb. for carload lots and \$5.05 per 100 lb. for smaller parcels.

Arsenic—The market is dull and there seems to be little prospect for better business at present. As low as \$2.75 per 100 lb. can be done on contract. Spot arsenic is quoted at \$2.87½ for carload lots and \$3 per 100 lb. for smaller orders.

Nitrate of Soda—The market is very dull, with little business forward. Quotations are 2.22½c. per lb. for both spot and futures. These prices are below the parity of both Europe and the West Coast, and any considerable buying would probably send them up.

Sulphate of Ammonia—Exports of sulphate of ammonia from Great Britain were 285,043 long tons in 1912 and 324,704 tons in 1913; increase, 39,661 tons; or 13.9%. Of the exports in 1913 the United States took 37,067 tons.

OTHER ORES

Current prices for manganese ore abroad are as follows: Indian and Brazilian ore, 50% manganese, 20@20½c. per unit; 48%, 19@19½c.; 45%, 18½@19c. per unit. Russian (Caucasus) ore, 50% manganese, 17½@18c.; 48%, 17@17½c. per unit. All prices are c.i.f., United Kingdom port.

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.

| | August | September | October | November | December |
|-----------------------|-------------|-------------|-------------|------------|------------|
| Alaska shipments | 1,847,785 | 2,261,216 | 1,951,883 | 3,391,300 | 3,104,155 |
| Alameda..... | 22,500,000 | 22,600,000 | 18,400,000 | 25,250,000 | 25,100,000 |
| Arizona, Ltd..... | 1,800,000 | 1,800,000 | 3,550,000 | 2,800,000 | 1,920,000 |
| Copper Queen..... | 8,252,404 | 8,434,803 | 8,292,929 | 7,115,991 | 9,033,459 |
| Calumet & Ariz..... | 4,500,000 | 4,000,000 | 4,500,000 | 4,600,000 | 5,230,000 |
| Chino..... | 5,788,572 | 4,196,296 | 4,767,466 | 4,270,821 | ..... |
| Detroit..... | 2,187,223 | 2,102,818 | 1,861,878 | 1,922,352 | 2,021,034 |
| East Butte..... | 1,162,007 | 1,233,018 | 1,040,997 | 1,002,190 | ..... |
| Giroux..... | 524,953 | 198,178 | 156,084 | ..... | ..... |
| Mason Valley..... | 867,960 | 918,000 | 1,052,000 | 1,174,000 | ..... |
| Mammoth..... | 1,750,000 | 1,750,000 | 1,700,000 | 1,700,000 | 1,400,000 |
| Nevada Con..... | 5,989,973 | 4,441,671 | 5,898,046 | 5,443,647 | 5,343,862 |
| Ohio..... | 689,000 | 685,900 | 698,691 | 772,120 | ..... |
| Old Dominion..... | 2,524,000 | 2,679,000 | 2,037,000 | 2,450,000 | 2,613,039 |
| Ray..... | 4,269,519 | 4,336,434 | 4,725,419 | 4,753,964 | 5,075,202 |
| Shannon..... | 1,248,000 | 1,233,000 | 1,216,000 | 1,110,000 | 1,078,000 |
| South Utah..... | 223,498 | 241,843 | 232,269 | 225,072 | ..... |
| Tennessee..... | 1,101,019 | 1,309,985 | 1,392,162 | 1,666,753 | 1,700,000 |
| United Verde*..... | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 | ..... |
| Utah Copper Co..... | 10,302,251 | 11,463,905 | 9,929,478 | 10,787,426 | 10,306,646 |
| Lake Superior*..... | 9,700,000 | 6,950,008 | 5,500,000 | 6,600,000 | ..... |
| Non-rep. mines*..... | 6,200,000 | 6,000,000 | 6,200,000 | 6,000,000 | ..... |
| Total prod..... | 96,427,264 | 91,836,075 | 88,102,302 | ..... | ..... |
| Imp., bars, etc..... | 22,474,471 | 35,703,660 | 21,935,023 | 21,796,866 | ..... |
| Total blister..... | 118,901,735 | 127,539,735 | 110,037,325 | ..... | ..... |
| Imp. ore & matte..... | 9,171,351 | 10,800,162 | 5,062,015 | 8,980,186 | ..... |
| Total Amer..... | 128,073,086 | 138,339,897 | 115,099,340 | ..... | ..... |
| Miami..... | 3,097,500 | 2,688,000 | 2,862,050 | 3,230,000 | ..... |
| Shattuck-Arizona..... | 1,001,634 | 1,163,237 | 993,224 | 995,429 | 1,050,731 |
| Brit. Col. Cos..... | 647,905 | 621,120 | 688,581 | ..... | ..... |
| British Col. Cop..... | 1,847,344 | 1,824,659 | 1,718,258 | 1,944,145 | 1,605,382 |
| Granby..... | ..... | ..... | ..... | ..... | ..... |
| Mexican Cos..... | ..... | ..... | ..... | ..... | ..... |
| Boleof..... | 2,264,640 | 2,369,920 | 2,424,800 | 2,315,040 | 2,315,040 |
| Cananea..... | 3,186,000 | 3,148,000 | 3,682,000 | 3,800,000 | 3,646,000 |
| Moctezuma..... | 3,542,047 | 3,024,121 | 3,178,136 | 3,517,800 | 3,139,613 |
| Other Foreign..... | ..... | ..... | ..... | ..... | ..... |
| Braden, Chile..... | 1,572,000 | 1,332,000 | 2,006,000 | 1,592,000 | 2,122,000 |
| Cape Cop., S. Af..... | ..... | 607,040 | 712,320 | 649,600 | ..... |
| Kyshtim, Russia..... | 1,585,000 | 1,187,000 | ..... | ..... | ..... |
| Spassky, Russia..... | 1,048,320 | 1,025,920 | 983,360 | 904,960 | ..... |
| Exports from..... | ..... | ..... | ..... | ..... | ..... |
| Chile..... | 8,736,000 | 5,600,000 | 6,160,000 | 7,616,000 | 10,640,000 |
| Australia..... | 7,720,000 | 6,944,000 | 7,728,000 | 11,200,000 | 6,720,000 |
| Arrivals—Europe..... | 14,624,960 | 9,661,120 | 18,040,960 | 9,107,840 | 13,787,200 |

† 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.

STATISTICS OF COPPER

| Month | United States | | | Visible Stocks. | | |
|------------|--------------------------|----------------------|------------------------|-----------------|------------|-------------|
| | U.S. Refin'ly Production | Deliveries, Domestic | Deliveries, for Export | United States | Europe | Total |
| Year, 1912 | 1,581,920,287 | 319,665,948 | 746,396,455 | ..... | ..... | ..... |
| I. 1913. | 143,479,625 | 65,210,030 | 60,383,845 | 105,312,582 | 78,491,840 | 183,904,422 |
| II..... | 130,948,881 | 59,676,492 | 72,168,523 | 123,198,332 | 77,504,000 | 200,702,332 |
| III..... | 136,251,849 | 76,585,471 | 77,699,306 | 122,302,890 | 81,244,800 | 203,547,690 |
| IV..... | 135,353,402 | 78,158,837 | 85,894,727 | 104,269,270 | 87,180,800 | 191,450,070 |
| V..... | 141,319,416 | 81,108,321 | 68,285,978 | 75,549,108 | 85,948,800 | 161,497,908 |
| VI..... | 121,860,853 | 68,562,571 | 68,067,901 | 67,474,225 | 77,235,200 | 144,709,425 |
| VII..... | 138,074,602 | 58,961,192 | 78,480,071 | 52,814,606 | 77,904,000 | 124,808,606 |
| VIII..... | 131,632,362 | 73,649,801 | 73,263,469 | 53,594,945 | 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 | 48,676,858 | 70,067,803 | 32,566,382 | 48,787,200 | 81,353,582 |
| XII..... | 138,990,421 | 21,968,570 | 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. | ..... | ..... | ..... | 91,438,867 | 53,916,800 | 145,355,667 |

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

| Assessments | | | |
|--------------------------------|---------|---------|---------|
| Company | Delinq. | Feb. | Amt. |
| Amador, Ida. | Jan. 20 | Feb. 21 | \$0.025 |
| Black Balsam, Utah. | Jan. 12 | Feb. 12 | 0.001 |
| Central Eureka, Calif. | Jan. 16 | Feb. 17 | 0.05 |
| Century, Utah. | Jan. 2 | Feb. 2 | 0.01 |
| Clear Grit, Ida, post'd. | Jan. 2 | Feb. 9 | 0.0025 |
| Cons. Virginia, Nev. | Jan. 13 | Feb. 3 | 0.10 |
| D.C., Calif. | Jan. 9 | Feb. 9 | 0.15 |
| Empire, Ida., postponed. | Jan. 12 | Feb. 2 | 0.005 |
| Federal Ely, Nev. | Jan. 12 | Feb. 12 | 0.001 |
| Huish, Utah. | Jan. 12 | Feb. 12 | 0.001 |
| Legal Tender, Ida., postponed. | Jan. 8 | Feb. 23 | 0.001 |
| North Bunker Hill, Ida. | Jan. 9 | Feb. 24 | 0.10 |
| Ophir, Nev. | Jan. 9 | Feb. 2 | 0.0025 |
| Pioche Metals, Nev. | Jan. 17 | Feb. 2 | 0.0017 |
| Polar Star, Utah. | Jan. 17 | Feb. 7 | 0.001 |
| Rainbow, Ida., postponed. | Jan. 20 | Dec. 20 | 0.002 |
| Roanoke, Ida. | Jan. 17 | Feb. 2 | 0.0017 |
| Ruby Mountain, Nev. | Jan. 14 | Jan. 26 | 0.0015 |
| Sandstorm-Kendall, Nev. | Dec. 29 | Feb. 2 | 0.02 |
| Silver Eagle, Ida. | Jan. 20 | Feb. 9 | 0.0025 |
| Stansbury, Utah. | Jan. 24 | Feb. 23 | 0.01 |
| United Tintic, Utah. | Jan. 20 | Feb. 9 | 0.0025 |
| Utah-Arizona, Ariz. | Jan. 17 | Feb. 3 | 0.005 |
| Utah Cons., Utah. | Jan. 7 | Feb. 14 | 0.00125 |
| Utah-Yerington, Nev. | Jan. 10 | Feb. 7 | 0.0005 |
| West-Yerington, Nev. | Jan. 10 | Feb. 7 | 0.00075 |
| Wisconsin, Ida., postponed. | Jan. 10 | Feb. 10 | 0.002 |

Monthly Average Prices of Metals
SILVER

| Month | New York | | | London | | |
|-----------|----------|--------|--------|--------|------|------|
| | 1912 | 1913 | 1914 | 1912 | 1913 | 1914 |
| January | 56.260 | 62.938 | 25.887 | 28.983 | | |
| February | 59.043 | 61.642 | 27.190 | 28.357 | | |
| March | 58.375 | 57.870 | 26.875 | 26.669 | | |
| April | 59.207 | 59.490 | 28.284 | 27.416 | | |
| May | 60.880 | 60.361 | 28.038 | 27.825 | | |
| June | 61.290 | 58.990 | 28.215 | 27.199 | | |
| 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 Standard | |
|-----------|--------------|--------|--------|--------|-----------------|------|
| | Electrolytic | | Lake | | 1913 | 1914 |
| | 1913 | 1914 | 1913 | 1914 | | |
| January | 16.488 | 16.767 | 16.767 | 16.767 | 71.741 | |
| February | 14.971 | 15.253 | 15.253 | 15.253 | 65.519 | |
| March | 14.713 | 14.930 | 14.930 | 14.930 | 65.329 | |
| April | 15.291 | 15.565 | 15.565 | 15.565 | 68.111 | |
| May | 15.436 | 15.738 | 15.738 | 15.738 | 68.807 | |
| June | 14.672 | 14.871 | 14.871 | 14.871 | 67.140 | |
| July | 14.190 | 14.563 | 14.563 | 14.563 | 64.166 | |
| August | 15.400 | 15.904 | 15.904 | 15.904 | 69.200 | |
| September | 16.328 | 16.799 | 16.799 | 16.799 | 73.125 | |
| October | 16.337 | 16.913 | 16.913 | 16.913 | 73.383 | |
| November | 15.182 | 16.022 | 16.022 | 16.022 | 68.275 | |
| December | 14.224 | 14.904 | 14.904 | 14.904 | 65.223 | |
| Year | 15.269 | 15.686 | 15.686 | 15.686 | 68.335 | |

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

TIN

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

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

LEAD

| Month | New York | | St. Louis | | London | |
|-----------|----------|-------|-----------|-------|--------|--------|
| | 1913 | 1914 | 1913 | 1914 | 1913 | 1914 |
| | January | 4.321 | 4.171 | 4.171 | 4.171 | 17.114 |
| February | 4.325 | 4.175 | 4.175 | 4.175 | 16.550 | |
| March | 4.327 | 4.177 | 4.177 | 4.177 | 15.977 | |
| April | 4.381 | 4.242 | 4.242 | 4.242 | 17.597 | |
| May | 4.342 | 4.226 | 4.226 | 4.226 | 18.923 | |
| June | 4.325 | 4.190 | 4.190 | 4.190 | 20.226 | |
| July | 4.353 | 4.223 | 4.223 | 4.223 | 20.038 | |
| August | 4.624 | 4.550 | 4.550 | 4.550 | 20.406 | |
| September | 4.698 | 4.579 | 4.579 | 4.579 | 20.648 | |
| October | 4.402 | 4.253 | 4.253 | 4.253 | 20.302 | |
| November | 4.293 | 4.146 | 4.146 | 4.146 | 19.334 | |
| December | 4.047 | 3.929 | 3.929 | 3.929 | 17.798 | |
| Year | 4.370 | 4.238 | 4.238 | 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 | 6.854 | 6.854 | 6.854 | 26.114 |
| February | 6.239 | 6.089 | 6.089 | 6.089 | 25.338 | |
| March | 6.078 | 5.926 | 5.926 | 5.926 | 24.605 | |
| April | 5.641 | 5.491 | 5.491 | 5.491 | 25.313 | |
| May | 5.406 | 5.256 | 5.256 | 5.256 | 24.583 | |
| June | 5.124 | 4.974 | 4.974 | 4.974 | 22.143 | |
| July | 5.278 | 5.128 | 5.128 | 5.128 | 20.592 | |
| August | 5.658 | 5.508 | 5.508 | 5.508 | 20.706 | |
| September | 5.694 | 5.444 | 5.444 | 5.444 | 21.148 | |
| October | 5.340 | 5.188 | 5.188 | 5.188 | 20.614 | |
| November | 5.229 | 5.083 | 5.083 | 5.083 | 20.581 | |
| December | 5.156 | 5.004 | 5.004 | 5.004 | 21.214 | |
| Year | 5.648 | 5.504 | 5.504 | 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 | \$17.35 | \$17.35 | \$17.35 | \$18.59 |
| February | 18.15 | 17.22 | 17.22 | 17.22 | 18.13 | |
| March | 18.15 | 16.96 | 16.96 | 16.96 | 17.53 | |
| April | 17.90 | 16.71 | 16.71 | 16.71 | 16.40 | |
| May | 17.68 | 15.80 | 15.80 | 15.80 | 15.40 | |
| June | 17.14 | 15.40 | 15.40 | 15.40 | 15.10 | |
| July | 16.31 | 15.13 | 15.13 | 15.13 | 14.74 | |
| August | 16.63 | 15.00 | 15.00 | 15.00 | 14.88 | |
| September | 16.65 | 15.04 | 15.04 | 15.04 | 14.93 | |
| October | 16.60 | 14.61 | 14.61 | 14.61 | 14.80 | |
| November | 16.03 | 13.91 | 13.91 | 13.91 | 14.40 | |
| December | 15.71 | 13.71 | 13.71 | 13.71 | 14.28 | |
| Year | \$17.09 | \$15.57 | \$15.57 | \$15.57 | \$15.77 | |

STOCK QUOTATIONS

| COLO. SPRINGS Jan. 27 | | SALT LAKE Jan. 27 | |
|-----------------------|------|---------------------|-------|
| Name of Comp. | Bid. | Name of Comp. | Bid. |
| Acacia | .021 | Beck Tunnel | 1.051 |
| Cripple Crk Con. | .009 | Black Jack | .071 |
| C. K. & N. | .06 | Cedar Fallsman | .001 |
| Doctor Jack Pot. | .061 | Colorado Mining | .111 |
| Elkon Con. | .501 | Crown Point | .01 |
| El Paso | 2.30 | Daly-Judge | 5.00 |
| Findlay | .02 | Gold Chain | .15 |
| Gold Dollar | .05 | Grand Central | .50 |
| Gold Sovereign | .011 | Iron Blossom | 1.171 |
| Golden Cycle | 1.00 | Little Bell | .10 |
| Isabella | .091 | Lower Mammoth | .01 |
| Jack Pot. | .051 | Mason Valley | 3.00 |
| Jennie Sample | .05 | May Day | .05 |
| Jerry Johnson | .031 | Nevada Hills | .46 |
| Lexington | .003 | New York | 1.001 |
| Old Gold | .01 | Prince Con. | .18 |
| Mary McKinney | .56 | Silver King Coal'n. | 3.70 |
| Pharmacist | .01 | Sioux Con. | .02 |
| Portland | 1.00 | Uncle Sam | .05 |
| Vindicator | .82 | Yankee | 1.03 |

TORONTO Jan. 27

| Name of Comp. | Bid. | Name of Comp. | Bid. |
|-----------------|-------|---------------|-------|
| Bailey | 0.061 | Foley O'Brien | 0.17 |
| Conlagas | 7.50 | Hollinger | 17.00 |
| Right of Way | 0.041 | Imperial | 0.011 |
| T. & Hudson Bay | 70.00 | Jupiter | 0.08 |
| Timiskaming | 0.121 | Pearl Lake | 0.091 |
| Wetlaufer-Lor. | 0.07 | Porcu, Gold | 0.111 |
| Big Dome | 17.00 | Preston E. D. | 0.011 |
| Crown Chartered | 0.001 | Rea | 0.15 |
| Doble | 10.10 | Swastika | 0.04 |
| Dome Exten. | 0.07 | West Dome | 0.05 |

SAN FRANCISCO Jan. 27

| Name of Comp. | Bid. | Name of Comp. | Bid. |
|-----------------|------|--------------------|-------|
| Comstock Stocks | | Misc. Nev. & Cal. | |
| Alta | 1.07 | Belmont | 7.75 |
| Belcher | .39 | Jim Butler | .92 |
| Best & Belcher | .05 | MacNamara | .11 |
| Caledonia | 1.25 | N. Idway | 1.20 |
| Challenge Con. | 1.12 | Mont.-Tonopah | 1.45 |
| Chollar | .02 | North Star | .41 |
| Confidence | .35 | West End Con. | 1.471 |
| Con. Virginia | .16 | Atlanta | .17 |
| Crown Point | .38 | Booth | .03 |
| Gould & Curry | .02 | C.O.D. Con. | .05 |
| Hale & Norcross | .07 | Comb. Frac. | .11 |
| Mexican | 1.10 | Jumbo Extension | .22 |
| Occidental | .70 | Pitts.-Silver Peak | 1.36 |
| Ophir | .13 | Round Mountain | 1.44 |
| Overman | 1.30 | Sandstorm Kendall | 1.10 |
| Potosi | .01 | Silver Pick | .07 |
| Savage | .07 | Argonaut | 12.50 |
| Sierra Nevada | .05 | Bunker Hill | 11.50 |
| Union Con. | .02 | Central Eureka | 1.30 |
| Yellow Jacket | .37 | So. Eureka | 12.00 |

N. Y. EXCH. Jan. 27 BOSTON EXCH. Jan. 27

| Name of Comp. | Cig. | Name of Comp. | Cig. |
|------------------------|------|--------------------|------|
| Amalgamated | 751 | Adventure | 11 |
| Am. Agri. Chem. | 551 | Ahmeek | 1289 |
| Am. Sm. & Ref. com. | 701 | Alaska Gold M. | 221 |
| Am. Sm. & Ref., pf. B. | 105 | Algomah | 111 |
| Am. Sm. Sec., pf. B. | 84 | Allouez | 38 |
| Anacosta | 361 | Am. Zinc | 201 |
| Batoplas Min. | 1 | Ariz. Com., cts. | 41 |
| Bethlehem Steel, pf. | 771 | Bonanza | 60 |
| Chino | 411 | Butte & Corbin | 50 |
| Federal M. & S., pf. | 43 | Butte & Balak | 14 |
| Great Nor., ore, ctf | 381 | Calumet & Ariz. | 671 |
| Guggen. Exp. | 491 | Calumet & Hecla | 430 |
| Homestake | 1151 | Centennial | 17 |
| Inspiration Con. | 161 | Cliff | 42 |
| Miami Copper | 241 | Copper Range | 39 |
| Nat'l Lead, com. | 50 | Daly West | 121 |
| National Lead, pf. | 107 | East Butte | 121 |
| Nev. Consol. | 161 | Franklin | 41 |
| Phelps Dodge | 183 | Granby | 84 |
| Pittsburg Coal, pf. | 901 | Hancock | 20 |
| Quicksilver, pf. | 4 | Hedley Gold | 129 |
| Ray Con. | 19 | Helvetia | 135 |
| Republic I&S, com. | 261 | Indiana | 71 |
| Republic I&S, pf. | 891 | Island Cr'k, com. | 471 |
| Sloss Sheff'd, com. | 331 | Island Cr'k, pfd. | 851 |
| Sloss Sheff'd, pf. | 90 | Iris Royale | 22 |
| Tennessee Copper | 341 | Keweenaw | 31 |
| Utah Copper | 541 | Lake | 91 |
| U. S. Steel, com. | 661 | La Salle | 141 |
| U. S. Steel, pf. | 1121 | Mass. | 3 |
| Va. Car. Chem., pf. | 102 | Michigan | 1 |
| | | Mohawk | 45 |
| | | New Arcadian | 31 |
| | | New Idria Quick | 131 |
| | | North Butte | 281 |
| | | North Lake | 21 |
| | | Ojibway | 75 |
| | | Old Dominion | 521 |
| | | Oseola | 79 |
| | | Quincy | 160 |
| | | Shannon | 61 |
| | | Shattuck-Ariz. | 281 |
| | | Superior | 281 |
| | | Superior & Bos. | 21 |
| | | Tamarack | 31 |
| | | Trinity | 41 |
| | | Tuolumne | 75 |
| | | U. S. Smelting | 421 |
| | | U. S. Smelt'g, pf. | 481 |
| | | Utah Apex | 2 |
| | | Utah Con. | 101 |
| | | Victoria | 11 |
| | | Wilona | 21 |
| | | Wolverine | 451 |
| | | Wyandot | 11 |

N. Y. CURB Jan. 27