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Recent Observations in Butte and Anaconda

By W. R. INGALLS

SYNOPSIS—The Anaconda company is carrying out plans which will add to its production upward of 50,000,000 lb. of copper per annum, heretofore wasted, and it will be relatively cheap copper. A great step in metallurgical conservation. About 95% of the copper of the ore will be recovered against the former 75%. Other new developments in Butte and Anaconda.

The Butte district is now credited with a population of about 80,000. It is preëminently the greatest mining

but Butte is far from being a one-company district. The North Butte and East Butte are important independent copper producers. The Butte & Duluth and the Bullwhacker promise to be. The Butte & Superior is a very large producer of zinc ore, and the Elm Orlu, of Senator Clark, is going to be. The Butte Central is doing some interesting cyaniding work. So there is a good deal going on at Butte outside of the Anaconda circles.

The thing that is especially noticeable to the occasional visitor to Butte is the disappearance of black coal



ROUND TABLE AND DEWATERING PLANTS, ANACONDA, MONT.

The round table plant is shown at the left of the picture. The slime dewatering plant is the long building in the center of the picture, standing just below the concentrator. The concentrates dewatering plant is the long low building at the right of the picture. The leaching plant will be built on the ground at the left of the picture, behind the round-table plant, but a considerable distance back from the latter.

district in America. In their palmyest days neither Virginia City nor Leadville attained any such size, and certainly neither of them had the permanence that Butte has already enjoyed and probably will continue to enjoy for a longer time than anyone can foresee. It is that substance which enables mining, transportation and metallurgy at Butte to be put on the basis of a manufacturing business and warrants capital expenditures that in many other districts would be too risky. Improvements inaugurated by the Anaconda company within the last two or three years, which are now just being brought to the stage of fruition, are of extraordinary character.

The Anaconda company is the principal thing at Butte,

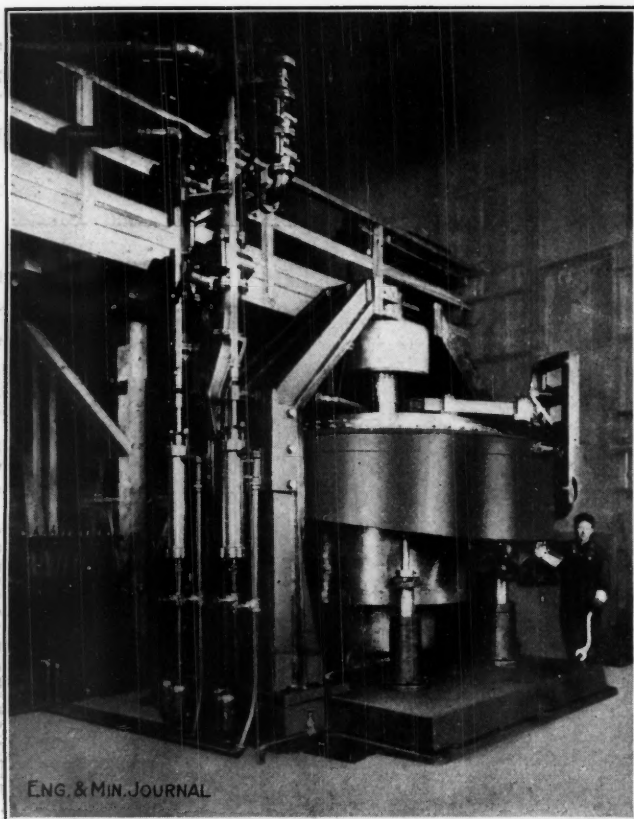
smoke from Butte hill. The pall from a hundred chimneys that used to hang over it is gone. This is because of the change from steam hoisting to electric-compressed air hoisting that is gradually being effected. The change had to be gradual inasmuch as the hoisting plants had to be taken in hand one by one in order not to interfere with current operations. The change from the old system to the new is now nearly completed, and the benefit is beginning to show clearly on the cost sheets. What with this and the electrification of the Butte, Anaconda & Pacific R.R., the consumption of coal in and around Butte has been reduced by many thousands of tons, and the coal-mining department of the Anaconda company is

beginning to complain of the diminution of its market.

The electrification of the Butte, Anaconda & Pacific R.R. has been a great success. The conditions were excellent, viz., a large and regular load. The powerful electric locomotives handle the ore trains on the steep grades to the smelting works at Anaconda with the greatest ease. It is said that the cost of carrying ore from Butte to Anaconda has been reduced to one-half what it used to be. Under favorable conditions, such as exist here, electric locomotives mean uniform speed, saving of time on stiff grades, no waste energy, fewer engine failures, and other advantages. The electrification of the Butte, Anaconda Pacific is reported to be saving \$20,000 per month, a saving which will pay for the installation in five years.

ORE DRESSING AT ANACONDA

It is, however, at the Washoe works that the most spectacular improvements have been and are being made;



THE PECK CENTRIFUGAL SEPARATOR

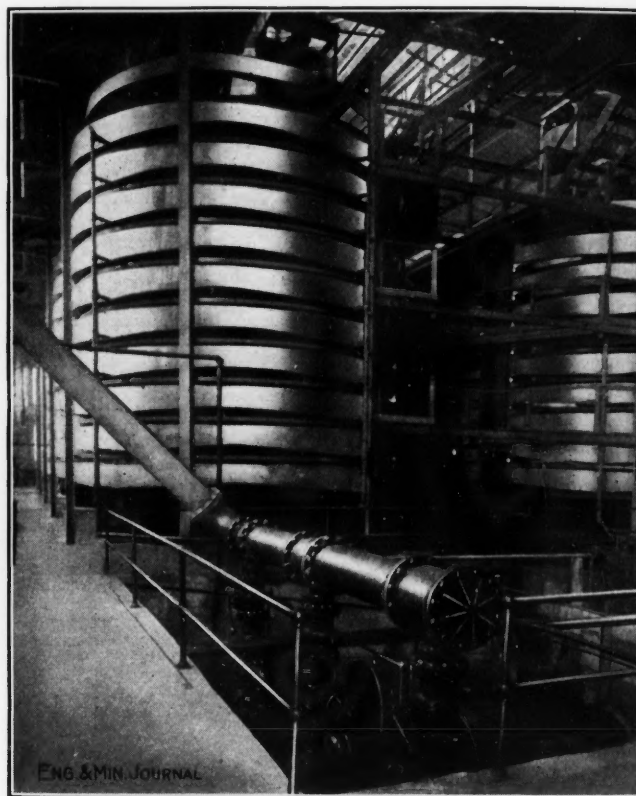
Two of these machines were built and tested, the capacity of each being about 250 tons per day. Their results were fairly good, but those of the round table were superior.

and they are a triumph of the metallurgist that excels anything ever done before, at least on this scale. Briefly, the baffling slime problem of ore concentration has been solved, or will be solved, and no longer will the Anaconda metallurgists endure the mortification of seeing about 25% of their copper going to the slum pond. Nor is there any reason why the managers of the porphyry copper mines should not to some extent at least profit immediately by the new Anaconda methods. The development of those methods in itself has been interesting. It has been the result of intelligence, thoughtfulness, experimenting, weighing and measuring; in short, modern engineering.

THE PECK CENTRIFUGAL SEPARATOR

Some years ago, P. F. Peck, an inventor of some note, went to Anaconda where he was given an opportunity to test his centrifugal separator with the Anaconda slime. Two of his machines were installed, an early and a later form, and they were operated for several years, making a commercial product and showing that the thing could be done. However, the results were not quite good enough. The Anaconda staff in the meanwhile went ahead with experiments with what may be called a glorification of the round table, using a construction of 20 decks, and got superior results. The experimental 20-deck round table was exhibited to the American Institute of Mining Engineers when it visited Anaconda last August.

The Peck plant was recently closed. Everybody feels sorry for Mr. Peck and accords him high credit for his persistent and intelligent pioneering. He has stuck to



THE ANACONDA 20-DECK ROUND TABLE

This machine was tested along with the Peck. In concentration the results were about equal, but the cost of operating and maintaining the round table was much less than that of the centrifugal device, and consequently the round table was adopted.

the idea of centrifugal separation for many years. He tells a story of himself about as follows: Many years ago he invented an apparatus for separating valuable constituents from smelters' slag. When he had showed the smelters what he could get out of their slag "they went to work and improved their smelting practice so that there was nothing for me to get out of it," in Mr. Peck's words. Now, the Anaconda millmen have done about the same thing. May Mr. Peck some time find a process that can be improved only in his way!

THE ANACONDA PROBLEM

The Anaconda engineers took up their problem broadly. The Washoe concentrator was discharging daily about

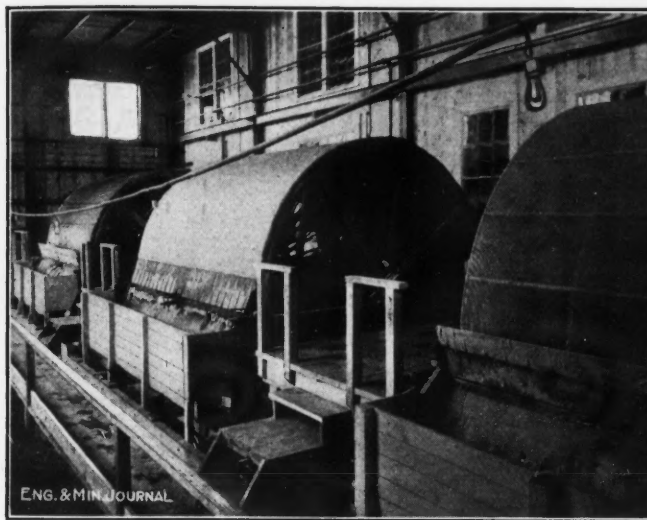
6000 tons of sand tailings assaying 0.65% copper and 2200 tons of slime assaying 2.2%. Exhaustive experiments, conducted on a large scale had demonstrated that a leaching process would extract most of the copper from the sand tailings; that a refined, supplementary method of concentration would give a great deal of the copper content of the slime; and that one of two methods would extract most of the copper of the tailings from the slime treatment. The same system would be applicable to the 15 to 20 million tons of tailings and slime in the dumps below the plant, but manifestly they would keep, just as they have been keeping for many years, and it would be most sensible to attend first to the current production of the plant.

Also, inasmuch as the execution of the whole plan involved necessarily several years of time, and the expenditure of millions of money, it was common sense to begin with that part of it which cost the least and promised the cheapest copper; in other words, the greatest saving.

the mechanism that sweeps the settled slime to the discharging point is actuated from one source of power. The settled slime, containing 10 to 12% of solid matter, is discharged continuously from each tank, the ingenious gate of the Dorr system permitting this to be done with perfect control. The clear water overflows into a launder around the upper periphery of the tank.

About 98% of the solid material and 99% of the valuable mineral is settled. The overflow water is clear and transparent. As it escapes from the settling house in the big common launder it looks as pellucid as a mountain brook. The highly successful settlement of a very fine slime depends chiefly upon providing sufficient settling capacity; in other words, letting the mud stand still long enough. This will naturally differ in every mill, but it is something that is easily determined. Of course, the excellent means of discharging the slime devised by Mr. Dorr is an important feature.

The thickened mud from the settling tanks flows to



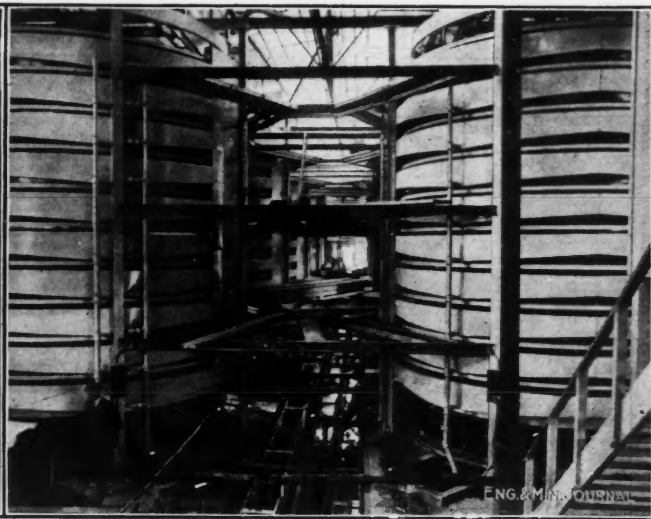
THE OLIVER FILTERS

The slime concentrates thickened in Dorr tanks pass to these filters, from the exterior of which a well-dried sheet of concentrates is continuously peeled off. The efficiency of these machines for this purpose is of a high order.

These two factors, viz., the least first cost and greatest saving, happened to run together in the simple mechanical slime treatment. Consequently that was the first thing to be undertaken. The completion of this part of the plan occurred only last month (April, 1914). The additional saving realized in this plant, will quickly pay for the next step in the great plan, that will quickly pay for the following one, and so on, wherefore, the whole thing, will be consummated by the relatively small outlay from the surplus of the company which has already been made.

THE ROUND-TABLE PLANT

The slimes from the old Washoe concentrator are led into the dewatering house. This contains 160 Dorr thickeners, which are circular, wooden tanks, each 28 ft. in diameter and 3 ft. deep. It was found that better settlement of the slime could be effected in four tanks of 3 ft. depth than in one of 12 ft. depth. The Anaconda tanks are set in tiers of four, one over the other, with just enough space between them to give easy access. A single vertical shaft passes centrally through the four, whereby



THE ROUND TABLE PLANT

This view shows the arrangement of the round tables looking down the double row and exhibits something of the interior construction of the building. The photograph was taken before the plant was fully completed and the working platforms carried by the three rows of horizontal girders are not yet in place.

the round-table house. This comprises 20 twenty-deckers, arranged in two parallel rows of 10 each. Midway in the house is a sump where are the pumps for elevating middlings, concentrates, etc. The 20-deck buddle is built as a self-contained structure, supported peripherally, at the bottom, on wheels, which turn on a circular track. Each 20-deck unit requires 3 h.p. The decks themselves are of sand concrete, an excellent surface, true in slope, solid, and just rough enough to afford a good grip for the heavy mineral to cling to. The mud coming into the plant is divided equally into 20 parts by a revolving distributor. On top of each unit there is a similar revolving distributor, which divides it into 20 parts, one part for each deck. Each deck is, in fact, an independent round table.

The Anaconda round-table plant is of superb construction, as also are the 20-deck tables, but again there is no novelty in principle. It is simply a perfection of old-time practice. The efficiency of these tables is obtained by the regularity and evenness of the feed to them and the provision of very ample washing area. To do their

work 600 vanners would be needed. The 20-deck construction has the special advantages of reduced floor area, reduced first cost, and reduced cost of operation, far fewer men being required than if the same number of tables were spread out only one deck high. In fact, the Anaconda round-table house is of surprisingly small dimensions, considering the tonnage of material treated.

The concentrates from the round tables are pumped up to a series of five Dorr settling tanks, similar to those in the slime house, but 50 ft. in diameter. The overflow water goes back to the round tables. The thickened concentrate slime goes to two Oliver filters, 11½ ft. in diameter by 12 ft. face, which deliver a product containing about 14% moisture, discharged upon a belt conveyor, which takes it to a railway car, which takes it to the briquetting plant of the smeltery. A third Oliver filter is in reserve.

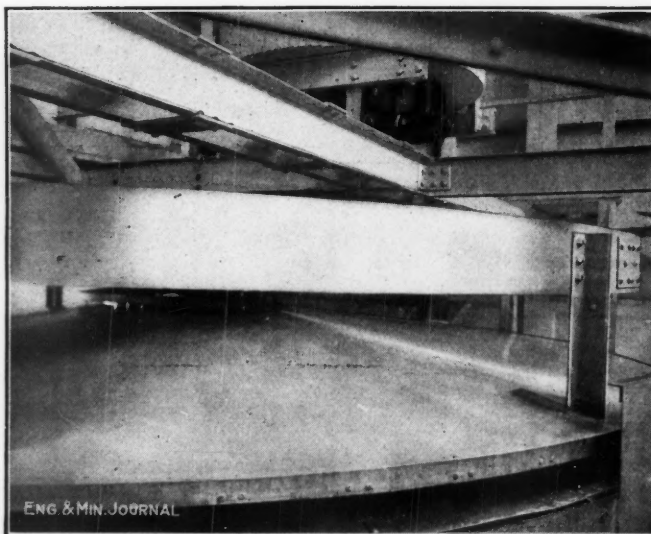
THE ECONOMIC RESULT

Out of 2200 tons of slime containing 2.2% of copper that formerly went daily to waste, there is now produced

plant arranged upon three main terraces. On the upper will be the McDougall roasting furnaces; on the middle terrace the leaching tanks; on the lower the precipitating troughs, tanks or whatever may be used.

The process is essentially as has been previously described in recent technical literature. The sand, which is of 2 mm. size and under, is roasted oxidizingly in McDougall furnaces. The latter are fired on the third hearth, giving the ore a good preliminary heating, after which roasting goes on autogenously on the fourth, fifth and sixth hearths. At first sight this looks like an illogical idea, but it may not be so and probably isn't. Anyway, the roasting is done with a marvelously small consumption of coal, viz., only 2 to 3%, especially when it be considered that the ore contains only about 2% of sulphur. The roasting renders a considerable portion of the copper soluble in water.

The hot roasted ore passes through cooling cylinders, the chief feature of which are longitudinal water-cooling pipes set in near the periphery of the cylinder, inside, of



A ROUND TABLE DECK

This view shows the jet of water sweeping off the concentrates.



ROUND TABLE TOPS

This view shows the revolving distributors. The feed pipes pass down through a central shaft, one pipe to each deck.

about 360 tons of concentrate averaging about 7% copper. There is no illusion about this saving. It is a new supply of smeltable ore that formerly did not exist. It is recovered at a cost of about ¾c. per lb. of copper for concentrating and 3¼c. for smelting, a total of 4c. It is the cheapest copper that the Anaconda company produces. It adds about 15,000,000 lb. per annum to the productive capacity of the company. The cost of the plant to do this was about \$650,000. It will pay for itself in about five months. Incidentally, it is interesting to note that the cost of the plant was about \$20,000 less than the engineers' estimates and that it was built at the opportune time of low-priced material.

THE SAND-LEACHING PLANT

The next step in carrying out the Anaconda plan is the erection of the sand-leaching plant. The grading and foundations for the first unit of this have just been begun. The slime-settling and round-table plant are immediately below the old concentrator. The leaching plant will be just to the east of them. The first unit, just begun, is estimated for 2000 tons daily capacity. It will be a long

course. This arrangement stirs and cools the ore very effectively. The cylinder is so constructed that there are no joints in the pipes inside of it and consequently no danger of water leakage, which would be very objectionable. The water heated in these pipes will be used in the leaching tanks.

The ore will be leached in wooden tanks 50 ft. in diameter. The tanks are not to be lead-lined, this having been found to be unnecessary. The ore will be charged into the tanks 12 ft. deep. The leaching will be by percolation. In the main, modern cyanide practice will be followed with regard to the mechanical operations. The lixiviant is dilute sulphuric acid and brine.

The method of precipitation has not yet been finally determined. Scrap iron is economically permissible and may be used at first. Sponge iron is next in order. Experiments in making that are still going on. Attempts to make it in a McDougall furnace failed completely. Good results have been obtained, however, from a sort of little Brückner cylinder, in which the charge is heated up, then sealed in and allowed to react in a reducing atmosphere,

and it has been found that the coal required is really quite small in quantity. Another thing that is being studied is the reduction of cuprous chloride by sulphur dioxide as in the Hunt & Douglas process, but done in an improved way.

The leaching plant just begun will treat about one-third of the current sand tailings of the concentrator. It will be completed about the end of this year. It is expected to yield about 11 lb. of copper per ton of tailings, discharging tailings with only 0.1% copper, and it is figured that the copper obtained in this way will cost about 7c. per lb. To treat all of the current production of tailings there will be needed 1½ or 2 more units like the one just started. With the full equipment Anaconda should make an additional production of about 23,000,000 lb. of copper annually from this source. It is estimated that the leaching plants will cost about \$900,000 per unit of 2000 tons daily capacity.

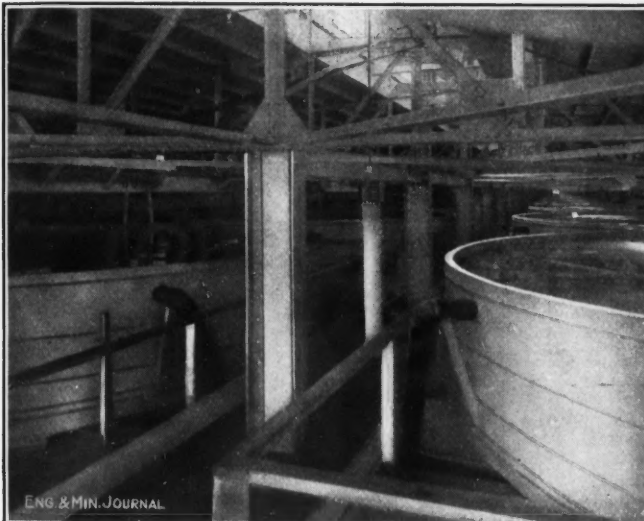
SULPHURIC ACID

In order to supply the sulphuric acid needed in the leaching process, an acid plant of 100 tons daily capacity,

erals Separation company to experiment with the flotation process for this material, and if floating should give certain results it may be adopted in preference to leaching. The floating of this mineral, already so fine, ought not to require extensive plant, and flotation in this case may beat leaching even if it does not produce so low tailings.

THE NET RESULTS

When the Anaconda plan is fully carried out the tailings discharged from its mills will carry only 0.1 to 0.2 copper against the former 0.65 to 2.2%. Instead of recovering only about 75% of the copper of the ore, the recovery is expected to be around 95%, and best of all the additional copper will be got at far less cost per pound than the present copper. Without increasing its ore production the company can increase its copper production by something over 50,000,000 lb. per annum, and reduce its cost on the whole product by ¾c. per lb. or so; or it can reduce its ore production; or it can mine a lower grade of ore when that be advisable. However the management determines to work the thing out, it will benefit



DORR THICKENERS

This view shows the upper tier of tanks.



DORR THICKENERS

View showing how the tanks are arranged in tiers.

basis 60° B., is to be erected. This is to be done under the direction of Utley Wedge. The plant will be situated on the flat toward Anaconda, not very far from where the Bradley-process plant stands. The 2000-ton leaching plant will require only about 65 tons of acid per day, but a surplus of acid will be provided inasmuch as the leaching plant may exceed the estimated capacity. Also there is some market for sulphuric acid at Butte and elsewhere in this part of Montana. Two Wedge furnaces will be installed for providing the sulphur dioxide. Grading for the acid plant has already been begun.

SLIMES LEACHING

The round-table plant discharges daily about 1900 tons of tailings containing 1.1% copper. The treatment of this stuff is the most difficult part of the problem and has been deferred to the last. During the coming year experiments will be made to devise a leaching process for this material. Preliminary work has indicated that tailings carrying only 0.2% copper can be made. In the meanwhile arrangements have been made with the Min-

enormously by the great step in the conservation of its resources that it is effecting.

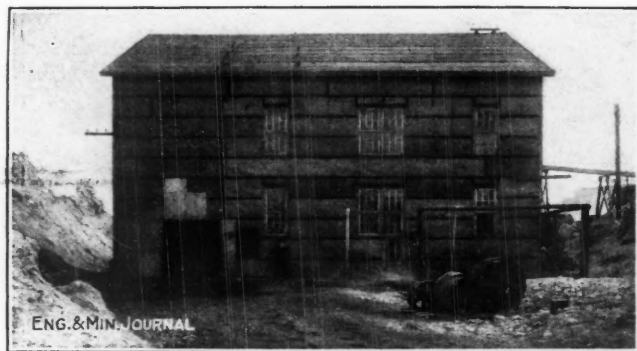
Its other economies are, of course, of the first order of importance—the compressed-air hoisting, the electrification of the railway, the remodeling of the Washoe concentrator, the reconstruction of the Great Falls smelting works, and the abandonment of concentration at Great Falls, saving the high cost of freight to there—these ought to do much more than merely offset the increased cost of living which Anaconda experiences alike with other mining companies.

COAL-DUST FIRING

An interesting experiment is about to be tried in the smelting works, viz., the firing of one of the reverberatory furnaces with coal dust. This is no new idea. Some years ago it was tried by Mr. Sorensen at the Highland Boy works in Utah, and later by Mr. Shelby at Cananea. At neither of those plants was it successful. Mr. Shelby experienced trouble especially from the ash of the coal, which blanketed the slag in the furnace, choked up the

throat, etc. Recently, however, coal-dust firing has been applied to a reverberatory furnace by the Canadian Copper Co., at Copper Cliff, Ont., with great success, it is reported, from the standpoint of fuel economy.

There are, therefore, the above precedents for the experiment at Anaconda. As to the fuel economy of this method of combustion there is no question. That has been demonstrated in cement burning in which it has become the standard practice in the Lehigh Valley. In copper-smelting practice the doubt attaches to the accompanying metallurgical effects. Mr. Mathewson and Mr. Laist think that the previous failures were probably due to the imperfect way of doing the thing, especially the failure to pulverize the coal sufficiently fine. Consequently at Anaconda arrangements are being made to grind the coal excessively fine. This seems to be logical. If the coal ash produced in the furnace be so fine that the draft will keep it moving and carry it out of the chimney there ought not to be much trouble from it. Anyway, that is reckoned upon. Not even are the waste-heat boilers to be removed. The coal dust will be blown directly into the firebox end of the furnace. If the expected results



THE PECK CONCENTRATOR BUILDING

are realized the present coal consumption of about 20% may be reduced to something like 15%, basing this upon the Copper Cliff experience.

The coal-crushing plant at Anaconda is being set up at the east end of the reverberatory-furnace house, where there is room to provide equipment for all of the furnaces if the trial with one of them proves successful.

BUTTE & DULUTH

The Butte & Duluth, on the east side of Butte, is rounding into a rather likeable operation. Last summer things there seemed to be pretty much at sixes and sevens, and there was a good deal of shaking of heads concerning it, but since then Captain Wolvin has put in a new manager, C. F. Sherwood, formerly with the Butte & Superior company, and he has revised operations in an intelligent, scientific and systematic way. Already the company has become a regular producer of copper.

The ore is now crushed to about five-mesh size and is leached in a series of Dorr classifiers, the slime passing to a set of circular tanks where it is treated by the ordinary process of decantation. The Dorr classifiers treating the sands give what is in effect a modern improvement of the old system of trough lixiviation, introduced many years ago by Ottokar Hoffman in connection with the hyposulphite process of treating silver ores. The last Dorr classifier of the series discharges sand, containing

only about 20% of water, and that nearly free from copper salts, which is taken mechanically to the dump. The leaching solutions pass through the series of classifiers in the usual counter-current way.

Mr. Sherwood finds the Dorr classifier to be an excellent apparatus for this work and reports no unsatisfactory wearing of its parts. The naked wood is not so far affected seriously by the acid solutions, and the rakes, which are especially subject to the mechanical wear of the ore, are easily replaced when necessary. About 80% of the ore is treated in the Dorr classifiers and about 20% in the slime tanks. The tailings from the latter carry away about 50% water. Consequently about 0.26 ton of water per ton of ore has to be added to replace what is discharged with the tailings. A Kelly filter press is to be put into handle the slime tailings.

The old V-shape vats of the leaching house have been put out of commission and are being torn out as rapidly as the Dorr classifiers can be installed. With the single line of Dorr classifiers already in use the plant has treated as high as 3600 tons of ore per month, and Mr. Sherwood reports, if I remember correctly, that he has been able to put as much as 200 tons per 24 hours through this leaching apparatus.

In the precipitation of copper from the solution the Butte & Duluth has adhered to its original scheme of electrolysis, but has made many improvements in details. Thus an ingenious new form of anode lug has been devised and better connections with the busbars have been arranged. The result of these, and other things, has been to reduce the voltage from about 2.1 to about 1.85. The electrolytic copper now produced is about 99.85% fine. The cathodes are shipped to Chrome, N. J. Mr. Sherwood says that the acid takes up so little iron and alumina from the ore in the short lixiviation that the solutions do not become foul and there is no longer any necessity for precipitating with scrap iron from anything but some wash water.

The Butte & Duluth ore goes about 2% in copper and yields about 85% of it, the production from 3600 tons of ore being about 120,000 lb. This output will be increased when the leaching house is completely remodeled and when the new tank house, just begun, is ready. A new crushing mill is nearly finished. This is a commodious, well framed building, equipped with a breaker, Symons disk crushers, and impact screens of the Colorado Iron Works Co. A belt conveyor will take the crushed ore to the leaching house.

I have touched only briefly and in general terms upon the leaching process of the Butte & Duluth, but Mr. Sherwood has promised to describe it in detail in the JOURNAL before long. The Butte & Duluth appears to have a large deposit of oxidized ore of fair grade, which is exceptionally well situated for cheap mining. A contract has recently been made which will deliver the ore for a surprisingly low figure. The ore requires only moderate grinding and no roasting, wherefore the process of treatment is simplified, and even if the cost of electrolytic precipitation be relatively high, the advantages enjoyed in other respects no doubt permit it. At present the sulphuric acid used in the process has to be brought from Denver and costs \$22 per ton. When the Anaconda begins producing acid a relatively cheap supply will become available to the Butte & Duluth.

BULLWHACKER COPPER CO.

The Bullwhacker Copper Co. is just completing a small plant near the Butte & Duluth's. Its mine is of similar character, but the grade of the ore is higher. The process of treatment will also be similar, in the main, but there is a good deal of difference in the details. The ore will be crushed to 16-mesh size and will be leached in Hendryx agitators. The solution will be separated by a Kelly filter press. In the electrolytic department, the tanks are cylindrical, the anodes and cathodes setting in four groups, these groups being arranged in a cruciform way. Centrally in the tank is a shaft turning stirring arms at the bottom of the tank, the purpose being to produce circulation of the electrolyte. In order to keep the anodes and cathodes from being disturbed from their proper position they are stayed in slotted frames at the sides. The anodes (lead) and the cathodes differ in details from those used in the Butte & Duluth plant. The Bullwhacker plant is expected to produce about two tons of copper per day from the treatment of 75 to 80 tons of ore. It ought to begin operating in May.

THE TIMBER BUTTE MILL

Another new plant that is nearly completed is that of the Timber Butte Milling Co., erected on the slope of Timber Butte, out beyond the old Colusa works. This is an enterprise of Senator Clark, and is to treat the zinc ore of his Elm Orlu mine. It will use the Minerals Separation's flotation process, and in the main the system is similar to that of the Butte & Superior. However, the flow-sheet is more simple and the design and construction of the mill are less messy. In one respect there is great similarity, viz., the selection of a steep hillside as the site. Commiseration may be expressed for the millman who has to climb from top to bottom of these mills several times a day.

The Timber Butte mill is unique in several things. The coarse crushing plant is at the foot of the hill. The ore goes thence to the top of the mill by a long belt conveyor. In the mill building reinforced concrete has been extensively used. The long spans thus made permissible give the interior a neat, commodious and light arrangement, unobstructed by numerous posts, braces, etc. This is advantageous in many respects. Concrete floors are built generally throughout the mill. They are not only strong and cleanly, but they afford excellent foundations for the concentrating tables. The designers figure that saving in repairs of the tables will soon pay for the cost of the floors. Beneath the floors there are ample tunnels and conduits for flow of tailings, concentrates, etc., and the elevator pits are exceptionally roomy.

The machinery equipment of the mill consists essentially of Hardinge conical mills, Akins classifiers, Wilfley tables, and James tables. There are two flotation units.

The Timber Butte mill is considered to be nominally of 400 tons daily capacity. It is expected to make something like 2500 tons of blende concentrate per month, and to be in operation early in June.

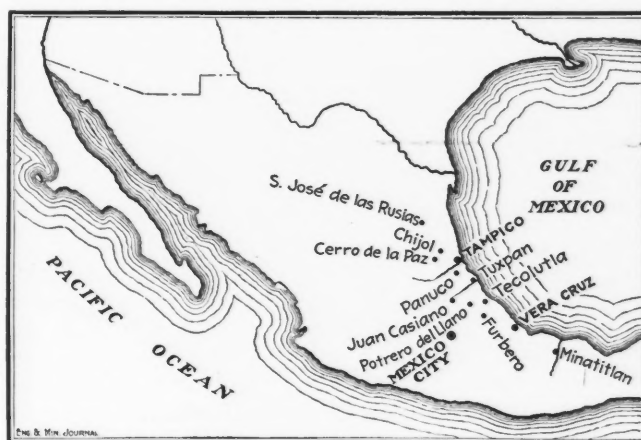
Explorations Are Being made on four concessions of auriferous mispickel at Beaune, five miles to the north of Limoges, more especially on a rich vein of gold quartz having an average thickness of 3 ft., and a value of about 30 dwt. to the ton, says the "Mining Journal." The quartz encloses blende, galena, pyrites, mispickel and frequently particles of free gold. There are many old Roman excavations in the neighborhood. The deposits are similar to others already worked in France.

History of Petroleum in Mexico

BY P. CHARTERIS A. STEWART*

One of the early grants from the Spanish Crown for land in New Spain, as Mexico was then called, mentions the existence of petroleum in the country. This particular grant was for land in the state of Tamaulipas, and probably refers to the seepages near San José de Las Rusias.

Doctor Ortray, the reputed inventor of "Angostura Bitters," was the discoverer of seepages at Cugas, now called Furbero. In the late '50s or early '60s he obtained the oil from the seepages and also drove a tunnel into the hillside, obtaining oil. He refined the oil and sold it locally in Papantla. He had some associates in Mexico City, who were interested with him, but after a short time they ceased to provide more money and they would not come down into the densely forested region where the petroleum was found, with all attendant discomforts, to see what he was doing. Matters were almost at a standstill in this field, with the exception of some 10 shallow wells drilled in 1899, until the Furber interests, Oil



KEY MAP TO OIL FIELDS ON EAST COAST OF MEXICO

Fields of Mexico Co., brought in their first well in 1903. It was not, however, until 1909 that the light railroad and pipe line were completed and oil shipments began.

Between 1880 and 1883 two companies were formed, one to work the oil on the property of Chapapote and the other the property of Cerro Viejo, the latter owned by the same men who owned the *Boston Post*. They were successful in bringing in a producing well; a second well was unsuccessful, but rumor has it that the foreman made it flow artificially. A refinery was erected and oil is believed to have been sold locally in the town of Tuxpan. These two companies were amalgamated, but apparently came to grief.

About the year 1900 Doheny & Canfield of California oil field fame began operations at Ebano, near Tampico. They drilled five or six wells, one of which was reputed to be a 600-bbl. producer. They could, however, get no outlet for their oil as the Mexican Central R.R. was antagonistic.

About 1905 or 1906 the Mexican Petroleum Co., Ltd., Doheny-Canfield interest, brought in its first well at Cerro de la Paz, which had a daily production of 2500 to 5000 bbl. a day. This put a different aspect as to

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Mexico being a petroleum producer, and the Mexican Central made a long-term, sliding-scale contract with the Mexican Petroleum Co., Ltd., for all the oil it wanted, to commence at 1.10 pesos per barrel.

Between 1900 and 1903 the Mexican Petroleum & Liquid Fuel Co., Ltd., English South African interests, drilled nine wells, from 1100 ft. to 2300 ft. deep, along the Tacolutla Valley, besides a large number of shallow wells down to 400 ft. deep. None of these, however, gave oil. About 1901 Sir Weatman Pearson began drilling on the Isthmus of Tehuantepec near the villages of Jaltipan and Sayula. A few months later wells were begun at Amisquite and San Cristobal. At the last named place a prolific field was brought in. In April, 1908, a refinery was completed at Minatitlan, the nearest town of any importance to San Cristobal. In July, 1908, the famous Dos Bocas gusher was brought in, but unfortunately got out of control, caught fire, and was lost. In December, 1910, these interests, by this time converted into the Mexican Eagle Oil Co., brought in their next famous well at Potrero del Llano, with a production of 100,000 bbl. per day. In the south these interests also brought in the producing fields of Soledad in 1909, Tecuanapa, in 1910, and Ixhuatlan in 1911. In the meantime the Doheny interests brought in a producing field at Chijol, near Tampico, in 1909, and the wells at Juan Casiano in 1910, each of which had an initial production of 12,000 to 15,000 bbl. per day. These large wells caused the forming of a number of companies, the East Coast Oil Co. bringing in a 600-bbl. well near Panuco, and in the spring of 1913 the Penn-Mex company brought in a well of about 20,000 barrels a day.

The Steel Corporation and Its Employees

A special report presented at the stockholders' meeting of the United States Steel Corporation on Apr. 20 gives the following particulars on the work which has been undertaken on behalf of the employees:

ACCIDENT RELIEF AND PREVENTION

The voluntary accident relief plan, established by the Corporation before Workmen's Compensation laws had become operative anywhere in this country, has been successfully continued in all those states where it has not been superseded by such statutes.

The amount paid in 1913 to and for our injured workmen, including expenditures both under our plan and under Workmen's Compensation laws was \$2,564,839. Thus 85% of the total amount expended by reason of work accidents was paid out to the injured men and their families or in taking care of them.

Our accident-prevention work has reached a high point of efficiency. Effort is now being directed toward teaching the workmen habits of caution, making watchfulness against dangers to themselves and their fellows a matter of constant attention. It has been necessary to overcome recklessness and disregard of dangers which had come to be treated as customary risks of the trade against which the men would not take any precautions; to teach them that taking risks will not be permitted.

The cost of safety work in 1913 was \$660,593. Serious accidents per 1000 employees are now 38¼% less than in 1906, when this work was first taken up by the Corporation. This means that 2273 men, who might have been injured under earlier conditions, were saved from serious injury during the year.

SANITATION AND WELFARE WORK

In Sanitation many improvements have been made in the proper investigation and observation of water supply and distribution to the men. All sources of drinking water are analyzed periodically. Great care is taken against possible

pollution. The most modern and sanitary methods are used in the proper cooling and distribution of water, including the sanitary drinking fountain. The common drinking cup has been practically eliminated. The investigation of water supplies and the installation of drinking-water systems alone cost \$130,000 during the year.

The common or roller towel has been abolished. Wash-rooms, shower baths and lockers, started in earlier years have been extended. During 1913, there were installed 1193 wash basins; 210 showers, and 15,471 lockers. Two additional swimming pools for general use in the mining towns were built during the year. The cost of providing washing facilities for 1913 was \$141,000. The total cost of sanitary work was \$564,977 during the year.

In welfare work of a character not covered by plans already mentioned for benefiting the workmen, our companies have tried many interesting things. They now maintain in the popular districts around their plants 101 children's playgrounds with an average daily attendance during last summer of 8688 children. At a number of the plants visiting nurses are available.

PENSION FUND

The pension fund has proved so satisfactory that no changes of any moment have been required. The number of pensioners continues to increase, with a corresponding increase in expenditure.

Total number of pensioners, Dec. 1913, 2092; number of pensions granted during 1913, 425; total amount paid in pensions during 1913, \$422,815; average age at which pensions were granted, 63.73; average service of pensioners, 28.82; average pension granted, \$20.85 per month.

The total expenditures of the corporation in 1913 for improving the condition of its workmen was \$7,240,669, apportioned as follows: Relief for men injured and families of men killed, \$3,013,638; accident prevention, \$660,594; sanitation and welfare work, \$1,600,243; pensions, \$486,195; toward creation of a permanent fund, \$500,000; employees' stock subscription plan, \$1,000,000.

Division of Pig-Iron Production

The Statistical Bureau of the American Iron & Steel Association gives the production of pig iron by grades for two years past as follows:

	1912		1913	
	Tons	Per Cent.	Tons	Per Cent.
Bessemer.....	11,381,656	38.2	11,276,567	36.3
Low-phosphorous.....	282,359	1.0	316,818	1.1
Basic.....	11,417,886	38.4	12,537,746	40.4
Foundry.....	4,969,856	16.5	5,114,203	16.5
Ferrosilicon.....	104,017	0.4	105,715	0.4
Malleable bessemer.....	825,643	2.8	993,736	3.3
Forge iron.....	469,183	1.6	324,832	1.1
Spiegeleisen.....	96,346	0.4	110,338	0.3
Ferromanganese.....	125,378	0.5	119,496	0.4
Miscellaneous.....	54,613	0.2	66,850	0.2
Total.....	29,726,937	100.0	33,966,301	100.0

Low-phosphorus pig runs below 0.04% phosphorus; bessemer from 0.04 to 0.10%. Miscellaneous includes direct castings, white and mottled iron, and ferro alloys other than spiegel and ferromanganese.

The ore or raw material consumed in 1913 included 58,274,000 long tons of iron ore and 3,009,000 tons of cinder, slag, scrap, zinc residuum, etc.; a total of 61,283,000 tons. This is an average of 1.882 tons ore, 0.97 tons cinder, etc., or 1.979 tons raw material per ton of iron made. The limestone and dolomite used for flux was 16,072,858 tons, an average of 1162.6 lb. per ton of iron.

In addition to the ore consumed in the blast furnaces, about 900,000 tons of iron ore are used yearly in open-hearth furnaces and steel works.

The fuel consumed included 37,217,566 tons coke, 39,008 tons raw bituminous coal, 107,318 tons anthracite and 35,242,059 bu. charcoal. The average consumption of fuel per ton of iron made was 2435.3 lb. coke; 680.8 lb. anthracite and 2368.2 lb. coke, mixed; 2978.1 lb. anthracite alone; or 103 bu. charcoal.

Quartz Mining in Colombia--II

BY RALPH W. PERRY*

SYNOPSIS—Short description of each mining district in the departments of Antioquia and Caldas, naming the mines and their equipment. Opportunities are good for the development of known properties along modern lines.

The departments of Antioquia and Caldas may be divided into the following districts, the district generally taking its name from the principal town in it. There are many mines in other parts of the country but they are small and unimportant. Beginning at the north these districts are Guamacó (in another department, but geographically belonging to Antioquia), Remedios and Segovia, Amalfi (including Vetilla), Anori, Santa Rosa,

Small, have developed a property from which they extracted a profit of \$150,000 in the last few years from development work alone, treating the ore in a mill of five light stamps and saving the free gold only. They are installing a larger mill and cyanide plant, and as they have a large supply of ore blocked out a great increase in the production of this district may be looked for. Undoubtedly this will stimulate interest in the district and lead to the development of other properties there.

REMEDIOS AND SEGOVIA

This district, about 45 miles from Zaragosa, the head of navigation of the Nechi River, is well known on ac-



ENG. & MIN. JOURNAL

WORKS AT FLORIDA MINES AT SAN ROQUE, A TYPICAL QUARTZ MILL

Santo Domingo and San Roque, Puerto Berrio, Titiribi, Andes (including Caramanta and Valparaiso), Marmato, Sonson and Manizales.

THE DISTRICT OF GUAMACÓ

This district is reached by several days' travel from Remedios, or by canoe from Zaragosa up the Bagre River. It is only recently that this district has attracted attention, being thinly settled and uncultivated on account of its dryness. Several mines have been worked there with little success, but two Americans, Burdette and

count of the location there of the Frontino & Bolivia company, an English company, which formerly worked mines in Frontino. These mines are the deepest in the department, at present having reached a depth of more than 600 ft. They have paid large profits in the past, but in the last few years have barely made expenses. Ore reserves are small, but the possibilities of the property are by no means exhausted, and with a different policy, the company will probably become a profitable producer. The company is operating a 20-stamp mill and cyanide plant, and has several native mills in operation. I understand that only a small part of the property

*Mining engineer, San Roque, Antioquia, Colombia.

has been developed. There are several other mines operating small mills in the district, the veins being associated with granite as are most of the mines in the northern part of Antioquia.

AMALFI

This district to the south of Remedios was formerly one of the most important in Antioquia, but its production has greatly declined in the last few years, and it now has only one mine worthy of the name. Of a total of 150 mines equipped with mills there are at present only three in operation. As few of these mines can now be examined, it is not known if this is due to impoverishment, or to the difficulties in mining when water was reached, or to the character of the ore. From an examination of samples from all of the mines in the district, the ore seems to carry such quantities of lead, copper and zinc sulphides that in many cases it is possible that the usual methods of treatment would not recover the gold. The Clara de La Union is the most important mine now working. It is equipped with a mill of 10 light iron stamps and treating ore yielding \$20 per ton in free gold and concentrates. The ore is free milling, some of the gold being rather coarse, and good extraction is obtained. The ore carries a small amount of arsenical pyrites and galena. The prevailing rock in the Amalfi district is granite, but many of the mines are in close relation with schists and slates, and have the same association of minerals as the mines of Puerto Berrio and Titiribi. Amalfi is reached by trail 50 miles from the station of Sofia on the Antioquia R.R. Vetilla, in the northern part of the district, which has some promising showings of ore, can be reached by canoe from Zaragosa.

ANORI

Numerous mines have been and are still being worked in this district, but it is best known from the Constancia mine, which has been worked to a depth of 300 ft. It has a 10-stamp mill, iron stamps and a leaching plant. The present production is around \$4000 per month, but it is proposed to remodel the cyanide plant when an increased extraction may be expected, as all sliming is needed to make good extractions from these ores. The main vein of the Constancia is large and can be traced for a long distance on the surface, where numerous denunciations have been made, but on which little work has been done. The ore carries a heavy percentage of iron pyrites and a small proportion of antimony minerals. The veins occur in granite.

SANTA ROSA

Next to Remedios this has been the most important district in the north, although its development has not kept pace with some of the other districts, and there is no mine with anything resembling a modern plant. There are about 100 wooden stamps at work at, say 15 mines. Several of these mills have leaching tanks for treating the sand by cyanide, but poor extractions result, due to the coarseness of the sand. The ores of this district after the oxidized zone is passed, carry large proportions of iron sulphides, but no other minerals, and are easily cyanided with a small consumption of cyanide, but require fine grinding.

The Trinidad mine is the best equipped, having 30 wooden stamps with a leaching plant for sands. This is

the only mine in the district which has been worked below the water level, two shafts having been sunk on different veins, but the machinery will only permit a depth of 60 ft. to be gained. The mine has produced several million in the past, and now produces from \$2500 to \$5000 per month, treating 300 tons per month. There are several residual deposits in the district that promise well, but they are higher than any water supply. Mines are also being worked on a small scale near the towns of Yarumal, Angostura, Carolina, Belmira, San Pedro and Don Matias. All of the mines in this district are in granite, associated with intrusions of other rocks.

SANTO DOMINGO AND SAN ROQUE

These two districts have about 15 mines, working with small mills, most of the mines being in the San Roque district which includes the mines of the Nus valley around Providencia, which produce more steadily than the others. All of these mines are within a few miles of the railroad, and many of them are of enough merit to warrant working on a large scale. The mines near Providencia, the Retiro and Las Animas, are worked by hydraulicking and milling the vein matter caught in the sluices. The veins are in granite and contain only quartz and iron pyrites as gangue minerals, but there is one small mine from which has been extracted a small amount of rich gold ore carrying a large percentage of copper. The Florida mines near San Roque are being developed by Americans.

PUERTO BERRIO

This district, while highly favored by its proximity to the railroad, is slightly developed, practically all of its production coming from the Andina and Desconocida mines. These orebodies occur near a contact of schist and eruptive rock, probably diorite. The ore consists of a complex mixture of lead, copper, zinc and iron sulphides with high gold content. Near the surface a large proportion of the gold is free, but at slight depth decreases and the simple methods of the past will have to be changed for something more effective.

The Andina mine, crushing seven tons per day, has maintained a production of \$4000 per month; tailings assay \$30 per ton. There are numerous large veins of heavy pyrite ore in the district, generally of low grade. It is an extremely difficult district in which to prospect, but is bound to develop into one of the best in the department. The mines are found in close proximity to the railroad about 25 miles from Puerto Berrio.

TITIRIBI

This district, 45 miles to the west of Medellin, is well known because in it is the Zancudo mine. The orebody occurs on a contact between eruptive rocks and triassic schists. The ore carries more silver than gold, and its composition is rather complex, including sulphides of lead, copper and zinc in greater proportions than other mines in the department, in which they resemble the ores of Puerto Berrio, but differ from the latter in carrying silver in commercial quantities. Titiribi is near the iron and coal mines of Amaga, and a smelting establishment was established here 70 years ago to treat the ores of the Zancudo and other mines. In recent years a more complicated process has been devised to aid the smelting and to treat the products from the smelter. While I am not familiar with all the details, the system used is under-

ANDES AND SONSON

This district with Marmato is the only one of present importance in the Cordillera Occidental. The best mines of the district are situated near the town of Andes, reached in two days' travel from Medellin. The ore in these mines, below the oxidized zone, carries a heavy percentage of iron pyrites, in the Soledad being as great as 50%, but a good extraction is made by the ordinary methods. Several mines are worked near the towns of Caramanta, and numerous veins are reported in various parts of the district.

The principal mines operating in this district are the San Andres, worked by an English company, and the Britannia, about 40 miles southeast of Sonson, which produces \$50,000 per year, mostly silver, which is shipped in the form of concentrates, after saving as much free gold as possible. The San Andres mine operates a 10-stamp mill, but intends to increase the capacity and install an all-slime cyanide plant. There are stated to be good showings of ore in various parts of the district.

MARMATO AND MANIZALES

This district lies in the department of Caldas, two days' ride from Medellin, and is controlled by an English company, which has leased the mines from the Colombian government for a long term of years. This company has blocked out a large amount of ore of a grade above \$10 per ton and has a 200-ton plant in operation. The ore is a heavy sulphide. The general scheme of treatment is crushing through a coarse screen with 40 stamps, separation of the sand and slime with Dorr classifiers, grinding the sand in tube mills, thickening in Dorr thickeners, agitation in Patterson agitators, followed by a second thickening, agitation and filter pressing. In this district are the silver mines of Echandia, which formerly made a large production of silver but for some unknown reason are idle at present.

This district near the city of Manizales, the capital of the department of Caldas, has been an important producer for years, the mines of Volcanes and Tolda Fria having past productions of several millions. In the last few years the district has become of greater importance through the successful opening of the Cascada mine, near the Volcanes.

The principal producing mines at present are the Volcanes, Cascada, Coqueta and Tolda Fria, in the department of Tolima, but only a few miles from Manizales. The Diamante and Union mines in the same mountain as the Cascada, but at an elevation of 12,000 ft., differ from the other mines of the district in carrying silver in excess of gold. The Union has about 20,000 tons of \$10 ore blocked out and is installing a cyanide plant, but, as I understand that no provision is being made for treating slimes, its success is uncertain, although the ore is easily cyanided. The Cascada has a plant consisting of 20 light iron stamps, and leaching and slime tanks for the cyaniding of the tails. The ore is free milling, 80% of the gold being saved in the mill. A poor extraction is made by cyanide, the plant barely paying expenses. It is handicapped by the small capacity of the agitators and the lack of a filter press. At times the mine produces some rich ore. Its regular production is around \$20,000 per month. The Coqueta and Volcanes are doing well with small mills.

The following is a rough estimate of what these districts may be expected to produce in 1914: Guamaco, \$100,000; Titiribi, \$400,000; Remedios, \$400,000; Andes, \$30,000; Amalfi, \$120,000; Sonson, \$70,000; Anori, \$60,000; Marmato, \$450,000; Santa Rosa, \$80,000; Manizales, \$350,000; San Roque, \$60,000; Puerto Berrio, \$70,000; others, \$20,000; total, \$2,210,000. Of this about \$300,000 is silver and the rest gold. Three-quarters of the production comes from five mines in as many different districts, and I believe that the time is not far distant when the other districts will be producing as much or more. No one need go there looking for developed mines, because they will not be found, but there are plenty of opportunities to secure mines on which a small amount of development work will produce results far exceeding the required expenditure. Most of these mines can be purchased on reasonable terms, if a small cash payment is made and work started to show that the purchaser is not taking the mines for the purpose of making a sale. The people have no idea of what a mine is worth, and so many options have been given on property, which has never received another thought from the holder, that they mistrust the intentions of any would-be purchaser. When they are once convinced that the buyer intends to work the property, they will be found willing to deal on a reasonable basis, I do not think it likely that many large mines will be opened, but a considerable number of mines capable of furnishing 50 to 100 tons per day will be developed, as soon as the opportunities are better understood. The required development work can be done much cheaper there than in the United States, and a little prospecting on some of these old mines will easily establish whether they are worth developing or not.

The laws are good, but so little care has been used in the measurements of claims, that there are many conflicting locations, but this need not cause trouble if reasonable care is used in studying the titles. Quartz claims are 600x240 meters, and pay a tax of \$1 each per year. There are no taxes on the product. Antioquia and Caldas deserve more attention than they have yet received, and I know of no gold field that can offer such reasonable chances of success, especially for the smaller companies.

Depositing Tailings on Adjoining Land

BY A. L. H. STREET*

In a suit against a mining company for trespass upon adjoining land, committed by depositing tailings thereon without the landowner's permission, it is open to the company to show, in mitigation of damages, that the tailings, having been abandoned to the landowner, are of value, thus limiting his right of recovery. In announcing this decision in the recent case of *Robinson vs. Moark-Nemo Mining Co.*, 163 *Southwestern Reporter*, p. 885, the Springfield, Mo., Court of Appeals adds that usually the measure of damages for such a trespass is the depreciation in the value of the land on account of the presence of the tailings, but that, if they may be removed at a cost less in amount than such damages, such cost measures the amount of recovery.

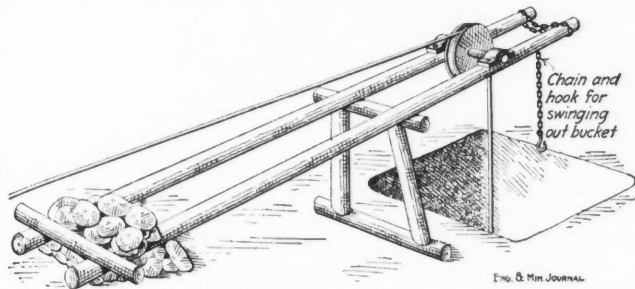
*317 Commercial Bldg., St. Paul, Minn.

Details of Practical Mining

Substitute for Small Headframe

BY WALTER R. HODGE*

The type of head rigging here shown has been used in many places on the Messabi range in sinking test pits and shallow timber shafts. It would be useful in most places where a temporary headframe is needed for shallow depths. It consists of two pieces of round timber about 28 ft. long, supported a little more than half way toward

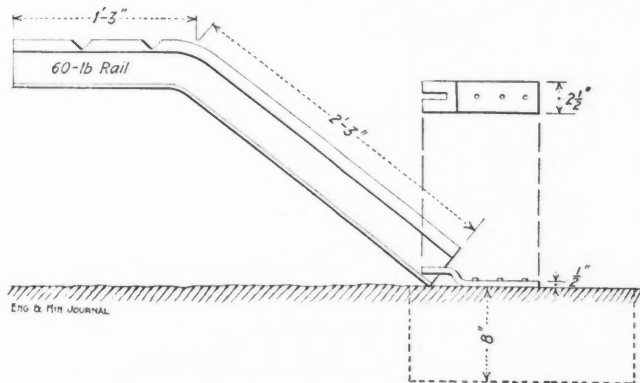


HOISTING ARRANGEMENT FOR PROSPECT SHAFT

the small end by a roughly made bent slightly inclined. The large end is weighted with waste rock or timber. The two timbers are set close together and the sheave revolves between them. The sheave is retained in place by two collars or simply revolves between two heavy pegs driven in the logs. Such a device may do good work to a depth of 200 ft. A small "puffer" is usually the source of power on the Messabi. A windlass may be framed to the butts of the timbers and leave the collar of the shaft free from obstructions.

Emergency Backing-Block

Mining operations in out-of-the-way places occasionally necessitate the invention of emergency tools and appli-



A BACKING BLOCK MADE FROM A STEEL RAIL

ances. In the accompanying illustration is shown a backing-block which, except for being somewhat light, answered the purpose as well as a standard cast block.

A piece of 60-lb. rail, 3½ ft. long, was bent as shown,

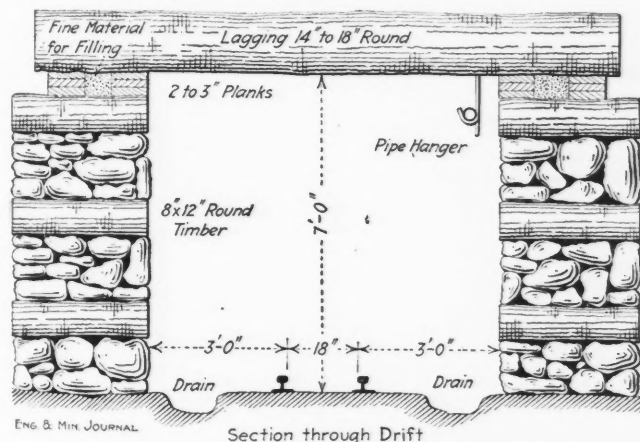
*Mining engineer, Ducktown, Tenn.

and holes were cut in the top of the rail for the accommodation of different length of drill steel. The upper end of the rail was rested on the anvil block and pushed firmly against the base of the anvil. To hold the lower end, a piece of 8x8-in. timber was sunk level with the ground, and to this was firmly spiked a 10- or 12-in. piece of ½x2½-in. iron, one end bent up as shown, and with a slot cut in it that will just fit the web of the rail.

Building Drywalls, Sudbury District

BY ALBERT E. HALL*

Although the drywall system of mining is being replaced in many districts by newer methods, it is still used in several of the older localities, such as the Sudbury nickel district. Although here also a new method is to replace the drywalls, it is customary at present to drive a small stope and follow up with two drywalls over which



DRY WALL AND TIMBER PROTECTION FOR DRIFT

lagging is placed to form a drift. The machines are then started breaking ground over the walls. Care is always taken to load the walls evenly, so that there will be no tendency toward movement as the result of unequal loading. Chutes are built in every 30 ft., and the even loading is especially important at these points, as slight differences in weight will cause the chutes to move.

The stopes are carried up on the shrinkage system. It is important that the walls be well built, as any defects may cause serious trouble, expense and delay.

The walls are built so as to give between track and lagging a clearance convenient for walking. The walls are 6 to 7 ft. high and 4½ ft. thick. A course of timber is placed every 2 ft., and the timbers in each course are about 2 ft. apart. The timbers extend through the wall and serve as a bond to hold the wall together. As a further bond, numerous headers are put in. The walls are built on contract at 12c. per sq.ft. of wall face. The

*Creighton Mine, Ont., Canada.

company has to furnish the contractors with stone and timber, two trammers usually being assigned to the masons in the event that no stone is convenient. The walls on the old levels are pulled down so that the timber can be used over on the lower levels. On top of the walls are placed two rows of 2-in. planking spiked to the top course of timber in the wall, one behind the other, so as to give a large bearing surface for the lagging. Between the two rows of planks about 6 in. is left and is filled in with fine stuff.

Care must be taken that only flat stones are put in the wall, since any that are not flat cause either themselves or the adjoining stones to be squeezed out when the wall is loaded. Strictly speaking, drywalls are not advantageous where sufficient rock is not obtainable to do the building. This condition exists in the Sudbury district, i.e., not enough rock is broken with the ore or in development drifting. For this reason some ore must be used, and since the ore has not sufficient crushing strength, some of the walls have failed where a piece of ore in the face was crushed.

At points opposite chutes a high wall is built consisting of a square timbered-crib filled in with rock between the timbers. Where a drift branches the point is also

locations and are built 5 ft. square. The timber in these is placed in a manner similar to that used in building up a mill.

The tables above will show what one mason can build in a day.

During the following month gang No. 1 averaged 25 sq.ft. per mason per day.

The costs per square foot on the face of the wall figure out about as follows: Masons, \$0.12; trammers, \$0.02. No charge has been made for timber, as that used in the wall is not new stock, and no price can be placed on it. Sometimes long sticks that have been used three or four times are cut up into smaller lengths suitable for the wall.

Cutting Floor Samples

By A. LIVINGSTONE OKE*

It frequently happens in the sampling of a mine that it becomes necessary to cut samples across the lode on the floor of the drift or working. The sketches illustrate a method I have adopted to facilitate the collecting of the

RATE OF BUILDING DRY WALLS
One Month Gang No. 1

Day of Month	Masons	Trammers	Sq.Ft. Built	Sq.Ft. per Mason
1	5	2	157	35.4
2	5	2	162	32.4
3	5	1	134	26.8
4	5	1	114	22.8
5	5	0.5	136	27.2
7	4.25	1	80	20.0
8	5	1	140	28.0
9	5	3	131	26.2
10	4.25	0.5	100	23.5
11	5	1	150	30.0
12	5	2	164	32.8
14	4	1.5	82	20.5
15	4	1	83	20.8
16	5	0	150	30.0
17	3	0	42	14.0
18	4	3	125	31.2
19	4	0.5	100	25.0
21	5	2	185	37.0
22	5	1	173	34.6
23	6	0	165	26.7
24	6	0	185	30.8
25	6	0	195	32.5
26	6	0	98	16.3
28	5	0	120	24.0
29	6	1	150	30.0
30	6	0	123	20.5

Average for the Month, 26.8 Sq.Ft. per Mason

Same Month, Gang No. 2

1	5	3	79	15.8
2	5	3	112	22.4
3	5	3	117	23.4
4	5	4	127	25.4
5	5	2.5	152	30.4
7	5	4	109	21.8
8	5	2	109	21.8
9	5	2	48	9.6
10	2.5	3.5	12	4.8
11	2	3	45	22.5
12	2	3	20	10.0
14	2	1.5	32	16.0
15	1	1	52	52.0
16	2	3	40	20.0
17	2	0	42	21.0
18	2	2.5	41	20.5
19	2	1.5	42	21.0
21	1.25	0.5	37	29.7
22	1	2	39	39.0
23	1	0	36	36.0
24	1	2.25	36	36.0
25	1	0	27	27.0
26	1	0	30	30.0
28	1	3	30	30.0
29	1	0	32	32.0
30	1	0	32	32.0

Average for the Month, 22.1 Sq.Ft. per Mason

made of cribbing, either square or round, and is filled in with stone. A wall is built around behind the chutes and in some cases mills are built above them. These are made round. The timber in these is laid in courses 2 ft. apart, as in the walls, but the individual timbers are placed touching each other. Manways are placed at suitable

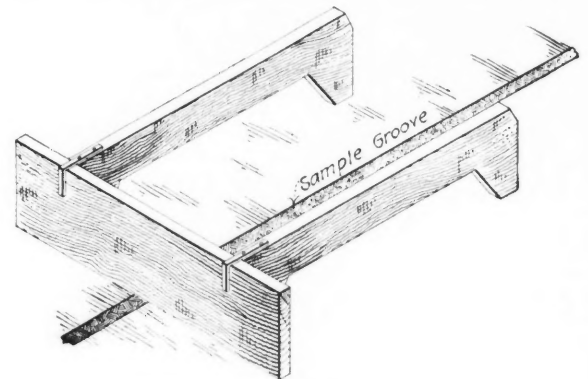


FIG. 1

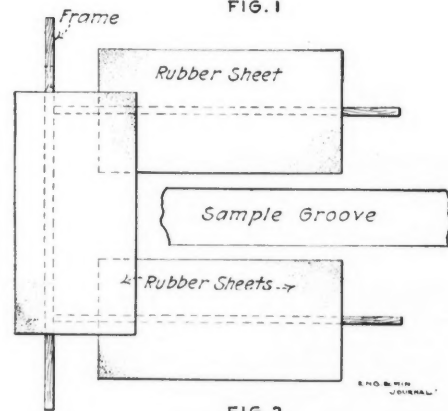


FIG. 2

DEVICE FOR CATCHING FLYING CHIPS IN FLOOR SAMPLING

material which is chipped from the sample channel. If precautions are not taken, a large amount of the material may be lost, due to the smaller pieces flying off under the blow of the steel, particularly in hard, brittle rock.

The adjustable frame shown in Fig. 1 consists of three planks, two of which have flat hooks made with a sliding fit over the third plank, as shown, forming three sides of a box around the channel which is being cut. Over this frame three pieces of rubber sheeting are ar-

*Mining engineer, 3 Marine Terrace, Penzance, Cornwall, England.

ranged as shown in Fig. 2. This forms a receptacle for all of the material, while being cut, and the high sides catch a large number of the flying pieces. To still further inclose the cuttings, a fourth piece of rubber cloth may be laid across two rods, resting on top of the sides, forming an entirely inclosed space, except at one end, where the sampler works.

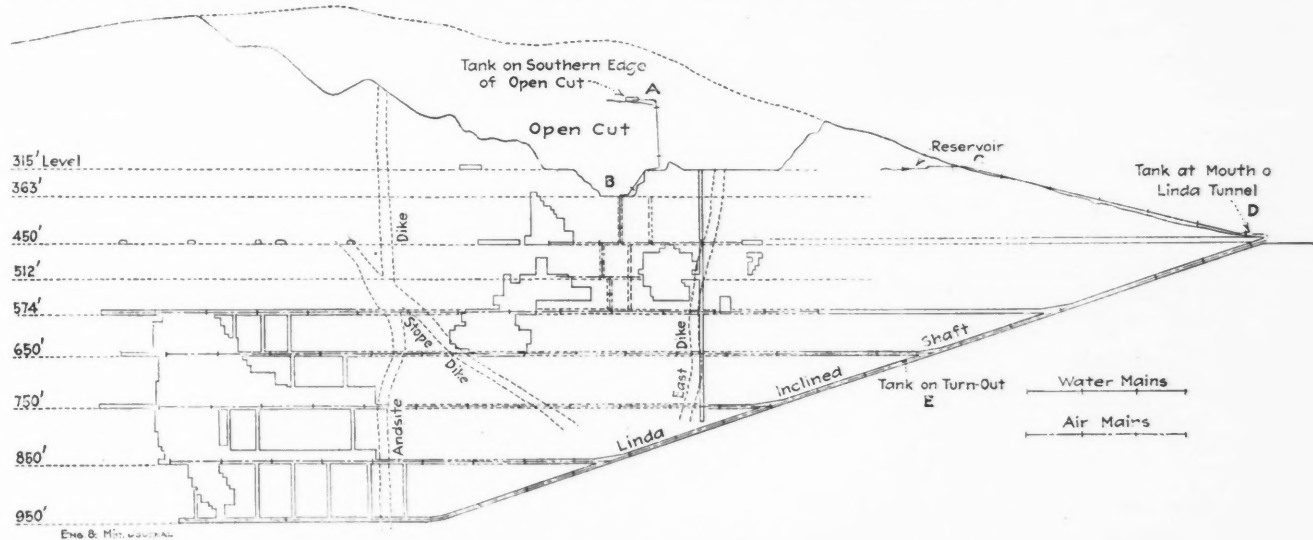
Fire-Fighting Arrangements at Mount Morgan

By B. MAGNUS*

In the latter part of 1909, it was found that a fire was smoldering among the filled sets of an isolated block of stopes in the extreme southeast corner of the Mount Morgan mine, in Queensland, Australia. By some means, the dust-coated hardwood timbering had taken fire and was burning in between the filling material. Fortunately, it was possible to wall up this block of stopes, and through pipe lines carried down into the mine from the surface reservoirs, water was poured in and the fire was subdued. This outbreak proved conclusively that mine fires were possible in spite of the quality of timber used and of

minutes after an alarm is given the 8-in. air mains can be conveying water to the place of the fire. This is effected by shutting off the air and opening the water-connection valves, thus giving the water free access to the air mains. The accompanying photographs and section will greatly assist in coming to an understanding of the system. To reduce the excessive head of water which would result if no break were made in the circuit, open tanks are placed at several points, underground and on the surface, at B, D and E, as indicated on the section. These tanks are provided with ball float valves which automatically keep them full.

The reservoir marked A, situated on the original hill-side at the south end of the open cut, supplies water to the tank B. For fire-fighting between the 450-ft. level and the 574-ft. level, the pressure is obtained from B, which is situated 87 ft. above the 450-ft. level; on the 574-ft. level, therefore, the head is 211 ft. A second reservoir marked C stores the water for the lower levels. It supplies a tank marked D, provided with a float valve, which, in its turn, supplies the tank E on the 650-ft. level. From this last, the water is drawn for the 750-ft., the 850-ft. and the 950-ft. levels.



DIAGRAMMATIC SECTION OF MOUNT MORGAN MINE, SHOWING PIPE LINES FOR FIRE FIGHTING

the dampness of the greater part of the mine workings, and indicated the advisability of preparation for coping with them.

To deal successfully with a fire discovered in its initial stage, it is essential that a supply of water under a good pressure should be immediately available at the scene of the outbreak. To make this possible, fire hoses and suitable connections to the network of pipe lines which supplies water for use with the rock drills are provided at convenient points on the various levels. Every working face has water pipe laid to it, which by means of a 1/2-in. rubber hose, supplies the necessary spray for boring and allaying the dust, consequently this pipe-line system is always full of water. The pipes, however, are only 1 1/2 in. in diameter, much too small to supply sufficient water if a fire once gained a firm hold. To furnish immediately abundant water, the underground air mains are connected with the surface reservoirs, so that within a few

One great advantage of using the air pipes is, that a supply of water is assured at every working place. In the event of fire, the rock-drill hoses, which are 1 in. in diameter, can be used as water hoses. To supplement these hoses there are on the main levels, connections to the standpipes for 2-in. canvas hoses.

Printed directions regarding the opening and closing of valves are posted in conspicuous places, so that the uninitiated may be able to manipulate them. Once the water is turned into the air mains, the valves regulating the supply of air in its ordinary course will serve to direct the water to wherever it is needed.

While such an arrangement as this would be dangerous if there were a possibility that men might be cut off by a fire in such a way as to be left dependent on the compressed air to escape suffocation, the layout of this particular mine renders such an occurrence exceedingly unlikely. The two main entrance and exit shafts are at the extreme southeast end of the workings, which trend in general northwest and southeast. At the far northwest

*General manager, Mount Morgan Gold Mining Co., Ltd., Mount Morgan, Queensland, Australia.

end of the workings, a ventilating shaft supplies an emergency exit. It is considered that these openings, in connection with the interlevel winzes and ladderways, reduce to a minimum the possibility of trapping and suffocation.

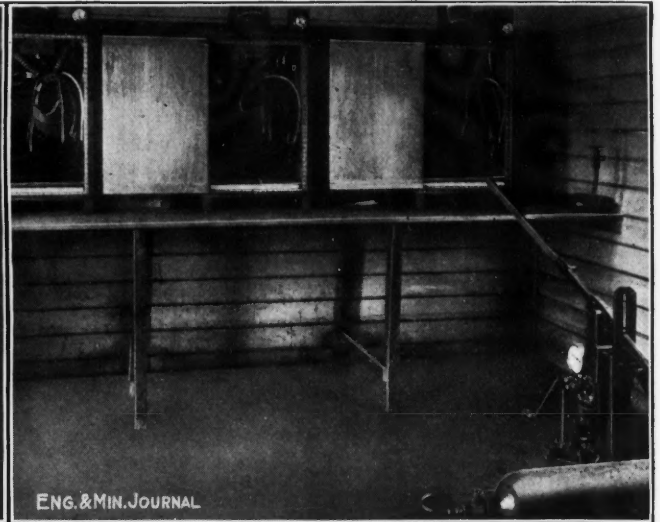
Although such an arrangement of shafts should render a fire readily accessible, it is recognized that it might probably be necessary to use some kind of breathing ap-

Two of these five sets are kept at the Many Peaks mine of the Mount Morgan Co., and three at Mount Morgan.

Both sets of equipments are kept in rooms close to the entrances to the mines, the helmet men being trained underground, thus dispensing with the practice chamber or gallery usual at stations. Each set of apparatus is stored in a tightly-lidded wooden case, suitable for transport when locked, and serving as a cupboard when stood



TYPICAL SET OF VALVES AND INSTRUCTIONS UNDERGROUND



HELMET APPARATUS IN LOCKERS OF EQUIPMENT ROOM



AN OUTSIDE STORAGE TANK AND CONNECTIONS

paratus in fire-fighting operations. For this purpose, the company has installed a smoke-helmet equipment comprising pump, spare oxygen cylinders, and five sets of Fleuss-Davis apparatus, with the necessary adjuncts. This make of helmet was selected by the Mines Department of Queensland for its station at Ipswich, as it was considered most suited for the conditions of this country.



ANOTHER VIEW OF EQUIPMENT ROOM

on end. When in the latter position, the case is arranged to take an iron tray containing kerosene, the vapor from which can pass into the upper part of the case, although no part of the apparatus can touch the oil.

At the Many Peaks also, as at the Mount Morgan mine, provision is made for turning water at a moment's notice into the air mains.

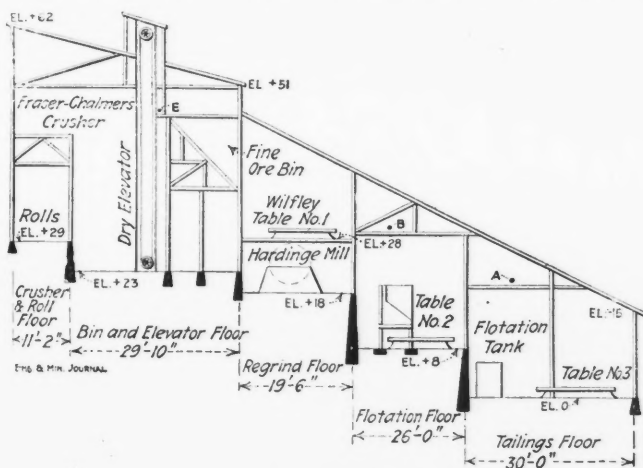
Details of Milling and Smelting

Testing Plant of the Burro Mountain Copper Co.

BY GEORGE HORN*

A new testing plant is being installed by the Phelps-Dodge company at its Burro Mountain plant, near Silver City, N. M., the object being to obtain accurate data from which to design a combination flotation, concentration and leaching works. The ore is first handled by a Frazer & Chalmers jaw crusher which reduces it to $\frac{1}{4}$ in. size, and the resulting rock is fed by an automatic feeder into a set of Frazer & Chalmers dry-crushing rolls. A belt and bucket elevator then lifts the material to a fine-ore bin holding 50 tons. At this stage the ore will all pass through a 20-mesh screen.

A 50-ton Hardinge conical mill is installed for re-



BURRO MOUNTAIN TESTING PLANT

grinding, its product being 50-mesh and finer. The fine pulp is designed next to be treated by the flotation system, a Minerals Separation Syndicate, San Francisco, unit of 50 to 75 tons capacity having been installed. The flotation unit handles at once the pulp which is —100-mesh size, while that above 100 mesh is concentrated over Wilfley tables.

The reason for the seeming discrepancy between the capacity of crushing, regrinding and concentration units, is accounted for by the company's desire to purchase only equipment that may be used in a future mill of large capacity, especially in the crushing department. The degree of fineness of crushing is one of the features of the operation which may change as experimental work progresses, so as to give to each of the dressing devices a pulp feed which will most accurately fit the conditions.

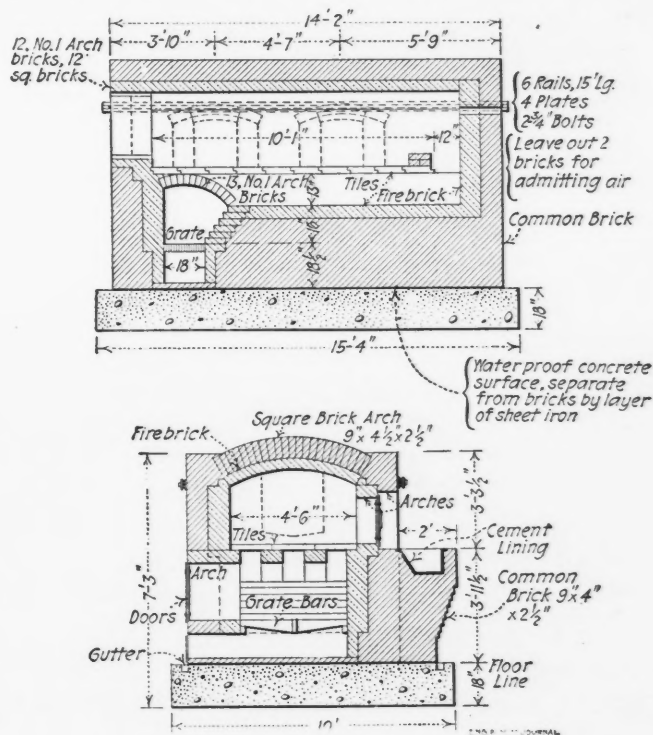


The Delassalde Leaching Process used by the Blaisdell Coscattlan Syndicate at Pachuca, Hidalgo, Mexico, is a hyposulphite-cupric chloride leaching process. It is especially adapted to leaching tailings containing organic material that would cause excessive consumption of cyanide.

*Silver City, New Mexico.

Mercury Recovery Plant at Fresnillo

The Fresnillo Co., at Fresnillo, Zacatecas, has a hyposulphite leaching plant and a newer cyanide plant. Both operations have suspended owing to the Mexican difficulties. Old tailings of the patio process, containing a large amount of organic material and mercury, are treated at the hyposulphite leaching plant. It is noteworthy that this material has received or will receive its third treatment. Once by the patio process and twice by hyposulphite leaching. After a period of standing, following the first application of hyposulphite leaching, the tailings are profitably retreated by the same process, and it is likely that when the Mexican revolutionary troubles are settled,



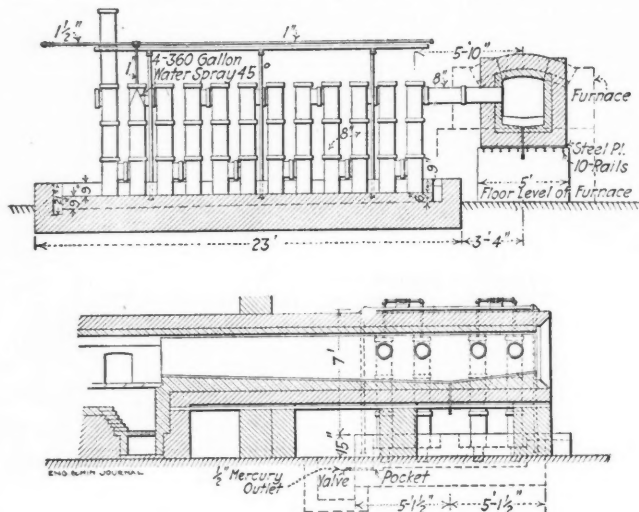
MERCURY-DISTILLING FURNACE

the Fresnillo Co. will proceed with the retreatment of the tailings at the Santa Ana plant.

The precipitated sulphide at the hyposulphite leaching plant contains from 200 to 300 grams of mercury per ton. This is recovered in a special roasting furnace and condensing plant designed by Cyrus Robinson, consulting engineer for the company.

The furnace was originally built for coal firing, but in the later period of its operation, oil fuel was used. The furnace has a special distilling hearth approximately 4x10 ft., made of fireclay tiles, 12x18x2 1/2 in. The furnace is lined with firebrick, and the distilling hearth is supported by two 9-in. partitions. Between the concrete base and the furnace proper a steel plate was placed as a stop against leakage of metal.

The precipitated sulphide from the leaching plant is sacked and placed upon the furnace hearth through the side doors. The sacks burn as the material is slowly heated, and the mercury is distilled over into the condensing chamber, being distributed from the flue to four lines of condensing tubes. The condensing tubes are made of 8-in. vitrified tile, cooled by water sprays. The condensing tubes are connected alternately at top and bottom, and set at 18-in. centers. There are sprays over the next to the last upright in each series of condensing tubes, and the 1-in. pipe between each two rows of tubes contains six $\frac{1}{8}$ -in. holes. The open ends of the vitrified



MERCURY-CONDENSING APPARATUS

pipe are sealed by water in a tank, the bottom of which is inclined so that the condensed mercury may be removed from a well at the lower end of the tank. This system of condensing occupies an area of only about 700 sq.ft., but has been found efficient, and there have been no cases of salivation at this works since the condensing plant was installed.

The Need for Improving the Quality of Lead Used for Acid Works

BY W. H. MAWDSLEY*

Now that the flotation process seems well established, a plant for making sulphuric acid is likely to be part of the mine equipment. As the chamber process is still in general use, and does not seem likely to be superseded, the question of the durability of the lead is of great importance. Mines being often at a distance from coast, or railroad, the transport charges are heavy and the cost of materials is proportionally increased. Lead burning, too, is a costly and tedious operation, and it is not possible to tell by the appearance if a really good joint has been made. It is, therefore, highly important to make the leadwork last as long as possible. During the years I was in charge of the acid works at Mt. Morgan, I noticed the life of the chambers was much shorter than in England, which I thought might be partly due to climatic influences. However, in the last report of the chief inspector under the alkali act in Great Britain, mention

is made of the fact that the leadwork of the chambers does not last so long as formerly. As the process is now watched much more closely, and is usually under the supervision of trained men, it is evident that the lead must be at fault.

This deserves careful investigation, and though impurities are usually present, in small quantities, their complete elimination is well worth striving for. Possibly the lead sulphate, or chamber bottoms, after being well washed to remove the soluble sulphates, would provide the purest lead. This, however, would not be always obtainable. An increase in the cost of lead would be of little moment if the life of the leadwork could be thereby prolonged. A small quantity of bismuth spoils the bending test of tin; copper, too, is very sensitive to slight impurities; so that perhaps small quantities of other metals may affect the solubility of lead. The usual impurities present are zinc, antimony, copper and silver, which are soluble in sulphuric acid. In the old process of lead refining, a little silver was usually left in the lead and this was considered beneficial. Now that the zinc process is generally used, that metal is more likely to be present than formerly. It may be, too, that zinc introduces impurities into the lead which are not distilled over with the zinc. In my own experience, when an alloy of 96% lead and 4% antimony was cast into valves, etc., the metal was always pitted after use, which was apparently due to the segregation and solution of the antimony. Possibly the acid vapors and the nascent acid have a more vigorous action on the lead than acid that has been made for some time.

In order to prove the effect of the various impurities on the durability of the lead in the chamber fumes, I would suggest this method: Obtain a sample of chamber lead from any good firm which makes a specialty of that line, and have it analyzed. Let us suppose it to contain Sb, 0.01%; Zn, 0.04%; Cu, 0.04%; Ag, 0.02%; Pb, by difference, 99.89%; the total impurities being 0.11%. Now make up 0.11% pure Sb + 99.89% pure Pb. and alloys of Zn, Cu and Ag in the same proportion. Provide enough of each alloy to make a small sheet of lead that will allow a piece, say $9 \times \frac{3}{4} \times \frac{1}{8}$ in., to cut; also have a piece of pure lead and a piece of the sample of chamber lead all of the same size. There will thus be six pieces, which will, of course, have distinguishing marks or numbers. Make a small hole near one end of each to admit a hook and make all as near as possible the same weight. Let all be suspended from different lutes (by a lead hook) in the top of the same chamber and have them removed every two months, washed, dried and weighed. The pure lead should wear smoothly, but the alloys will probably all be pitted. It will then be seen which alloy is most severely attacked and whether the presence of all four impurities in one piece makes the lead more vulnerable than when individually present. Of course, both sides of the lead would be exposed to the fumes, which would make the action more severe than on the chamber itself and probably more so than if immersed in acid. Now that fans, cooling towers and other appliances are used, the lead should last longer rather than otherwise. The use of water sprays instead of steam should also be beneficial. The chamber space in the majority of plants is not abnormally low. Perhaps some of the JOURNAL readers have other explanations to give for the shortening of the life of the chambers.

*Rockhampton, Queensland.

Company Reports

Burro Mountain

Phelps, Dodge & Co., in its 1913 report, states that the Burro Mountain Copper Co., Tyrone, N. M., has advanced its Niagara haulage tunnel 3753 ft., making the total length 4286 ft. to date. This tunnel is to deliver ore from the Burro Mountain claims at the railroad terminals and to explore the intermediate ground. Toward the end of the year a prospect drift was turned from the main tunnel at a point about 1200 ft. from the portal and revealed a body of low-grade sulphide ore. Development in this ore has so far opened up 50,000 tons of ore averaging 2.35% Cu. A site for a concentrating plant of 1000 tons daily capacity has been selected about three miles from Tyrone. Excavation of 6000 cu.yd. has just been completed preparatory for foundations for the power plant which will be equipped with two 1000-hp. Diesel engines. This plant will be located near No. 2 shaft. With additions during the year the company's property now aggregates 4463.92 acres of land. Surveys are being made for a new townsite.

Copper Queen

The annual report of the Copper Queen Consolidated Mining Co., Douglas and Bisbee, Ariz., for 1913, shows metal production from 1,034,357 tons treated as follows:

PRODUCTION OF REDUCTION WORKS

	Tons Treated	Ounces Gold	Ounces Silver	Pounds Copper
Copper Queen ore and precipitates.....	692,897	14,855	608,662	82,355,137
Copper Queen old dump slag.....	97,165	.....	200	3,039,691
Copper Queen lease ores.....	21,287	358	17,642	3,250,490
Moctezuma ore and concentrates.....	140,134	1,343	526,570	36,598,132
All other ores.....	82,874	14,585	717,088	8,167,132
Total reduction works.....	1,034,357	31,141	1,870,162	133,410,582
Ore shipped:				
*To El Paso.....	15,573	896	203,214	290,789
To Globe.....	18,136	507	7,204	334,335
*The ore shipped to El Paso also yielded 5,701,628 lb. of lead.				

The Copper Queen mines and old dumps produced 867,481 tons of ore, slag, precipitates, etc., the metal contents of which were as follows: 16,213 oz. of gold, 919,138 oz. of silver, 97,181,725 lb. of copper and 5,701,628 lb. of lead. Compared with 1912, the ore mined showed an increase of 81,113 tons and 8,900,817 lb. of copper. Shipments to El Paso were richer in lead but leaner in silver.

The reduction works purchased 1,041,453 tons of copper-bearing material, total contents of which were 29,925 oz. gold, 2,007,083 oz. silver, and 141,551,247 lb. of copper. In addition to this, 153 tons of burned lime and 3127 tons of barren quartz for fettle were purchased. Stocks of ore and metal contents on hand Jan. 1, 1914, compared with Jan. 1, 1913, were:

	Tons Dry Weight	Ounces Gold	Ounces Silver	Pounds Copper
On hand:				
Jan. 1, 1914.....	105,147	4,357	234,259	12,830,570
Jan. 1, 1913.....	100,716	3,875	232,211	11,999,650
Increase, 1914.....	4,431	482	2,048	830,920

The cost of maintaining the hospital department was \$92,025, not including construction account and interest

on investment. The staff consists of 10 physicians and surgeons, seven at Bisbee and three at Douglas. There are also 12 other persons employed in this department.

Employees of the company number 3661, of whom 2569 are engaged in the mining department, 1040 in the smelting department, 22 in the hospital department, and 30 in miscellaneous work. The Employees' Benefit Association at the close of the year showed a membership average of 70.6% of mine and smeltery employees compared with a general average of 50.60% for the year. Under the accident and compulsory-compensation law, it is claimed experience confirms that there are an undue number of claims for minor injuries. The table given herewith shows details of accidents and settlements under this law for 1913:

	Bisbee	Douglas
Injuries.....	2,062	238
Claims paid.....	303	71
Claims paid per cent. of injuries.....	14.7%	29.9%
Fatal accidents.....	9	2
Payments for injuries.....	\$24,678	\$5,079
Payments for fatalities.....	17,414	6,164
Total payments for accidents.....	\$42,092	\$11,243
Total payments on account of accidents amounted to 1.17% of amount of payroll.		

The Copper Queen paid \$5,700,000 in dividends in 1913 and ended the year with cash, accounts receivable, and copper stocks on hand amounting to \$8,885,038. Accounts and drafts payable totaled \$2,486,242, leaving a balance of quick assets of \$6,398,796. Net earnings as given in the balance sheet were \$6,916,900 for the year.

In the mining department a safety-first organization was organized and meetings are regularly held to discuss means for the prevention of accidents. This department is under the leadership of W. E. McKeehan, as safety inspector for the mine and smelter.

Detroit Copper Co.

According to the 1913 report of Phelps, Dodge & Co., the Detroit Copper Co., Morenci, Ariz., produced 532,792 tons of ore from its mines consisting of 518,718 tons of concentrating ore, 5330 tons of smelting ore, 8380 tons of quartz, and 364 tons of talc. There were 537,324 tons of ore treated, yielding 22,225,130 lb. of bullion or 41.42 lb. of refined copper per ton of ore. The average grade of all ore mined was 2.9% copper. The mining department employed 946 men, which indicates a mine output equal to about 561 tons a year per man. Concentration operations follow:

Ore concentrated, 517,518 tons, assaying.....	2.785%	Cu
Concentrates produced, 66,928 tons, assaying.....	15.834%	Cu
Savings—Ore and concentrates.....	73.52	¢
Ore and tailings.....	75.18	¢
Concentrates and tailings.....	74.76	¢
Assay only.....	75.27	¢
Tailings assay.....	0.79	¢
Tons of ore milled per ton concentrates.....	7.73	¢
Actual running time to total time.....	95.46	%
Ore milled per 24 hr. actual running time.....	1,485.14	tons.
Water used per ton of ore milled.....	554.98	gal.
Total men employed in mill, 186, about one for 2,780 tons milled per year.		

In the smeltery 141,094 tons of charge, including flux, were smelted in the blast furnace; of this, 72,488 tons consisted of ores and concentrates. Coke consumption was 16,099 tons of coke, or about one ton for every 8.76

tons of charge. The converters treated 9601 tons of copper-bearing material, making a total of 150,695 tons handled at the smeltery, including flux. There were 168 men employed in this department, indicating that about 840 tons were handled per man per year.

All men employed were as follows: mining, 946; concentrating, 186; smelting and converting, 168; mechanical, 169; miscellaneous, 41; total, 1510 men. This indicates that about 354 tons of ore were mined and treated to copper bullion per man per year. During the year, 18,492 ft. of development work was done, which is equal to one foot for every 28.853 tons of ore mined.

Algomah Mining Co.

During 1913, according to the report of the Algomah Mining Co., Houghton, Mich., the company received \$70,000 from assessment No. 2, this together with miscellaneous receipts and a deduction for a deficit in 1912 left a working balance of \$58,308 for the year. Mining, Boston office, and interest expenses amounted to \$30,601, leaving a balance of \$27,707 in the treasury at the end of 1913. Total expenses at the mine were \$22,489, of which \$12,391 was for 203 ft. of shaft sinking at \$37.355 per ft. and 358 ft. of drifting at \$13.432 per ft. No active work has been done on the property since it was closed down in July on account of the strike. As soon as labor conditions will permit, shaft sinking will be resumed. A crosscut at the second level disclosed an amygdaloid bed but a drift 130 ft. long was run without developing any commercial ore. Copper ore of the same character as that opened on the surface was found at several places in the shaft.

Yukon Gold

The report of the Yukon Gold Co., for 1913, shows a gross production of \$4,789,402 and nonoperating income of \$46,389; from this is deducted working costs amounting to \$2,251,955, leaving an income of \$2,583,836. Other expenses aggregating \$1,453,536 and consisting of royalties, amortization, interest charges, general expenses, etc., leave a net profit of \$1,130,300 for the year. The following table is a summary of operating results.

SUMMARY OF OPERATING RESULTS				
	Cu.yd. of material handled	Av. yield per cu.yd. e.	Avg. cost. per cu.yd. e.	Total operating gain.
Dawson-Dredges.....	5,133,575	65.13	29.53	\$1,827,795.17
Dawson-Hydraulics.....	2,875,952	9.0	9.7	22,425.91*
Iditarod-Dredge.....	493,756	167.0	64.33	507,860.36
California-Dredge.....	2,550,271	6.9	4.07	72,173.80
Miscellaneous operations.....				152,044.18
Non-operating income.....				46,389.16
Total operating income.....				\$2,583,836.60

* Loss.

The Dawson dredges began operations May 1 and ran until Oct. 31. The dredges were idle 11% of possible running time due to power trouble. The power contract with the Granville Power Co. has been canceled and in the future power will be furnished from the company's own plant. The average length of the dredging season was 184 days, during which dredges operated 79.6% of possible time. Of the area mined, 445,624 sq.yd., or 68.4% was frozen and had to be thawed by steam.

The Iditarod dredge commenced operations on May 8 and closed down on Nov. 25. The principal causes of low yardage and high costs are summarized as follows: steep grade, 6.5 to 10%; large boulders, heavy granitic sand

from workings above; scarcity of water for flotation due to unusually dry season; and the presence of strata of gumbo clay. The grade and sands were the greatest obstacles. A series of dams had to be built, both before and behind the dredge.

In California, a new property was acquired on the American River and one of the company's dredges was moved thereto from the Oroville district. The dredge was placed in operation on Sept. 30, and has a capacity of 120,000 yd. per month.

While the yardage handled in hydraulic operations was nearly as large as in 1912, it consisted largely of top gravel which had to be stripped before the pay gravel could be mined. About 50% of the total area stripped remains to be mined so that the gross value is not representative of the area mined or the gold content of the gravel. The indebtedness to the Guggenheim Exploration Co. was reduced by \$425,000. Liabilities amount to \$1,185,292 over current assets.

La Salle Copper Co.

In the 1913 report of the La Salle Copper Co., Houghton, Mich., a decrease of \$81,832 is shown in quick assets. Copper production was 43,906 lb. from stockpile. Balance of quick assets at the end of the year was \$158,827. The copper production came from 2221 tons of rock yielding 19.76 lb. The only development work performed consisted of 141 ft. of drifting from No. 2 shaft. The total depth of shafts to date follow: Shaft No. 1, 2146 ft. from surface; shaft No. 2, 1770 ft.; shaft No. 5, 1450 ft., and shaft No. 6, 882 ft. from surface. New rock houses were completed at No. 1 and No. 2 shafts.

Old Colony

According to the report of the Old Colony Copper Co., Houghton, Mich., for 1913, the work consisted of drilling 12,627 ft. of diamond-drill holes. Two drills were employed continuously on holes No. 19 to No. 27, inclusive. Holes No. 19 to 25, inclusive, developed the Mayflower lode and indicated a formation of varying thickness and degree of mineralization. Holes Nos. 26 and 27, which were drilling, at the date of report, at depths of 1323 ft. and 589 ft., respectively, had not attained sufficient depth to cut the lode. The monthly rate of drilling was about 500 ft. per drill. The company started the year with cash and quick assets amounting to \$69,641; received \$2851 and ended the year with \$25,111 in cash, accounts, etc., after deducting all bills payable.

Union Copper Land & Mining Co.

The Union Copper Land & Mining Co., Houghton, Mich., in its 1913 report says that while at the date of the last annual report several options had been granted and other propositions were under consideration, all were abandoned on account of conditions brought on by the strike. It is stated that several inquiries for timber lands in large blocks have been received recently and conditions seem to be somewhat improved. Negotiations have just been concluded involving the sale of timber which will put the treasury in funds. The company had cash on hand at the end of the year amounting to \$822 and land holdings amounting to 6366 acres.

The Cost of Doing Things

Bingham Mines Co.

As shown in its annual report for 1913, the Bingham Mines Co., Salt Lake City, Utah, received \$230,836 in income, of which \$139,000 came from dividends on Eagle & Blue Bell Mining Co. stock and \$91,836 from operating the Dalton & Lark and the Commercial mines. After deducting \$19,050 for interest paid on outstanding bonds there was a net balance of \$211,789. Operations at the Dalton & Lark and Commercial mines were as follows:

Dry tons of ore mined.....	38,987	
Average value of ore per ton.....	\$7.70	
Costs	Total amt.	Per ton
Mining	\$103,869	\$2.65
Office, legal, etc.....	16,220	0.42
Development	16,100	0.41
Smelting, freight, sampling, etc.....	77,162	1.98
Total at mines.....	\$213,351	\$5.46
Boston office and management.....	3,971	0.10
Total expense.....	\$217,322	\$5.56
Less other income.....		0.26
Net cost per ton.....		\$5.30

The metal contents of the ore were as follows: 2995 oz. of gold, 179,117 oz. of silver, 2,745,881 lb. of lead, and 1,122,955 lb. of copper. The Eagle & Blue Bell operations were:

Dry tons of ore mined.....	35,244	
Average value of ore per ton.....	\$14.60	
Costs	Total amt.	Per ton
Mining	\$97,701	\$2.78
General and legal.....	11,058	0.31
Examinations and assessments.....	714	0.02
Development	42,583	1.21
Smelting, freight sampling, etc.....	210,409	5.98
Total	\$362,465	\$10.30

The metal contents of the Eagle & Blue Bell ore were: 7514 oz. of gold, 417,279 oz. of silver, 4,639,073 lb. of lead and 157,596 lb. of copper.

Pump-Unit Efficiencies and Costs

The accompanying table gives pump-unit efficiencies, costs, and costs of operation, from bids and estimates for a plant for station pumping in a Western mine situated at an elevation of about 5000 ft. The pumps were

PUMP-UNIT EFFICIENCIES

	One 500-Gal. Plunger Set	Two 500-Gal. Plunger Sets	One 500-Gal. Centrifugal Set	Two 500-Gal. Centrifugal Sets	One 1000-Gal. Centrifugal Set
Gal. per min.....	500	1000	500	1000	1000
Head	1690	1690	1680	1680	1680
Hp. in water.....	213.8	427.6	212.5	425.1	425.1
Efficiency of pump.....	80%	80%	65%	65%	72%
Efficiency of motor.....	91	91	93	93	93.5
Efficiency of cable.....	99	97	99	97	97
Efficiency of transformer.....	98	98	98	98	98
Combined efficiency.....	70.6	68.8	58.7	57.5	64.0
Total hp. required.....	302.8	620.0	362.0	739.2	664.2
Kw. required.....	225.9	462.5	270.1	531.4	495.5
Cost of electricity for one year on sliding scale.....	\$14,941	\$27,914	\$17,529	\$32,313	\$29,474
Cost per kw. for one year on sliding scale.....	\$66.14	\$60.35	\$64.89	\$58.60	\$59.48
Cost per hp. for one year on sliding scale.....	\$49.34	\$45.02	\$48.31	\$43.71	\$44.37

to be motor driven, power for which was brought from one of the big high-tension service companies. The capacities, head, etc., are all given in the table. The cen-

trifugal pumps were of the multi-stage turbine type, of foreign manufacture. Two 500-gal. centrifugal sets proved to be more economical in every respect for 1000 gal. capacity than a single 1000-gal. centrifugal, or than one or more ordinary plunger pumps.

Rock-Drill Repair Costs

One great obstacle to obtaining data on the life of a rock drill is the manner in which repairs are made, it being common practice to take worn parts from a machine, true them up, and put them into some other machine. In a short time, the original parts of a drill may be widely scattered. Probably each one of a group of machines at work on the same job for two years, will, at the end of that time, consist principally of new parts and parts taken from its mates.

The data here given relate to 15 machines of a well known make, 2 3/4-in. pistons, put to work during the spring and summer of 1912. The records were kept by the month, and the total repair cost of each drill, including both labor and material but not including mountings or connections, at the end of each month was plotted on a chart against the total number of days, of two shifts each, during which the drill had worked from the time it was put into commission. From this chart were scaled the costs as recorded in Table I.

TABLE I. REPAIR COSTS OF 2 1/4-IN. DRILLS

Drill.	Days in Use								
	25	50	75	100	125	150	175	'900	225
A	\$0.60	\$1.25	\$1.50	\$2.40	\$3.00	\$7.05	\$10.80	1.40	\$21.89
B	3.75	7.50	7.50	8.75	12.00	16.25	21.80		
C	3.30	10.00	11.10	13.50	20.30	40.75	40.91	40.95	
D	0.90	1.25	4.55	5.30	28.39	28.39	28.39		
E	0.15	0.40	1.50	4.50	5.80	6.40	9.20	9.85	13.20
F	3.80	7.40	8.00	8.08	8.08	12.15			
G	0.20	0.50	1.10	4.75	8.00	14.95	16.20	20.08	27.29
H	0.55	1.05	5.60	5.91	7.80	10.57	10.70		
I	4.00	6.20	8.70	12.30	41.20	54.59			
J	0.70	0.70	3.50	4.70	8.29	8.45			
K	0.60	1.00	1.50	21.00	41.00	42.10	43.36	52.40	
L	0.55	1.00	2.20	9.10	12.00	12.39	21.30		
M	0.85	1.20	4.40	7.70	8.70	10.25	18.14	22.70	
N	3.65	4.10	4.85	5.05	8.50	50.50	52.01		
O	2.55	4.35	4.65	5.20	11.20	14.60	14.75		
	\$26.15	\$47.90	\$71.05	\$118.24	\$224.26	\$329.30			
Av.	\$1.74	\$3.19	\$4.74	\$7.88	\$14.95	\$21.95			

The service varied from 150 days to 325 days each. This variation is explained by the fact that the drills were not all put to work at the same time, and also that the number on hand was somewhat in excess of the number in use, so that some were always idle, whether in the repair shop or not. Good average results, therefore, were obtained for only 150 days, beyond which time the averages were incomplete, inconsistent and without significance. Most of the smaller repair parts were made in the mine shops, but the larger ones were bought from the drill makers.

It is a curious fact, though probably only a coincidence, that the average repair cost for the first 150 days approximates closely the following geometrical progression, having 1.66 as a ratio: 1.74, 2.89, 4.80, 7.96, 13.22, 22.95.

Note—An abstract from an article in the "School of Mines Quarterly" by C. K. Hitchcock, Jr., manager, Lake Copper Co.

This progression if plotted and extended to 200 days or further, would show so great an expense of keeping up the drills as to indicate that they had practically gone all to pieces, which is contrary to general experience. Therefore, beyond 150 or 175 days, the repair cost graph, if continued, would probably become a straight line, having such inclination as to represent a cost of \$10 or over for each 25 days. This approximation is based partly on the fact that the actual repairs between 100 and 150 days were about \$7 for every 25 days, and partly upon the performance of another size and type of drill, now to be discussed.

TABLE II. REPAIR COSTS OF 31-IN. DRILLS
Days in Use

Drill	25	50	75	100	125	150	175	200
P	\$2.00	\$2.50	\$4.00	\$5.40	\$8.00	\$19.00	\$22.00	\$22.60
Q	3.00	11.30	19.10	22.30	27.00	34.00	40.20	41.30
R	6.10	14.20	18.20	19.60	24.50	28.60	28.90	28.90
S	4.20	5.20	6.20	9.20	18.10	18.20	18.30	21.50
T	28.00	33.30	36.10	37.00	38.10	41.50	44.70	45.90
U	0.50	4.30	4.90	11.00	12.80	14.00	17.80	18.20
Average	\$43.80	\$70.80	\$88.50	\$104.50	\$128.50	\$155.30	\$171.90	\$178.40
Drill	225	250	275	300	325	350	375	400
P	\$40.00	\$64.20	\$84.80	\$88.10	\$97.00	\$99.50	\$101.50	\$102.00
Q	42.20	46.70	53.20	59.60	66.00	66.80	67.00	78.80
R	32.60	33.40	46.30	49.20	50.20	48.80	54.50	61.00
S	22.10	46.00	46.00	47.60	48.20	53.70	54.60	57.10
T	46.50	46.90	48.20	49.50	72.00	90.50	111.20	112.00
U	18.20	35.00	55.20	59.30	60.20	60.70	63.00	63.70
Average	\$201.60	\$272.20	\$333.70	\$353.30	\$393.60	\$420.00	\$451.80	\$474.60
Drill	425	450	475	500	525	550	575	600
P	\$115.50							
Q	79.50							
R	75.00	\$76.70	\$77.30					
S	60.20	62.70	62.70	\$63.00	\$64.00	\$67.70	\$78.10	\$78.30
T	113.80	113.80	114.00	114.50				
U	64.00	70.00	73.70	74.40	98.80			
Average	\$508.00							
Drill	\$84.67							

The drills of this second group were larger, having a 3 1/8-in. piston. Eight new ones were put to work in 1911, and records were kept, as for the 2 3/4-in. machines. After two of the drills had worked about 160 days, their cylinders cracked and they were put out of commission. The repair costs and service of the remaining six drills for two years are given in Table II. The results plotted will produce a graph more irregular than that for smaller drills; but a straight line joining the two ends averages the irregularities fairly well and represents a cost of practically \$5 per 25 days. Of course, this is hardly a fair comparison, and for the purposes of this discussion, it would have been desirable to have had the drills repaired and kept in commission. The immediate cost would have been between \$60 and \$80, with a resulting average increase of \$8 or \$10 at the 175-day period. How great the increase would be after 175 days is uncertain, but probably enough to bring average up to \$10 per 25 days.

Again, from other data too incomplete to give here, obtained from such drills of another group of the same size and type, as had been in commission for from three to five years, it was found that the repairs amounted to \$7.50 every 25 days. This rate is based on the best machines of the lot, the poor ones having been discarded. If all had been kept at work, there is evidence that the cost would have been nearly double.

Cost of Mine-Timber Treatment

A plant for the open-tank treatment of mine timber having a capacity of 100,000 cu.ft. per 250 days may be installed for about \$1500, according to the Can. Min. Inst. Transactions for 1913. The cost of a cylinder-pres-

sure plant with a capacity of 780,000 cu.ft. per 250 days is about \$20,000. The cost of handling in the open tank is about 3c. to 4c. per cu.ft. and about 2c. to 3c. in the pressure cylinder.

Costs of Small and Medium-Sized Steam Hoists

A recent tender for bids for steam-driven mine hoists to hoist a dead unbalanced load of 3000 lb., in a single shaft at a rope speed of 500 ft. per minute, with steam at 100 lb. at the throttle, brought bids which, figured on a per-pound basis, averaged 11c. f.o.b. factory in the Atlantic States. The highest price was 12.6c., and the lowest was 9.9c. The highest-priced hoist, however, was not actually offered for this duty as given above, but is a present quotation on a smaller hoist, which is at present taking the place the new hoist is to fill and so is properly enough included in the average.

The hoists above are all geared hoists and include both friction drum and fixed drum, reversible and nonreversible types, all with band brakes. The weights vary from 6100 lb. to 22,400 lb.; the cylinders from 9x10 in. to 12 1/4x15 in.; and the horsepowers from 35 to 75, normal rating.

On a distinctly different type of hoist, geared but with an automatic cutoff valve gear guaranteed to effect a considerable steam saving the quotation figured 10.7c. per lb. Illinois delivery, which is a close check on the other prices. For the same duty as above, a 10x14-in. hoist, same type as the first set, for Missouri River delivery, was quoted at 8.35c. per pound.

Drilling Costs in Nova Scotia

Some interesting data are presented in the report of the Nova Scotia Department of Mines for 1913, covering the operations of the government drills.

The total amount of drilling done was 5782 ft. with diamond and 1820 ft. with Calyx machines. The cost per ft. for drilling for minerals was \$2.08, ranging from \$0.25 to \$4.60 for diamond drills and from \$1.24 to \$3.23 for Calyx.

The table represents the data for the holes on which the most detailed information is published. Other holes for which less complete records were kept were also drilled. One put down with a 2-in. core diamond drill through sand, gravel, sandstone, shale and clay for 53 ft. cost \$4.60 per ft. In another case a series of holes was put down in search of gypsum, 27 in all, ranging in depth from 13 to 235 ft., through soft sedimentaries; the total footage was 2093 and the cost \$1 per foot.

Maintenance of Mine Pumps

Approximate figures on the maintenance for one year of four centrifugal pumps used by the Penn Iron Mining Co., as compared to four triple-expansion steam pumps formerly doing practically the same duty are as follows (Bull., A. I. M. E., February, 1914):

	Centrifugal	Steam
Shop labor	\$717	\$760
Labor on pumps	690	590
Supplies	503	2021
	\$1910	\$3371

This saving was chiefly on the water end, in packing, etc.

Gold-Dredging Operations of the Ashburton Mining Co.

BY LEWIS H. EDDY*

SYNOPSIS—Description of the operations of the first company in the American River district of California.

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The Ashburton Mining Co., the oldest company engaged in gold dredging in the American River district, Calif., completed its territory near Folsom at the close of 1913. The company began dredging in this district in 1900, and has turned over a total area of about 260 acres. The Ashburton installed the first successful bucket-elevator dredge in the American River district, though it was the second company to undertake gold dredging. Two $7\frac{1}{2}$ -cu.ft. dredges have been built and operated by this company. No. 1 dredge was built in 1899, installed at Sailor Bar on the north side of the river near Fair Oaks, and operated from March, 1900, to December, 1907, inclusive. No. 2 dredge construction was started in 1906, but was delayed by a strike of machinists in the East, and was installed on the south side of the river between Natoma and Folsom in January, 1908. The hull and other wooden parts of No. 1 dredge were destroyed by fire on May 25, 1903. The dredge was rebuilt in that year. The total operating time of No. 1 dredge was approximately 5 yr. 6 mo. and it turned over about 100 acres of ground. No. 2 dredge has operated steadily, with the exception of lost time necessary for repairs and improvements, making a total of about 5 yr. 6 mo. The actual dredgeable land in this field was about 195 acres. In January, it was decided that the grounds occupied by residence, offices and shops would be withheld from dredging, as they are of great value by reason of the improvements, leaving a total of 160 acres of dredged ground in this field.

The dredge was dismantled and the useful machinery was shipped to the Marigold in Yuba Basin district in March, 1914.

DESCRIPTION OF DREDGES

Ashburton No. 1 was the first $7\frac{1}{2}$ -cu.ft. bucket-elevator dredge installed in this district. The original boat was equipped with open-link buckets and with tail scow and tail sluices, and worked on a spnd. The reconstructed dredge was equipped with close-connected buckets and was provided with new spuds, and a belt conveyor for stacking the tailing. Dredge No. 2 was similar in design and construction to the reconstructed No. 1, though with some added improvements. No. 2 was the first boat in the American River district, and probably in the state to be provided with two steel spuds. The usual practice then and until recently provided for a wooden spnd for stepping and a steel spud for digging. The boat was thus equipped to dig on either spud. Both boats were provided with shaking screens and that type of screen remained in No. 2 without special change.

The general dimensions of No. 2 are practically the same as the dimensions of No. 1. The length over all is

230 ft. The hull is 110 ft. long, 40 ft. wide on the water line; total width of deck including overhand, 51 ft. The digging ladder is 79 ft. 6 in., centers, equipped with 64 buckets dumping 24 per minute. The stacking ladder is 100 ft., centers, provided with a 36-in. belt. The dredge was rated to dig 35 ft. below the water line, the buckets complete weighed 1800 lb. each. The maximum digging radius is 140 ft.; the maximum stacking radius 90 ft. The draft at the bow with the ladder up is 4 ft. 7 in.; at the stern with the ladder up, 3 ft. 9 in.; deck-level, 3 ft. 4 in. The height of the upper tumbler shaft-center above the ground of the deck is 24 ft. 9 in. The upper tumbler was originally five-sided but was replaced by a six-sided tumbler; the lower tumbler is six-sided. The shaking screen area is 255 sq.ft.; the total gold-saving area, 3088 ft. The buckets on both boats were of the Bucyrus type. No. 1 dredge was built by the Bucyrus company. The machinery for No. 2 dredge was built by the Allis-Chalmers Co. The electrical equipment on both boats was by the General Electric Co. The total power of No. 1 dredge was 301 hp.; the total of No. 2 dredge is 380 hp. The displacement is 561 tons. No. 1 dredge was dismantled in the fall of 1909. The boat was good for a longer term of service after reconstruction, but the company had no additional ground available, and it was not considered in that day, and it is not considered in the present day, economical or even practical to remove a wooden hull from one to another field. The hull of No. 1 was good when the boat was closed down. There was little rotting and it could have been economically repaired and made of practical service for two or more additional years. The worst feature of wear of the machinery was found in the winch, and this could have been easily and economically repaired as the wear consisted chiefly of broken parts that could have been replaced. Both spuds were broken, and before the boat was shnt down the head line was again brought into use. All the other machinery and operating parts were in good condition with the exception of the bucket line which was badly worn; but was held on at reduced capacity in order to work out the ground without adding the expense of new buckets. It was found to be more economical to occupy a greater length of time in digging than to increase the yardage at the expense of a new bucket line.

The same practice was also followed with No. 2 dredge in regard to the maintenance of the old bucket line until the whole field was completed. With the exception of 15 buckets put on in March, 1913, the bucket line is badly worn. Nearly one-half of the buckets have done two years' service; the remainder from one year to five months. The principal wear of the buckets was formerly on the base where the upper tumbler sole plates hit; but since the introduction of manganese insert plates the wear is principally on the eyes. The present condition of the hull is not good. It is rotted throughout, and at the time of my last visit, in September, it was problematic whether or not the boat would finish the few acres remaining to be dug. This condition of the hull is

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readily accounted for. It was built in 1906-07, in the winter, and of lumber that had been kiln-seasoned. Then there was a year of elapsed time between the completion of the hull and the installation of the machinery, and the disuse of the hull materially shortened the practical life of it.

There were many minor improvements made in No. 2 dredge and some important changes and repairs. One feature of importance was the placing of the winch room directly over the bucket line. This situation of the winch room enabled the winchman to see the upper tumbler, stacker, spuds, hopper and the bucket line and bucket pins without shifting his position from one part of the room to another. The other practice is to place the winch room to the starboard side of the bucket line, which has its advantages and disadvantages. In 1911, a change was made from single to double drive. This is an important improvement and has proven economically satisfactory both in the operation and the capacity of the dredge. New main gantry posts had been set in place on the outside of the old posts; this strengthens the gantry, avoiding the necessity of a new one. The size of the original tumbler shaft was 10½ in. The later shaft which was put in before the change from single to double drive, is 14 in. The pump capacity of No. 2 dredge was increased over that of No. 1. Instead of 8-in. and 10-in. pumps, No. 2 was equipped with 10-in. high-pressure and 12-in. low-pressure pumps.

HEAVY GROUND WITH CLAY TO WORK ON

The gravel in this field, with the exception of a portion at the south end is all straight river wash, containing some clay; on the south end of the property the ground is cemented hard on the bottom, but there is no cementing at the top. The gravel lies on a volcanic ash bottom, which is thoroughly soft and can be cut by the buckets. The Ashburton practice is to dig to a depth of about 1 ft. into the bottom. This bottom or so called bedrock lies on the top of another bed of gravel. This lower gravel has been drilled and has furnished a good water-supply. It contains some gold which is mostly fine. The ground is generally heavy and contains many large rocks weighing from 500 to more than 1000 lb. The material varies from fine sand up to boulders that weigh a ton. The average size of the gravel is from 3 or 4 in. to 10 or 12 in. or from 2 or 3 lb. up to 50 or 60 lb. The greatest obstacle in digging has been the clay. A large portion of the central part of the property around Humbug Creek and between Humbug and Willows Creeks was originally a swamp covered with willows and tule growth and underneath this are large bodies of clay. The roots interfered with the pumps. If the screens were made fine enough to cut the fine roots out, the roots would mat alongside of the screens and the pumps would suck the screen dry, allowing the water pressure to crush them. There is always trouble with clay in the shaking screens, which are not adapted to the handling of such material.

PROBABLE ORIGIN OF THE ASHBURTON FIELD

The flat comprising the upper portion of the ground dredged by No. 2 dredge is apparently a bench gravel that has been left by the river. It is a later deposit and probably secondary from the original bed. Blue Ravine lying to the northeast and Rebel Hill to the southwest, both on the south side of the American River, contained

the original gravel bed. These gravels are more compact and tightly cemented, practically from the surface to a 60-ft. depth. In Rebel Hill, there is a large amount of heavy cement sand in the dredge tailing. The gravel of Ashburton flat is clean and sandy and is quite loose, except in spots, where there is more or less cement in the bottom. The higher flats are hard ground. It is the opinion of geologists that the original streams flowed through Blue Ravine and Rebel Hill and later on they broke through and cut out the Ashburton flat and flowed on to the west.

Two peculiar and interesting features of the geologic structure of Ashburton flat were disclosed by dredging. The bucket line of No. 2 dredge struck a rock at a depth of 18 ft. from the surface that was 40 ft. long, 24 ft. wide and 3 to 4 ft. thick. It was impossible to move or even to jar it with the bucket line. It was too large to permit of getting hold of it with the buckets. It was an inconvenient obstacle, and its removal was accomplished by digging a short length on either side and then blasting off the projecting piece with giant powder, and repeating the operation until the entire rock was broken up and removed. It required three days time to dig and blast, and remove it in pieces, with the bucket line. The rock lay on a bed of gravel at about 6 ft. above bedrock. From this gravel, beneath and around the rock, the dredge recovered \$4000 in gold, a profitable experiment.

There is one corner of the flat which was not considered of great value, as the drills going to a depth of 36 ft. and 32 ft. showed an average prospect in the two holes of about 3c. per cu.yd. One hole showed 2c. and the other 4c. This corner embraced an area of about three acres. The bottom has the general appearance of the volcanic bedrock in other parts of the field but the buckets cut through it easily. Mr. Wright, in studying this material, concluded that it was not regular bedrock and decided to dig a little deeper. The buckets were sent down to a further depth of 3 ft. where there was disclosed a very rich gravel bed. The digging was then extended to the regular bedrock, which was about 15 ft. deeper than the false bedrock. The gravel averaged 25c. per cu.yd. The dredge turned over about three acres and had not finished all the gravel at the time of my last visit, in September. Up to that time the gravel lying under the false bedrock had yielded \$30,000. It was not then known how far in area the false bottom extended.

The cost of operation of the Ashburton dredge has varied from 3c. to 8c. per cu.yd. of gravel handled. The higher cost, considering the recent condition of the dredge and the necessity for maintaining a maximum payroll compares very favorably with the cost in other portions of the district. The ground has averaged a gross recovery value of 10c. to 11c. per cu.yd.

The superintendence of No. 2 dredge has been in charge of W. H. Wright from the beginning of its operation. Mr. Wright went to California from the Smuggler-Union mines in Colorado, in 1907. He began his dredge-mining experience in the surveying and cleanup departments of No. 1 dredge, at Fair Oaks, and at Marigold, in the Yuba Basin district. The Ashburton dredge has been a good steady money maker from its installation, and considering the fact that a larger crew of men is required for a single dredge and the same maintenance of shops is necessary in the operation of the single dredge as would be required in the operation of two or

more dredges, the Ashburton No. 2 has been operated with remarkable economy. The main feature of this economic management has been the method of laying out the geography of the field and close observance of the plan as prepared in advance. This feature is presented in the Apr. 18 issue of the JOURNAL by Mr. Wright.

The total area of ground turned over by No. 2 dredge in the period from Jan. 15, 1908, to Aug. 31, 1913, was 150.4173 acres. The average digging depth varying from 14 ft. to 52 ft. below the water line. The largest area of ground turned over in one year was 39½ acres in 1910, an average of 3.2592 acres per month. The smallest area was 22½ acres in 1912, an average of 1.8527 acres per month. The smallest monthly average in the history of the dredge was 1.7987 acres, the average for the eight months in 1913.

The land dredged by the Ashburton dredges was originally held on purchase bond or option by R. G. Hanford and was prospected by R. E. Cranston. It was sold by Mr. Hanford to Bulkeley Wells, of Massachusetts; he transferred it in July, 1903, to the Ashburton Mining Co., organized under the laws of the State of Maine. In the early history of the company, Mr. Hanford appeared on the board of directors. With the exception of Mr. Hanford, the officers and directors of the company are the same now as in the initial organization. The officers are Bulkeley Wells, president; R. S. Agassiz, secretary and treasurer; T. L. Livermore, H. L. Higginson, and Q. A. Shaw, Jr., directors. Mr. Wells is manager; A. D. Snodgrass, cashier; W. H. Wright, superintendent. The head office of the company is No. 14 Ashburton Place, Boston, Mass. The California office address of the company is Folsom. Mr. Cranston was from the initial operation the consulting engineer of the company, but recently resigned to accept the position of chief engineer of the Breitung Mines Corporation, operating on the Cauca River, South America and consulting engineer for Breitung & Co., New York.

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Removal of Improvements by Lessees

BY A. L. H. STREET*

Questions relating to the right of lessees under mining leases to remove improvements constructed by them upon the premises have been so frequently before the courts that the law on this subject is now fairly well settled. It has been judicially declared that a mining lease is subject to the general rule of law, applicable to ordinary leases, that, unless the lease contains a provision to the contrary, the lessee is entitled to remove any improvements made by him in furtherance of the purpose of the lease. Thus the Michigan Supreme Court has held that persons who took an iron-ore lease were entitled to remove engines and boilers erected by them on brick and stone foundations, bolted down solidly to the ground, and walled in with brick arches; and dwelling houses, resting on posts and dry stone walls. (Conrad vs. Saginaw Mining Co., 20 Northwestern Reporter 39.)

The Utah Supreme Court upheld the right to remove buildings and railroad tracks placed on the premises, where the removal could be effected without substantial injury to the land, and where the lease is silent as to the

right of removal. (Couch vs. Welch, 66 Pacific Reporter 600.)

The law on this subject in California and in the other Western mining states was summed up in the case of Merritt & Bourne vs. Judd & Byrne, 14 California Supreme Court Reports 59, as follows: A steam engine and boiler, fastened to a frame of timber, imbedded in the ground of a quartz vein sufficient to make it level, with a roof or shed to protect the machinery, and used for the purpose of working the vein, are so annexed to the freehold as to become a fixture. But such machinery, when applied to quartz leads, constitutes a trade fixture, removable by the tenant, if he be otherwise entitled to remove it. But this removal can be made only during the term of the lease, or during such further period of possession by the tenant as he holds the premises under a right to still consider himself a tenant, and not during the time he may actually hold possession after his lease has expired. This right of removal may be regulated by agreement between the parties, and, possibly, by implication, from the custom of a particular district. But it was decided in this case that an engine and pump, placed upon the particular premises, were an improvement which belonged to the owner of the land, under a clause which provided that on certain conditions he should be entitled to "improvements that may be put on the ground for working the lead."

Where a lease reserves the improvements to the lessor, the lessee's attaching creditors can acquire no interest in the improvements, although they may have had no notice of such provision, since a creditor can acquire no greater rights in his debtor's property than the debtor has himself. (Colorado Court of Appeals, Little Valeria Gold Mining & Milling Co. vs. Lambert, 62 Pacific Reporter 966.)

The principles decided in these cases are illustrative of the rules applied in litigation under other mining leases and are consistent with the law governing leases generally. In short, the test which ordinarily determines the right of a lessee to remove improvements installed by him, where the lease is silent on the question, is whether they can be removed without substantial injury to the property. Here let it be noted that when a lessee reserves the right to remove improvements, which could not be removed in the absence of express reservation of that right, he is not liable for such permanent damage to the land as follows as a natural consequence of the removal in a proper manner. But there is liability for any unnecessary damage. (Michigan Supreme Court, Hunt vs. Potter, 10 Northwestern Reporter 198.)

From this statement of the law, as announced by the courts, the importance to mining lessees of reserving in definite terms in their leases any right to remove improvements will be readily recognized. The principles, important under any lease of premises, become particularly important under mining leases on account of the fact that mining improvements are usually affixed more securely to the soil than ordinary trade fixtures.

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"Ballas" Are a Peculiar Kind of White Diamond, according to J. K. Smit & Zonen. Their structure does not show cleavable layers but rather crystallization around a center. Brazilian ballas are as hard as carbons and are recommended as test stones for use in judging the latter. They offer the advantage of being uniform in hardness. They are rare and bring the same price as the best carbons. It is good practice to use a few of them in a bit with carbons when drilling hard rock. Ballas also occur among Cape diamonds; these are harder than bortz but not so hard as Brazilian ballas.

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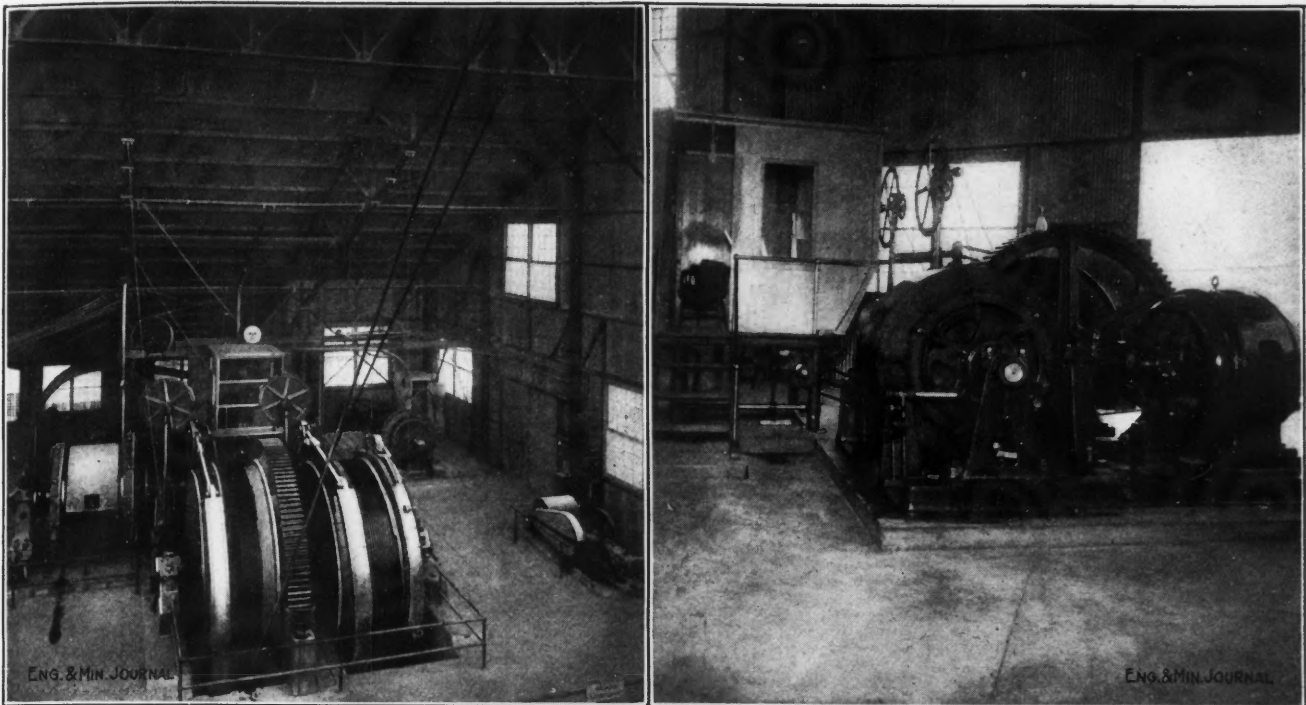
Ray Consolidated Mine



BUSINESS SECTION OF RAY, ARIZ., THE MINE TOWN OF THE RAY CONSOLIDATED COPPER CO.
In this part of the town all structures are of concrete. The company's railroad connects it with Kelvin.



GENERAL VIEW OF MINE PLANT, SHOWING NO. 1 SHAFT
Ore is shipped over Ray & Gila Valley R.R. to Kelvin, thence over the Arizona Eastern to the mill at Hayden,
16 miles distant.



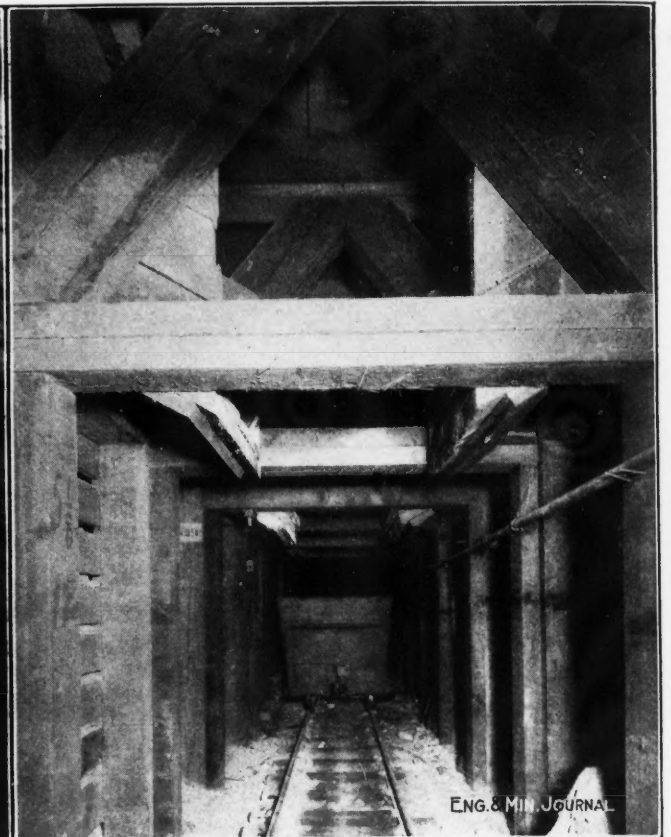
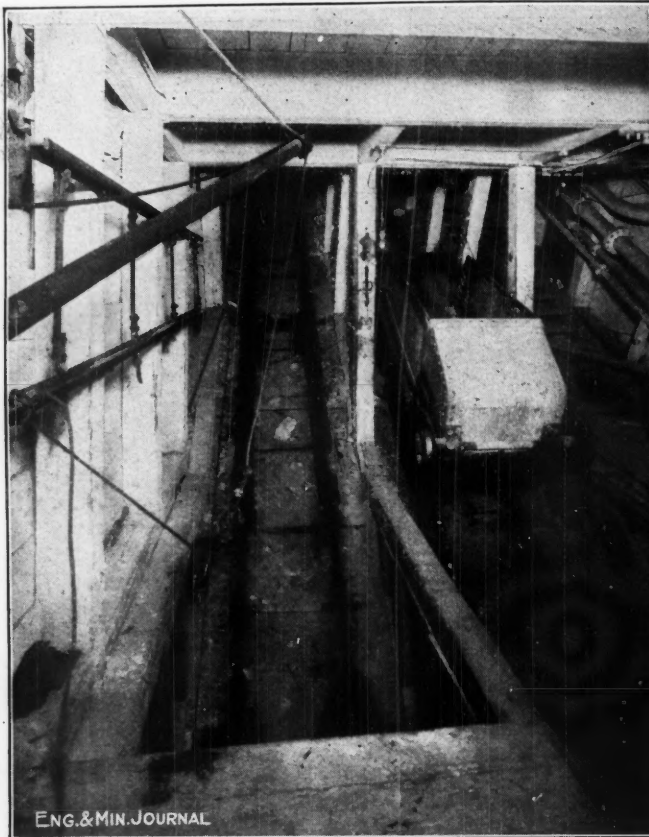
INTERIOR OF NO. 1 HOIST HOUSE AND HOIST USED FOR WASTE AND SUPPLIES

In the view at the left the motor at the right is driving the hoist, the motor being connected by endless rope with the large pulley in the left background, which is mounted on the gear shaft of the hoist. The drive gearing is inclosed and appears at the left of the hoist. Auxiliary compressor in right foreground is used to operate brakes and clutch.



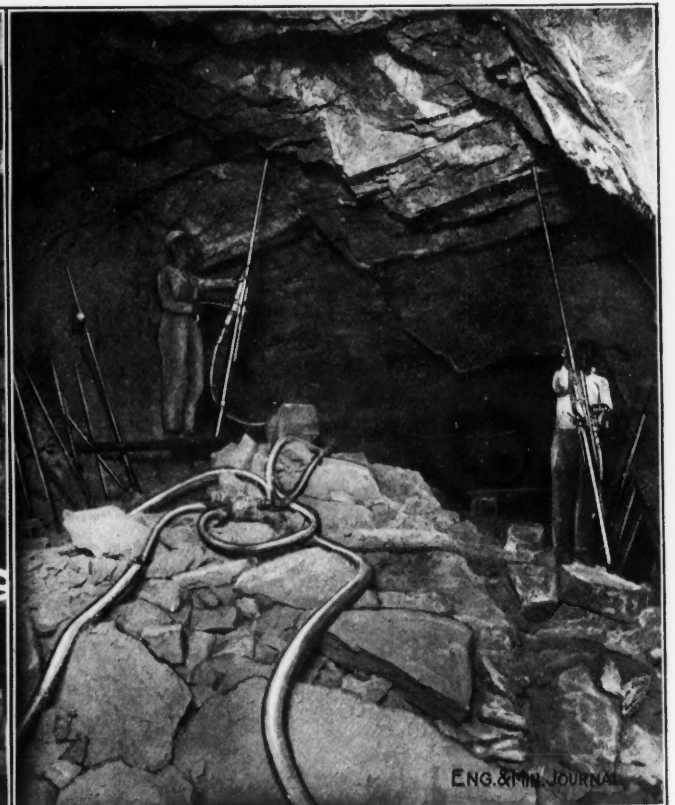
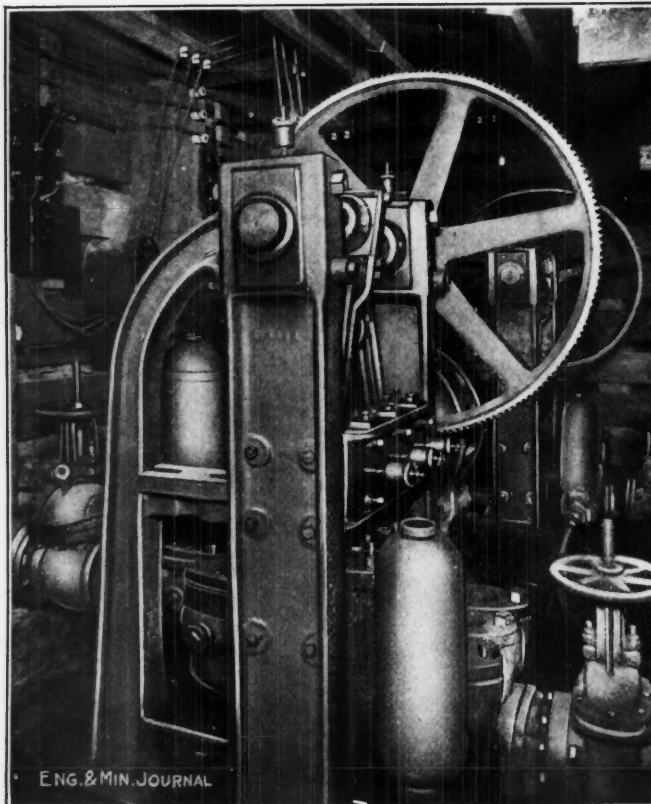
NO. 2 SHAFT AND COARSE CRUSHING PLANT

Skips weigh seven tons and hold 12 tons of ore; hoisting speed 300 ft. per min. All ore is crushed to 1 in. at the mine.



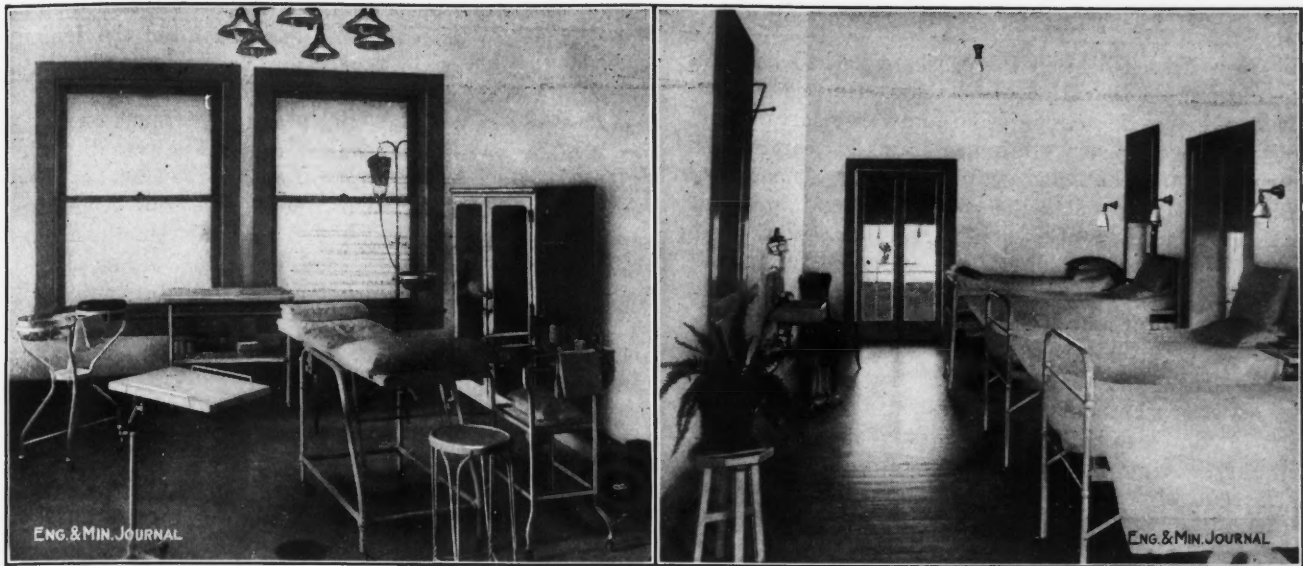
STATION ON 30° INCLINE AND A MOTOR-HAULAGE DRIFT SHOWING CHUTES AND TIMBERING

The incline is used for hoisting waste, lowering timbers, etc. View shows stairs used by miners in going to and from work, men not being hoisted at No. 1 and No. 2 shafts. Incline contains all water, air and electric lines, leaving main vertical shafts for hoisting ore only. The haulage drifts are under the stoping areas. Access to stopes is through raises which are similar to the "box raises" of Transvaal gold mines and which are carried up through the broken ore in the bottom of the stope, as fast as the roof is broken, from the drifts below.



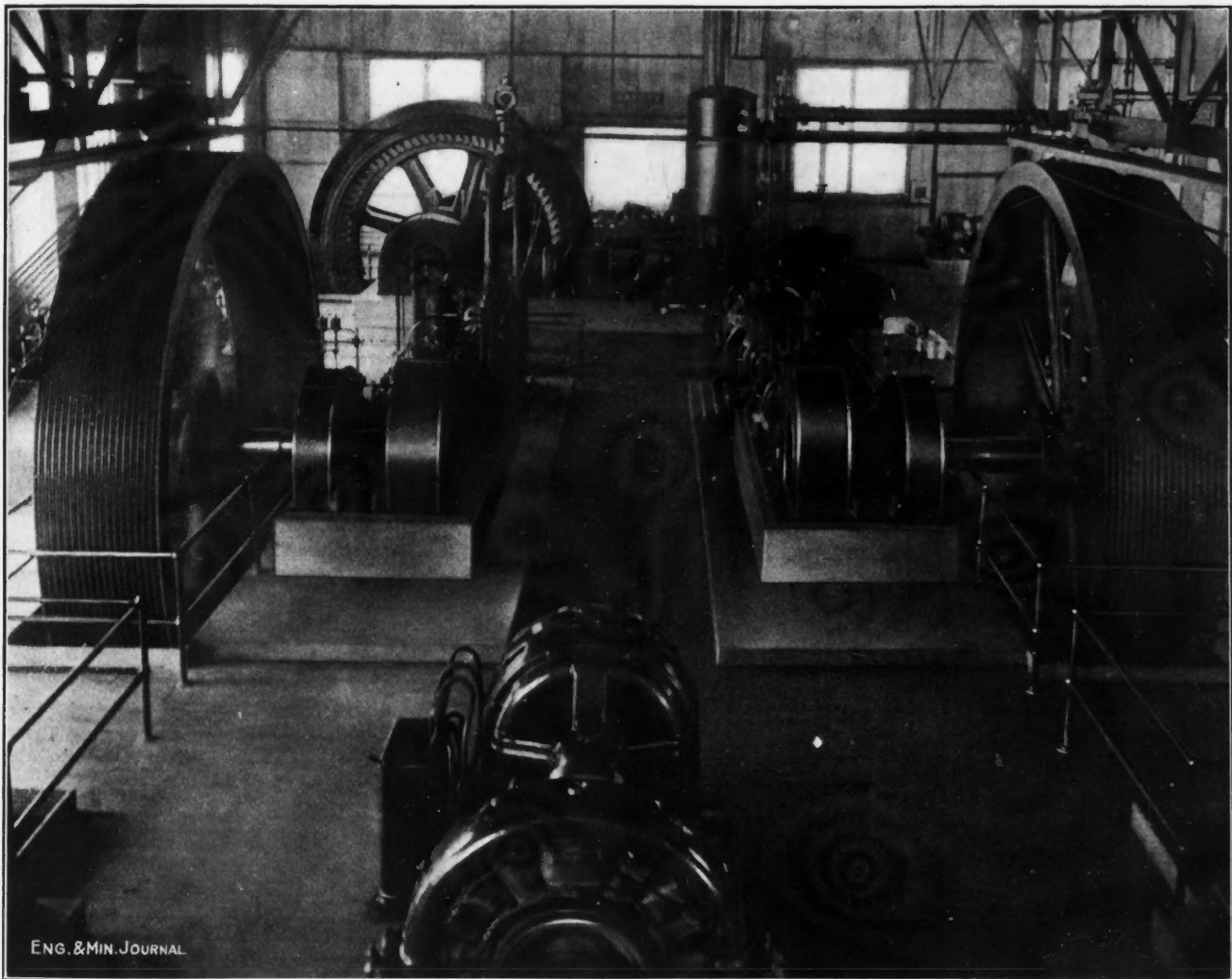
TRIPLEX ALDRICH PUMPS AND HAMMER DRILLS IN A STOPE

Pump is electrically driven; stope view shows method of drilling holes.



OPERATING ROOM AND WARD IN THE COMPANY HOSPITAL

This modern hospital for employees was completed in 1912, but the company is aiming to keep the attendance down by its thorough "safety-first" campaign. It is claimed that since the inception of this work, the accident rate at the Ray has been lower than at any similar operation of equal magnitude.



MINE POWER PLANT SUPPLIED WITH ELECTRICITY FROM THE PLANT AT HAYDEN

View shows two rope-driven, 3000-cu.ft. Nordberg variable capacity compressors in foreground, driven by 500-hp. motors, and in background, 1000-kv.-a. direct-connected synchronous motor driving 5200-cu.ft. Nordberg compressor equipped with reversing motion so that compressor can be brought up to speed operating as an engine from air supplied from either of the other compressors, and when brought up to speed, the valves can be reversed, causing it to act as a compressor.

Herman Frasch

Herman Frasch died in Paris, where he had been for some months, on May 1, aged 62 years. He was a chemist who achieved high reputation and large fortune, not only by his remarkable attainments and his careful and systematic work; but also because his experiments and discoveries made possible the commercial and profitable use and exploitation of two important classes of products. The greater part of his life was spent in investigation of various problems of a practical character and he made many useful and important discoveries.

He was born in Wurtemberg, in Germany, and received much of his education there, coming to America when a young man. His first employment was in a pharmacy in Philadelphia, where he was engaged in the laboratory. After a short time, however, he abandoned pharmaceutical work and took up industrial chemistry as a more interesting and profitable field, establishing his own laboratory in Philadelphia, but shortly afterward removing to Cleveland, Ohio. His first inventions were for refining paraffin wax and for improvements in the separation and treatment of petroleum oils. At this time also, he invented a process for manufacturing white lead directly from galena and also obtained several patents for improvements in manufacturing salt and in the ammonia process for the manufacture of soda salts. A considerable part of his time, however, was devoted to petroleum, and in 1885 he removed to London, Ont., where he acquired control of an oil well and commenced to experiment in the removal of the sulphur which characterized the Canadian oil and prevented its use as an illuminating oil. His work applied also to the Lima oil from northwestern Ohio, which had very much the same characteristics as the Ontario oil. He worked out successfully the problem of removing the sulphur, which was the constituent which made the oil commercially unsuitable and inferior. At a somewhat later period, he did similar work for some of the heavy crude oils of California. His work was so successful that the Standard Oil Co. purchased the refinery which he had built in Ontario, and also the right to use his patents, which were adopted at a number of its refineries. He continued his work on petroleum, however, for some years, patenting several inventions and improvements.

About 1890, his attention was called to the sulphur deposits of Calcasieu Parish, in Louisiana, which had been owned by several different companies, all of which had failed because they were unable to devise any method of reaching the sulphur which was overlaid by a great depth of quicksand. A great deal of money had been spent in this work, but no results had been secured. He had previously taken considerable interest in the salt deposits of Louisiana, and appreciated the conditions.

After much experimenting he finally succeeded in devising the plan at present in use, which, briefly described, consists in sinking wells, through pipes in which superheated water at a very high pressure is forced down into the sulphur, melting it, so that it can be pumped to the surface and there solidified and shipped. The deposits being of large extent and depth, the supply is practically unlimited and its utilization revolutionized the sulphur trade in this country.

Previous to that time, the sulphur used here commercially had been mainly imported from Sicily, with a

smaller quantity from Japan. Mr. Frasch obtained control of the Louisiana deposits and organized the Union Sulphur Co., which in a very few years obtained entire control of the sulphur trade here and was in a position to export sulphur to Europe and beat the Sicilians on their own ground. At first, European companies were disposed to laugh at the American intrusion into the trade, as they considered it. They soon found that the American supply was a permanent one and that the American control of the trade was an established fact. The Anglo Sicilian Sulphur Co., which then controlled a large part of the Sicilian mines, came to terms with Mr. Frasch and his company, and the agreement has since been maintained by the Italian Consorzio Obligatorio, which was organized by the Italian government and which assumed control of the sulphur industry in Sicily, the Anglo Sicilian company retiring. Under this agreement, the price of sulphur, commercially, has been maintained at a fair level, its only competition being found in the use of iron pyrites in making sulphuric acid. The business is practically divided between the American and the Sicilian companies and there is little or no actual competition.

Mr. Frasch was a man of broad interests and during his life acquired knowledge of many things. In his younger days, he wrote considerably and contributed several interesting papers to the earlier volumes of "The Mineral Industry." Later, however, his time was so fully occupied that he was forced to decline writing.

In 1912, the Perkin medal, which is given jointly by the Society of Chemical Industry, the American Chemical Society and the American Electrochemical Society, was awarded to Mr. Frasch. The presentation was made at a meeting held in New York, Jan. 19, 1912, at which time Mr. Frasch gave an exceedingly interesting summary of his early work and a description in some detail of the method which he devised and which proved so successful in the exploitation of the Louisiana sulphur.

It is understood that he leaves a very considerable fortune, which he may be fairly said to have earned by his successful work and his power of applying the knowledge which he worked out experimentally to practical ends.

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The Vieille-Montagne in 1913

According to the report of the Société Anon. de la Vieille-Montagne, the largest zinc producer of the world, its production of spelter in 1913 was 104,265 metric tons; of sulphuric acid, 102,699 tons; of lead, 8,304 tons; of silver, 15,582 kg. Its production of spelter in 1912 was 107,526 tons. The cost of fuel in 1913 was about 1,000,000 francs more than in 1912, while wages cost 550,000 francs more. The company is going into coal mining on its own account, and hopes to be able soon to produce all of its requirements. The law prohibiting the employment of white lead in France becomes effective on Jan. 1, 1915. The works of the Vieille Montagne for making zinc white in France being insufficient to supply the demand, a new plant is to be erected. The net income of the company in 1913 was 7,641,134 francs, the net profit remaining after the deduction of taxes, interest charges, etc., being 6,255,145 francs.

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Ytterbium Consists of Two Elements, according to C. Auer von Welsbach ("Monatsh. Chem.," 1913, p. 1713). These are, cassiopeium, Cp (at. wt. 175), and aldebaranium, Ad (at. wt. 173). From 500 grams of ytterbium oxide he obtained about 48 grams of cassiopeium oxide and over 200 grams of aldebaranium oxide.

Correspondence and Discussion

Treatment of Cyanide Precipitate

In regard to Mr. Megraw's ideas of a system which might be developed for operation of Monarch-Rockwell furnace on cyanide precipitates, it is hard, from Belmont mill conditions, to see any benefit in the suggestions. As to the distillation of zinc from precipitate, if this could be done as successfully as the average zinc smelters are able, we could expect about 60% zinc recovery. Belmont product averages less than 5% content, so after handling one ton of this product we would have 60 lb. of zinc dust, worth at the mill 8 1/3c. per lb., or \$5. The following analysis is from our complete precipitation circuit which is always the lowest grade, the product from partial precipitation circuit always assaying 80% fine or better.

Au, Ag	74.23	Cd	1.00
NaCl, KCl	1.00	Zn	4.70
MgO	Tr.	Se	5.5
CaCO ₃	3.60	Soluble SO ₂	1.4
FeSO ₄	0.26	Soluble Al ₂ O ₃	1.4
Al ₂ O ₃	0.60	Soluble CaO	0.1
Pb	2.36		
Cu	2.10	Total	96.85

Zinc recovery will hardly look like a practical operation with the minimum labor charge \$4 for 8 hours and fuel oil at 3.8c. per gallon.

Proper fluxing, or in other words, more flux as suggested, would naturally produce a finer bullion which could be brought to a further degree of fineness by skimming, air blast and remelting, but dollar and cents revenue has to be figured against every procedure in milling the same as any manufacturing business. In marketing bullion, 1c. per oz. is paid for parting and refining with no stipulation as to fineness; so our saving would be 1c. for each ounce which we were able to eliminate by the further labor, flux, fuel, etc., which in our practice would not compensate for the additional expense.

Belmont mill costs for the fiscal year of 1913-1914 are somewhat lower than those given in the article of Mar. 21, 1914, which were deduced from the first few months of the mill's operation, before conditions were as well worked out.

Fine ounces melted	3,805,789.29	
		Per Oz.
Lining expense (Rockwell furnace):		
Labor	\$147.00	
Carborundum (15,782 lb.)	648.06	
Water glass (3250 lb.)	110.57	
Total	\$905.63	\$0.000238
Flux	2639.05	0.000693
Fuel oil	1996.64	0.000524
Melting, briquetting and general labor	3158.80	0.000830
Power, blower, briquetting, etc.	570.86	0.000150
Total		\$0.002435

A. H. JONES.

Tonopah, Nev., Mar. 28, 1914.

As to the quantity of zinc which can be recovered. My experience has been that with zinc shavings, the raw, dry precipitate will contain from 40 to 60% of zinc. With zinc dust, I should expect it to be somewhat less

when silver ores are being handled. On reference to Clark and Sharwood's article in *Trans.*, I. M. M., Nov. 21, 1912, however, I find that the Homestake raw precipitate, zinc dust used as precipitant, contains from 37.6% to 57.8% of zinc, and the average is 44%. Even the acid-treated precipitate contains 19.9% zinc, about four times that in the Belmont product.

Where the precipitate contains much zinc, the retorting step is suggested to take the place of some other procedure, such as acid treatment. Even when acid treatment is not resorted to, ordinary melting simply loses the zinc in the atmosphere. Why not make an attempt to save it, no matter how small its quantity, when no extra step is necessary, nor any extra labor?

Naturally, in all operations, cost must be balanced against income. That point has not been forgotten, but, on the contrary, the object of my suggestion is to find some way to improve the product and reduce the cost. It still seems possible that a one-step process might be devised which would take little, if any, more flux, no more time in total, and make the labor much easier. Of course, where one produces a precipitate containing only 5% zinc, one naturally has a product which will not pay to handle further for zinc. Other mills, however, are not doing so well, and are looking for possible improvement. My suggestion was tentative only. I have not tried any such scheme and did not attempt to give any such impression.

H. A. MEGRAW.

New York, Apr. 3, 1914.

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Aerial Transportation at the Irvine Bank Mine, Queensland

A few inaccuracies exist in the article "Aerial Transportation at the Irvine Bank Mine, Queensland," in the *JOURNAL* of Jan. 17. "Irvinebank" is spelled as one word, while the name of the company installing the cableway illustrated is the Vulcan Tin Mining Co., N. L., Irvinebank, and not the Irvine Bank Tin Mine, as stated. The Vulcan company has not a mill of its own, and the ore it produces is treated at the reduction works of the Irvinebank Mining Co., Ltd., Irvinebank.

The statement, "The country is rugged and wagon transportation is too expensive to be seriously considered," is correct only as far as the character of the country is concerned; from Oct. 31, 1890, to Feb. 3, 1914, the Vulcan produced 145,718 tons of ore, all of which was carted to the mill; this ore yielded tin to a gross value of about \$2,700,000 and allowed dividends to the amount of about \$885,000 to be paid.

The cableway was not running regularly at the close of the half-year end, Feb. 3, 1914, although a trial run of the rope alone had been made. It was confidently anticipated then, however, that the permanent service would be ini-

tiated at the end of that month, a lack of essential parts causing a hindrance.

My figures and statements relative to regular running are taken from the report to the shareholders of the Vulcan Tin Mining Co., N. L., for the half-year mentioned.

J. P. MITCHELL.

Marmor, Queensland, Mar. 10, 1914.

[The information on which the original article was based was furnished us by the manufacturers of the tramway.—EDITOR.]

Chemicals Used in the Cyanide Process

I have read with interest and profit H. A. Megraw's article in the *JOURNAL* of Jan. 31, 1914, on "Chemicals Used in the Cyanide Process," but I cannot agree with him in his conclusions regarding the relative merits of lead acetate and litharge used in cyaniding. In first cost litharge is not much over half as expensive as lead acetate for a given weight, and 1¾ lb. of litharge furnishes the same amount of lead as 2½ lb. of acetate. The only question remaining, then, is the one of relative applicability to secure the effect of the lead. Mr. Megraw assumes that this is dependent on the relative solubility of the two salts. I claim that so long as either salt is finely ground and intimately mixed with the pulp, it is immaterial whether it is in solution or not. When soluble sulphides develop in the course of the treatment the lead salt is there ready to be acted upon and, owing to the strong affinity of sulphur for lead, will be acted upon in preference to the cyanide compounds. It may be that the alkaline sulphides never form in this case; that the hydrogen sulphide on generation immediately combines with the lead to form lead sulphide. This, of course, is conjecture. The reaction may be a much more complex one, but the result remains, that with lead present in the form of oxide, acetate, carbonate, or almost any salt, dissolved or undissolved, the cyanide compounds are not attacked. Of late years, I have had no occasion to use lead salts for protective purposes, but a number of years ago, in cyaniding concentrator tailings from the complex ores of Rossland, B. C., I found their use absolutely necessary, throughout the entire treatment. Soluble sulphides were constantly forming from the decomposition of pyrrhotite, and possibly arsenopyrite and chalcopyrite, all of which were present, though the first was much more abundant. It required the addition of at least 2½ lb. of lead acetate per ton of dry ore, and sometimes more had to be added before the treatment was finished, the exhaustion being indicated by a bad odor from the charge, by tests showing rapid consumption of cyanide, and by presence of sulphocyanide in the solution. Immediately on addition of more lead salt, the trouble would cease, the solution become cleared of sulphur and the extraction resumed. If sufficient lead salt was added to begin with, to last out the treatment, no trouble was experienced. Owing to the high cost of acetate when used in such quantities, experiments were made with other lead salts, and while they all were effective in the proportion of lead content, litharge proved the best and cheapest, and was adopted, with a reduction to 30% of the former cost, and with easier operation and control, for all that was found necessary was to sift a weighed quantity directly into the

charge being agitated, and if more were found necessary later, it was easy to add the required amount with almost instantaneous results. In a former brief note,¹ I mentioned these facts, giving credit to Wm. Magenau, who was chemist at the works and made the laboratory experiments.

In this note I suggested the addition of the litharge to tube mills where practicable, in cases where the presence of a lead salt was found necessary. I have met several engineers since who have so added it, and they confirm the suggestion. Where crushing is done in solution, it might be even better to add it to the stamps, or other primary wet crusher, so as to get the benefit of its protective action as early as possible. On reaching the tube mill, it would be further ground and mixed.

Probably the reason why lead salts are seldom required is the one suggested by Mr. Megraw: that the work of removal of soluble sulphides is accomplished by the zinc salts. It is only in cases where the quantity of these present is insufficient that the use of lead becomes necessary. In the case mentioned, the generation of sulphide was apparently unusually strong, and the treatment solution only reached the charge after having been on and off three charges as wash, after having been through the zinc boxes. The only solution passed through the extractors was that decanted from the treated charge. It is likely that in this case, all zinc salts had been eliminated long before the treatment solution reached the charge.

C. M. EYE.

Ogilby, Calif., Apr. 6, 1914.

My opinion that litharge could not be as efficient as lead acetate for precipitating sulphides from solutions is based on the fact that in the use of litharge, it is difficult to insure that all the lead be acted upon by the sulphide. It is true, as Mr. Eye states, that any lead presented to the action of sulphur will be acted upon. This is as true of a plate of metallic lead as of lead in solution, but in the case of metallic lead, the surface soon becomes coated with a layer of sulphide or sulphate, effectually protecting the remainder of the metal from attack. It seems reasonable to assume that an analogous process is true with lead oxide; in fact, I have found it less efficient when added to treatment tanks. Of course its use in the tube mill would provide abrasion, and keep the particles free from sulphide, thus insuring complete use of the lead present.

H. A. MEGRAW.

Mastic Lining for Acid Tanks

In the *JOURNAL* of Mar. 28, 1914, I notice under "Details of Metallurgical Practice" an article on "Mastic Lining for Acid Tanks," by D. T. Pierce.

The asphaltum-covered concrete tanks are by no means new so far as the asphaltum covering is concerned. I have used in Russia tanks made of ordinary masonry covered with asphaltum. These tanks have now been in use for over five years, and have never required any serious repairs. They are described in a paper entitled "Copper Leaching Plant in the Ural Mountains," an extract of which appeared in the *JOURNAL* of Feb. 26, 1910, shortly after the paper was read before the Institution of Mining & Metallurgy in London.

London, Eng., Apr. 6, 1914.

A. SIMON.

¹"Min. & Sci. Press," Jan. 9, 1909.

Editorials

The Flotation Process

The judges of the U. S. Circuit Court of Appeals in San Francisco, on May 4, handed down a decision reversing Judge Bourquin, of the lower court, and upsetting the Minerals Separation Co.'s patents in the litigation with James M. Hyde, whom it sued as an infringer. A summary of the decision is published elsewhere in this issue. It will be seen that the decision is of sweeping character.

In substance, the court has held that the only material difference between the Minerals Separation process and prior processes is the smaller quantity of oil used, and in the opinion of the court that is neither an invention nor a discovery sufficient under the patent law to render the Minerals Separation process patentable. The upholding of its patent would be to give its owners a monopoly of something which others have discovered. The discovery that the use of a very small proportion of oil is sufficient to cause the flotation of certain minerals is not sufficient by itself or in combination with other steps to be made the subject of a valid patent, and the Minerals Separation cannot take from others the right to use oil economically.

This is the first time that the froth-flotation process has been judged in the United States by the higher court, and the decision has been awaited with peculiar interest, inasmuch as it was in this country that the first serious experimental work for the flotation of sulphide minerals by stirring up the pulp with the addition of oil and acids was done. This was the invention of Carrie J. Everson, a Western school teacher, who took out patents in the '80s. Her patents expired long ago and her disclosures upon this subject have been free to everybody. In her work she used a large proportion of oil, but certainly she showed how flotation could be caused to take place. The contestants of the Minerals Separation patents have held all along that the reduction of the proportion of oil is something that would naturally be tried by anybody practicing the art. With this view, the Circuit Court of Appeals apparently coincides.

The decision is one of great importance to the mining and metallurgical industry, the flotation process having come already into extensive use, with promise that in the course of a few years it will be applied upon a very much broader scale and will bring important new ore supplies into the market. The Minerals Separation people are naturally much disappointed by the decision and probably will take the case to the Supreme Court, if that can be done. Anyway, they will not give up the fight. In their British and Australian cases they went twice to the House of Lords, and probably will not be satisfied by anything short of adjudication by our highest court.

However, the taking of a patent case to the Supreme Court is not an easy matter, that court having to a large extent divested itself of patent cases. Nowadays, it hears them only on a writ of *certiorari*, based on questionable points of law, or when different decisions have been rendered by different circuit courts of appeals. The latter

may arise by the inauguration of a new suit for infringement in a new circuit and in going over the whole case anew, which is not easy to bring about, unless the plaintiff can introduce new evidence.

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The Colorado Trouble

Whatever be the merits of the imbroglia in Colorado and the actions of the several parties in the recent battles, it is clear enough that the only real point in the labor trouble is the recognition of the union. Thus it is much the same as at Calumet. The companies in Colorado have not been minded to discriminate against the union, but neither would they discriminate against the nonunion men. In other words, they have stood for the principle of the open shop and the right of every man to work without a permit from anybody. That is a principle worth standing for and will be so long as this is a free country.

The agitators don't like it. They want dues for their treasuries and the right to make trouble. When they get around among such a collection of different nationalities as there is in the coal fields of Colorado, but recently introduced into this country and in no way imbued with American ideas, it is easy enough to make trouble when they preach that the mines belong rightfully to the men who work in them and that they should get guns and take them, etc.

The greatest disgrace has fallen upon the people of Colorado. After a shameful record of bloody labor troubles, ineffectively handled, beginning with Leadville, going on with Cripple Creek, then Leadville again and Telluride, the state's sovereignty broke down in the coal war and the Federal government had to be called in to restore and maintain order. That was quickly done when the troops arrived, showing that even labor agitators bow under a strong and impartial hand. But if state sovereignty means anything, it means the exercise of the police power. States which cannot exercise that may have to relapse to the position of territories under federal protection. Manifestly the people of Colorado need to think more about their prerogatives and duties.

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Lake Copper

We have this week discontinued the daily quotation of the price for Lake copper, whereof our record extends back for nearly half a century. Indeed it is within but 20 years that daily quotations for electrolytic copper began and up to that time Lake copper was the criterion of the market. Since then, however, the production of electrolytic copper has far outpaced that of Lake and at the present time the latter constitutes but a small proportion of the total production of American refiners, to be exact only about one-eighth of the total. That relatively small production is divided into several kinds, realizing rather wide differences in price, and each governed by its peculiar market conditions. The result of this has been

that during many weeks no sales of Lake copper are reported and the market has had to be quoted as "nominal." Another result is that often the only business that can be reported is of but carload lots, relatively of retail character in comparison with the electrolytic business, which is always a wholesale affair, an average of nearly 5,000,000 lb. daily having to be sold to dispose of the American refinery output. Electrolytic copper has long been the kind of metal that establishes the market and the price for Lake has ceased to be a matter of steady interest.



The Temple Iron Company

The Temple Iron Co., though still a going concern, has closed its career as an important factor in business. The latest incident is the sale of the stock and property last week to S. B. Thorne, of New York, who will, presumably operate it as a simple coal and iron company. This sale was made in accordance with a decree of the United States Circuit Court that the company, as heretofore managed, was a restraint on trade.

The Temple Iron Co. was not in itself a trust, nor was it a concern of large dimensions. On the contrary, it was rather a modest corporation, owning a blast furnace and several collieries in the Pennsylvania anthracite company. But by a remarkable coincidence its board of directors was entirely composed of the presidents of the anthracite carrying railroads; and by another coincidence the business of the company, simple as it apparently was, required frequent meetings of the board.

The attorney-general and the Sherman law were suspicious of so many meetings and inclined to believe that the anthracite trade and not the Temple property were the occasion and object of these meetings. In other words, it was one of the elusive manifestations of the Anthracite Trust—which is not and never has been a trust. The court agreed with the government's view and ordered the company dissolved or reorganized. Hence this sale and the probable disappearance of the company into the unnoticed crowd of smaller iron and coal concerns.



The Fallacy of Generalization

A large mining and metallurgical corporation, seeking to extend its business, organized a department several years ago, for the special purpose of getting information about new mining properties, examining those that seemed worth while and purchasing those it wanted. A tabulation of the work done and the results achieved by this department are given in the following table:

	Mines Offered	Partly Examined	Measured and Tested	Bought
1913	614	100	24	3
1912	694	121	36	4
1911	921	144	28	1
1910	684	124	46	2
Total	2913	489	134	10

Thus only ten properties were purchased in four years out of a choice of nearly 3000. A fine text for a sermon on the caution that should be exercised by prospective investors in mining industries. The editor of one financial paper used this text, assuming that the ratio of worth while to discovered properties is 1:300. The above table does not warrant the inference. As a generalization it is insidious and hurtful to the industry. Without specific data, knowledge of each of the "2913 mines offered," no one could justly make such a general statement. The

figures simply show that out of properties considered the United States Smelting, Refining & Mining Co., found only 10 that it wanted.

Mining is like any other industry. The men engaged in it are not of one opinion, are not seeking after the same thing. The United States company could see nothing in a property that gave promise of one ton of ore per shareholder, and it must recoup the expense of investigating those 2913 properties out of the profits of the 10. Bill Jones, lessee, might find that same quantity of ore the means to "Easy Street."

Then there are personal whims. One wealthy owner of mines in the East once bought a mine that nearly drowned his wealth before he decided to quit pumping. Mine water is to that man today as "holy water" to the devil, and he refused to put up a cent to develop an unusually promising vein because it ran out to sea, while in that vicinity were several good sized mines opened far below the ocean's floor. Another man has the same fear of swelling ground; another is not interested in anything but high grade; another wants tonnage. If all the facts were known we do not doubt that the officers of this department of the United States company would admit that others might find as many desirable properties in the rejected 2903 as the 10 that they decided to buy. The figures do not show that all the 2903 properties by any means lacked the promise of making mines. One man's mine may be but a hole in the ground to another.



It seems to be clear that the railways must be enabled to earn more money, but the Interstate Commerce Commission is very deliberate about permitting it. Mr. Brandeis held a few years ago that they ought to economize, but lately he has been silent on that subject, advising instead that they cut off free services. Even that has not panned out very well. Manufacturers' associations and important shippers protest against an advance in freight rates, and being more or less organized, they make themselves heard. We wonder that the railways have not considered a stiff increase in passenger rates. The general public is not organized and would simply have to pay the piper as always.



Reports from Germany are to the effect that in spite of reports of lagging business over there, copper consumption is ahead of the rate of last year. The great exports of copper to Europe have been the subject of much agitation in certain quarters over here. The idea that Europe is really needing and using the copper has been too commonplace to receive any attention. In truth, the occasion for surprise is not that Europe has been taking so much copper as that America has been able to get along with so little.



There is a hope, but merely a hope, that the pending arbitration between Huerta and the government at Washington, may lead to a settlement of the internal strife in Mexico. But what can be arranged? Mexico needs a strong government, as has frequently been stated, but also it needs one that is just. We suggest that Mexico might be governed by a commission appointed by the other countries of North and South America, the United States to nominate the chief and he to be Theodore Roosevelt.

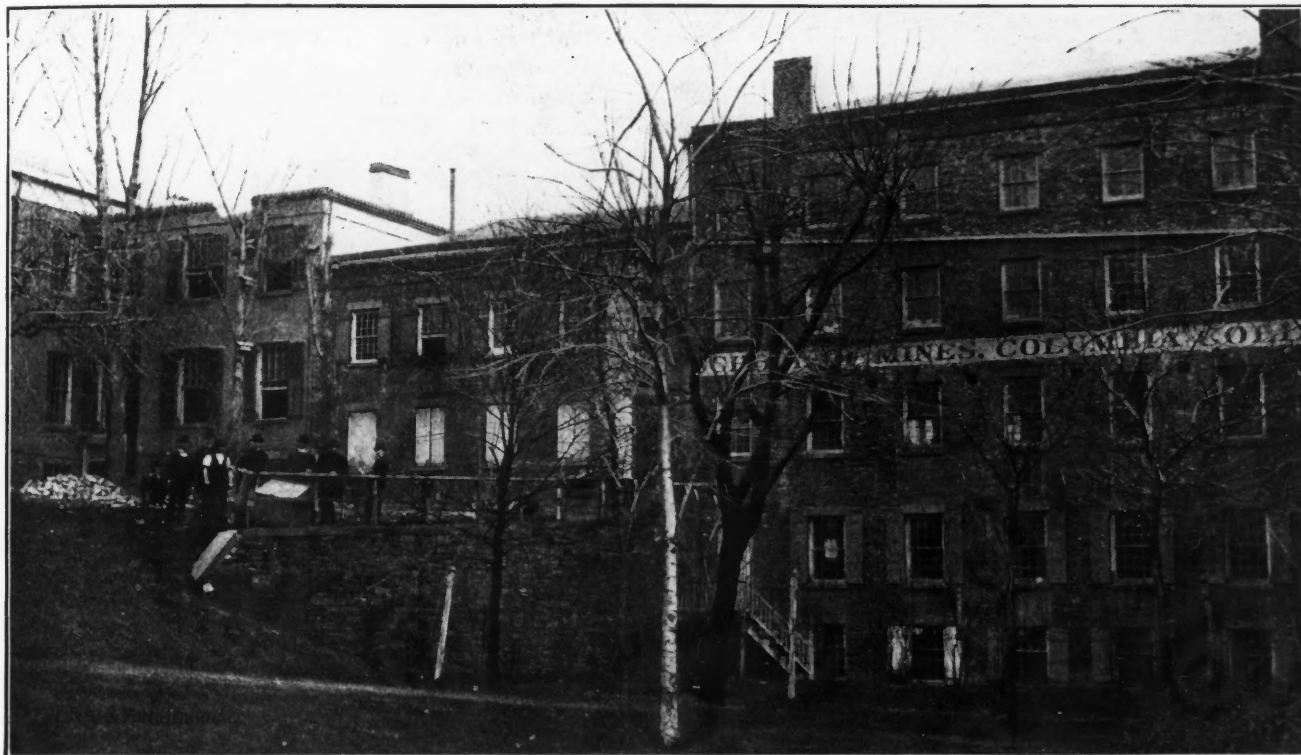
Columbia School of Mines Celebration

The preparations for the fiftieth anniversary celebration of the School of Mines of Columbia University, on May 28 and 29, are assuming more definite shape. It is the purpose of the committee to make the celebration more of a family reunion than a purely formal event, but as the seating capacity of some of the halls is limited, alumni are requested to register at Earl Hall, where badges will be distributed, admitting the wearers to all exercises.

The principal events are the reception at the gymnasium on Thursday evening, May 28; the procession and convocation at the gymnasium on Friday morning; the alumni luncheon at 1 p.m. in the University Commons

- 10.30 a.m., Convocation in the Gymnasium with commemorative and scientific addresses, and the conferring of honorary degrees upon distinguished alumni.
- 1.00 p.m., Alumni Luncheon in the University Commons.
- 3.00 p.m., Inauguration of Chandler Lectureship and award of Chandler Medal.
- 4.00 p.m., Faculty Teas in the several Departments.
- 7.30 p.m., Anniversary Dinner at the Waldorf-Astoria Hotel, Fifth Avenue and Thirty-fourth Street.
- Saturday, May 30
 - 10.00 a.m., Meeting of Electrical Engineers.
 - 3.00 p.m., Baseball Game, South Field.
- Sunday, May 31, Baccalaureate Service.
- Monday, June 1, Class Day and Senior Dance.
- Tuesday, June 2, Campus Night.
- Wednesday, June 3 Commencement Day—Conferring of Degrees—Alumni Luncheon—Costume Parade—Baseball Game—Beefsteak Dinner—Decennial Celebration—Singing on South Court.

The School of Mines includes the departments of Engineering, Chemistry and Architecture, which will join in the celebration. An event of much interest will be the awarding of honors to 12 or 15 of the graduates of the School of Mines, on whom the degree of Master of Science will be conferred. These men have been se-



THE ORIGINAL BUILDING OF THE COLUMBIA SCHOOL OF MINES ON 49TH STREET NEAR MADISON AVENUE

and the anniversary dinner at the Waldorf-Astoria, on Friday evening. Saturday will be devoted to a meeting of electrical engineers and various events leading up to the regular commencement exercises. Columbia is the oldest of our mining schools, and on this occasion, representatives of the oldest mining schools abroad have been invited to attend. Dr. Nicholas Murray Butler will preside at the convocation, and addresses will be made by Dr. Friedrich Kohlbeck, of the Bergakademie, at Freiberg, by T. A. Rickard, of the Royal School of Mines, of London, and by Hennen Jennings, representing the mining-engineering fraternity at large. At the inauguration of the Chandler lectureship and award of the Chandler medal, on Friday, Dr. Leo Baekeland will make the address. The official program as now arranged is as follows:

- Thursday, May 28
 - 9.00 p.m., Reception in the University Gymnasium—Dancing.
- Friday, May 29
 - 10.00 a.m., Academic Procession—Alumni to assemble in Earl Hall.

lected by the trustees' committee on honors, and each candidate will be presented by Dean Van Amringe to President Butler, who will confer the degrees.

A tablet will be presented by the Society of Older Graduates of Columbia, which will bear the following inscription:

School of Mines
1864-1914

In commemoration of the founding of the School of Mines, and in honor of

- | | |
|-----------------------------|-----------------------|
| F. A. C. Barnard, President | |
| Thomas Egleston | J. Howard Van Amringe |
| Francis L. Vinton | Charles A. Joy |
| Charles F. Chandler | William G. Peck |
| John S. Newberry | Ogden N. Rood |

Our Early Teachers

This tablet is erected by the Society of Older Graduates of Columbia.

It may be mentioned that two of the original faculty, Professors Chandler and Van Amringe, are still living. The accompanying engraving shows the original building of the School of Mines when it was at the Forty-ninth

street site, from 1864 to 1897. This building presents a marked contrast with the fine new halls that have since been erected for the School of Mines.

Mining Dividends for April

In April, 1914, 37 United States mining companies making public reports paid dividends amounting to \$7,418,038, as compared with \$9,856,355 paid by 43 companies in 1913. The difference lies chiefly in the reduced and omitted dividends of the Lake Superior mines. It is interesting to note that with this month Bunker Hill & Sullivan passes the \$15,000,000 mark.

United States Mining Companies	Situation	Per Share	Total
Ahmeek, c.	Mich.	\$2.00	\$100,000
Anaconda, c.	Mont.	0.75	3,249,375
Arizona, c. pf. A.	Ariz.	...	5,769
Bingham-New Haven, c.g.	Utah	0.20	45,738
Brunswick, g.	Calif.	0.06	23,717
Bunker Hill, con. g.	Calif.	0.02	10,000
Bunker Hill & Sullivan, l.s.	Ida.	0.25	81,750
Centennial-Eureka, l.s.g.c.	Utah	1.50	150,000
Center Creek, l.z.	Mo.	0.05	5,000
Daly-Judge, l.s.	Utah	0.15	45,000
Eagle & Blue Bell, g.s.l.	Utah	0.05	44,657
Fremont, g.	Calif.	0.02	4,000
Golden Cycle, g.	Colo.	0.03	45,000
Goldfield Con., g.	Nev.	0.30	1,067,744
Homestake, g.	S. D.	0.65	163,254
Hecla, l.s.	Ida.	0.02	20,000
Iron Blossom, l.s.	Utah	0.10	100,000
Iron Silver, l.s.	Utah	0.10	50,000
Mary McKinney, g.	Colo.	0.02	26,185
New Idria, q.	Calif.	0.10	10,000
North Butte, c.	Mont.	0.50	205,000
Old Dominion, c.	Ariz.	1.25	202,500
Osceola, c.	Mich.	1.00	96,150
Portland, g.	Colo.	0.02	60,000
Shattuck Arizona, c.	Ariz.	0.50	175,000
Silver King Coalition, l.s.	Utah	0.15	187,500
Silver King Consolidated l.s.	Utah	0.10	62,000
Stewart, c.	Ida.	0.10	123,826
Tom Reed, g.	Ariz.	0.06	54,473
Tonopah-Belmont, g.s.	Nev.	0.25	375,000
Tonopah, g.s.	Nev.	0.25	250,000
United Globe, c.	Ariz.	4.00	92,000
United Verde, c.	Ariz.	0.75	225,000
Vindicator, g.	Colo.	0.03	45,000
Yellow Aster.	Calif.	0.05	5,000
Yellow-Pine.	Nev.	0.01	10,000
Yosemite.	Calif.	0.01	2,400

Iron, Industrial and Holding Companies	Situation	Per Share	Total
American Sm. Sec. pfd. A.	{ U.S. }	1.50	255,000
American Sm. Sec. pfd. B.	{ Mex. }	1.25	375,000
Bethlehem Steel pfd.	Penn.	1.25	186,350
Cambria Iron.	Penn.	2.00	169,360
Duluth & Utah Dev.	Utah	0.04	2,250
Guggenheim Expl.	{ U.S. }	0.87	727,768
La Belle.	Ohio	0.50	49,577
Old Dominion of Maine, c.	Ariz.	1.00	293,353
Penn Salt.	Penn.	3.00	150,000
Republic Iron & Steel, pfd.	U. S.	1.75	357,296
Sloss-Sheffield S. & I. pfd.	U. S.	1.75	117,250
U. S. Sm., Ref. & Min. com.	{ U. S. }	0.75	263,331
U. S. Sm. Ref. & Min. pfd.	{ Mex. }	0.87	425,536

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Alacran, g.s.	Mex.	2.00	19,200
Buffalo, s.	Ont.	0.05	50,000
Canadian Goldfields, g.	B. C.	0.0015	60,000
Chontalpan, g.s.l.z.	Mex.	0.75	5,250
Crown Reserve, s.	Ont.	0.02	35,376
Consol. M. S. & P. l.s.	B. C.	2.00	116,088
El Favor, s.	Mex.	0.01	35,000
Hollinger, g.	Ont.	0.15	90,000
La Rose, s.	Ont.	0.25	374,656
Lucky Tiger, g.	Mex.	0.07	50,074
McKinley-Darragh-Savage, s.	Ont.	0.06	134,861
Nipissing, s.	Ont.	0.37	450,000
Nova Scotia S. & C. com.	N. S.	1.50	90,000
Nova Scotia S. & C. pfd.	N. S.	2.00	20,600
New York & Honduras Rosario, g.	C. A.	0.30	60,000
Poreupine Crowa, s.	Ont.	0.03	30,000
Seneca-Superior, s.	Ont.	0.12	59,860
Standard, s.l.	B. C.	0.02	50,000
Victoria, l.s.g.	Mex.	0.50	1,250

Iron, industrial and holding companies paid \$3,372,071, and Mexican and Canadian companies paid \$1,732,215, the last being also a reduction, as \$1,950,786 was disbursed last year. Total payments for the four months are: By United States mining companies, \$23,689,502; by Mexican and Canadian companies, \$7,097,372; and by metallurgical and holding companies, \$19,200,201. Last year the corresponding figures were: \$29,690,169; \$9,494,122; and \$18,586,410.

Anaconda Copper Mining Co.

A general description of the new works of the Anaconda Copper Mining Co. is given elsewhere in this issue, therefore this abstract of the report for the year ended Dec. 31, 1913, will concern itself only with production statistics.

The mines of the company produced during the year 4,644,201.24 tons of ore and 7,243.62 tons of precipitates, or a total of 4,651,444.86 tons. The reduction works treated for all companies during the year 4,016,689.16 tons of ore and other cupriferous material at Anaconda, and 1,170,150.43 tons of ore and other cupriferous material at Great Falls. Of this 4,566,450.85 tons of ore from company mines, 619,864.03 tons of ore purchased from or treated for other companies, and 524.71 tons of precipitates and cleanings from the old works were treated, from which there was produced 205,730,594 lb. of fine copper, 9,026,690.13 oz. of silver and 53,934,869 oz. of gold at Anaconda; and 64,571,050 lb. of fine copper, 1,294,606.08 oz. of silver and 10,963,565 oz. gold at Great Falls, or a total production of 270,301,644 lb. of fine copper, 10,321,296.21 oz. of silver and 64,898,434 oz. of gold; of which amount 241,983,323 lb. of fine copper, 8,719,132.54 oz. of silver, and 64,898,434 oz. of gold were produced by the company.

SUBSIDIARIES

The coal mines at Belt, Mont., were closed permanently during the year, but prior to the shutdown there had been produced 17,054.70 tons of coal, of which amount 11,867.60 tons were shipped to other departments of the company, 9.70 tons were sold commercially, and 5,177.40 tons were used at the coal mines. The mines at Diamondville, Wyo., produced 567,086.55 tons of coal; 337,457 tons were shipped to other departments of the company; 177,681.20 tons were sold commercially, and 51,948.35 tons were used at the coal mines. The mines at Washoe, Mont., produced 152,091.80 tons of coal; 128,912.60 tons were shipped to other departments of the company, 16,783.20 tons were sold commercially, and 6,396 tons were used at the coal mines.

PROFIT AND LOSS ACCOUNT

Debit	1912	1913
Copper, silver and gold on hand at beginning of year—copper at cost; silver and gold at net selling price.	\$14,343,155	\$14,895,384
Mining expenses, including development.	16,905,772	18,457,559
Ore purchases, including transportation.	4,836,823	1,979,059
Transportation of ore from mines to reduction works.	1,381,810	1,463,662
Reduction expenses at Anaconda and Great Falls.	8,863,801	8,709,580
Transportation of metals from West to East, refining and selling expenses.	3,730,455	3,503,771
Administration expenses and federal corporation tax.	394,063	239,155
Depreciation of mining plants, smelters, etc., written off this year.	1,009,453	727,359
Balance, being profit before dealing with interest, carried down.	15,796,709	11,283,227
Balance, being profit, carried to foregoing balance sheet.	\$67,262,041	\$61,258,756
	\$15,856,335	\$11,323,498
	\$15,856,335	\$11,323,498
Credit		
Sales of copper, silver and gold—i.e., deliveries to customers.	\$51,723,032	\$44,003,473
Royalties, tolls, etc.	107,075	430,383
Income from investments.	158,375	319,438
Rental of properties.	69,829	66,974
Net profit of subsidiary departments, after deducting depreciation of plants and depletion of coal and timber lands.	308,346	264,699
Copper, silver and gold on hand at end of year—copper at cost; silver and gold at net selling price.	14,895,384	16,173,788
Balance brought down.	\$67,262,041	\$61,258,756
Interest.	\$15,796,709	\$11,283,227
	59,626	40,271
	\$15,856,335	\$11,323,498

The sawmills of the lumber department at Hamilton, Hope, Bonner and St. Regis cut during the year 86,780-

763 ft. of lumber, and 49,934,678 ft. were purchased, of which 69,076,633 ft. were shipped to the mines of the company, 63,515,212 ft. were sold commercially, 1,521,203 ft. were used at the mills for repairs and construction, 3,564,832 ft. were supplied to the factory, 271,020 ft. were shipped to agencies, or a total disposition of 137,948,900 ft., decreasing stock of finished lumber on hand 1,233,459 ft. The subsidiary departments of the company show for the year profits of \$264,699.

The Butte, Anaconda & Pacific Ry. was electrified during the year (cf. *ENG. AND MIN. JOURN.*, Mar. 14, 1914), and shows increased operating economy. Its net income was \$232,421.

The profit balance carried to balance sheet was \$11,323,498, as shown; the previous surplus was \$8,695,172, giving a total surplus of \$20,018,671, from which dividends of \$12,997,500 were paid. Total assets stand at \$124,559,174.

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Chronology of Mining for April, 1914

Apr. 1—Underground mining abandoned at Utah Copper Co.'s property, at Bingham Cañon, Utah.—Suit of Charles S. Hinchman, of Philadelphia, against Consolidated Arizona Smelting Co. dismissed.

Apr. 2—Sheep Creek tunnel, of Alaska-Gastineau Mining Co., near Juneau, Alaska, holed through.

Apr. 3—Strike at Dean mine, of Hudson Iron Ore Co., near Highland Falls, N. Y.—Man killed at Seneca Superior mine, at Cobalt, by fall in shaft.

Apr. 8—Last spike driven on Grand Trunk Pacific Ry., 1½ miles east of Nechacco River Crossing, B. C.—Miner killed by fall in shaft, at St. Lawrence mine, at Butte, Mont.

Apr. 12—Michigan copper miners vote to end strike begun July 23, 1912.

Apr. 14—Strike at Cananea, Mexico.

Apr. 18—Two men killed by cave-in in Golden Cycle mine, in the Cripple Creek district, Colorado.

Apr. 19—Beginning of active intervention in Mexico, by landing of U. S. forces at Vera Cruz.

Apr. 20—Anaconda Copper Mining Co. proposes taking over International Smelting & Refining Co.

Apr. 20-21—Pitch battle fought between Colorado coal miners and state militia, in coal fields of southern Colorado.

Apr. 22—Man killed in shaft of Dome Lake mine, at South Porepine, Ontario.

Apr. 23—Man killed by run of ore in the Badger State mine, at Butte, Montana.

Apr. 24—American Smelting & Refining Co. ordered all American employees out of Mexico.

Apr. 28—President Wilson ordered regular troops to the strike zone in Colorado.—Explosion in collieries of New River Collieries Co., a Guggenheim corporation, at Eccles, W. Va.; it being estimated that 180 or more men were in the mines; probably none survived the explosion.

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The St. Paul Electrification

The St. Paul railway across Montana is the biggest thing of this kind that has yet been undertaken. The *Boston News Bureau* gives the following data: The electrification will comprise 440 miles of line. With normal

traffic about 60 electric locomotives will be needed as against 82 steam locomotives. Electric power will be supplied by the Montana Power Co. at 0.536c. per kw. It is estimated that 5000 to 6000 tons of copper will be required, or at the rate of 11½ to 13½ tons per mile. The work has already been commenced. The entire job should be finished by Jan. 1, 1918. It will cost about \$8,000,000.

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The Flotation Litigation

In the appeal of James M. Hyde against the decision that he had infringed the patents for oil separation issued to Sulman, Pickard and Ballott and assigned to the Minerals Separation, Ltd., Judge Gilbert, of the Circuit Court, read the decision on May 4, in favor of Hyde. Some excerpts follow:

The appellee's process depends primarily upon the affinity of oil for the metalliferous portion of powdered ore when mixed with water. It is conceded that the affinity and the fact that oil will carry the metalliferous portions to the surface of the mixture . . . have been known for many years. That which is presented as new in the patent, and as the pivotal discovery on which its validity depends, is the formation of a froth or scum containing the metalliferous matter produced by agitation of the pulverized ore in water, by the action of oil in a quantity less than 1% of the quantity of ore treated.

The previous patents were reviewed. These were: Hayne's British patent of 1860, using 11 to 25% of oil, but using the same oil to saturation; Everson's of 1886, specifying 5 to 18%, in which the important discovery was announced that the addition of an acid increases the affinity of oil and the mineral; the Schwartz patents of 1905, in which dry ore is mixed with oil and water added later; this process used 3.6% of cotton-seed oil; the Kirby patent of 1906, using kerosene, in which 5% of bitumen is dissolved; the Froment (Italian) patent of 1903, in which the modification is set forth of releasing gas from the finely powdered ore, which patent was purchased by Sulman, Picard and Ballot; and the Cattermole process, which used oil amounting to 4 to 6% of the weight of metalliferous mineral matter, or less than 1% of the weight of the ore.

Of this process the decision says:

The fact that the final purpose of the Cattermole process is to increase the sinking tendency of the metalliferous mineral instead of removing it upon the surface, does not render the process any less instructive as to the state of the prior art, for there . . . is first a violent agitation to cause the oil to gather up the metalliferous particles, as in other oil flotation processes. . . . Here is described a process in which the quantity of oil used approximates the quantity of oil called for by the appellee's (Minerals Separation) patents, a fraction of 1 per cent.

When the claims and description of the process of the appellees' patent are compared with the prior patents, it will be seen that the only material difference is in the smaller quantity of oil which the appellees use. . . . Froment recommends the use of oil from 1 to 3½% of the ore by weight; the appellees, a fraction of 1 per cent.

Quoting from a previous decision, the judge said:

The law does not require that a discoverer or inventor, in order to get a patent for his process, must have succeeded in bringing his art to the highest degree of perfection. It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way of putting it into operation.

The fact that the appellees use a smaller quantity of oil than was used in the prior state of the art is not of itself, and it is not claimed by them to be, sufficient to distinguish their process so as to render it patentable. To discover that the desired result may be accomplished with the use of a fraction of 1% of oil when formerly a much larger quantity of oil had been used, and had been deemed necessary, is not an in-

vention or discovery within the meaning of the patent laws. It is a difference of degree and not of kind. "A change only in form, proportions, or degree, doing substantially the same thing in the same way by substantially the same means with better results is not such invention as will sustain a patent." *Roberts vs. Ryer*, 91 U. S., 150.

But it said that the appellees' process is the only froth process, and that the others described in the prior art are the bulk-floatation or oil-buoyancy processes.

The oil-buoyancy process is described in the Elmore patents. . . . It is essential to the process that the oil must be thick and viscous, for otherwise the metal would easily fall out of the oil; the process must be carried on in the cold: . . . the mingling of the oil and pulp must be as gentle as possible, so as to avoid breaking the oil in globules. The appellees' expert, Dr. Chandler, testified that in bulk floatation, 15.7 parts of oil must be used per 6.7 parts of ore.

. . . In none of the patents herein discussed aside from the Elmore's, is that process used. Haynes uses 11% of oil to the ore, and directs that the mixture be agitated with hot, cold, or warm water. . . . The Everson patent declares that thorough agitation of the mass is necessary, and in the "Engineering and Mining Journal" of Nov. 15, 1890, there is an article describing a test operation of the process.

The contention is made, however, that if the prior patents disclose froth processes, the scum which the appellees' process causes to rise to the surface is so different that it is a new result. . . . The froths are similar in appearance. They all rise after the same amount of agitation, they all gather with equal efficiency the same quantity of metal, and all may be removed from the surface the same way.

Following this came a lengthy discussion as to whether the difference in oil content of scums produced in any way gave them any essentially different properties so far as smelting or table concentration go, and it was the judge's opinion it did not.

The decision of the Court below appears to have been largely influenced by the consideration that the appellees' patent had gone into extensive and successful use. The fact that a process has gone into extensive use . . . is of no value whatever where the question of invention or patentability is free from doubt, and in any case its value depends largely upon the causes producing it. It is often due to business ability in manufacturing, exploiting and advertising, and to the fact that prior conditions have not stimulated development.

We hold that to sustain the appellees' patent would be to give to the owners thereof a monopoly of that which others had discovered. What they claim to be the new and useful feature of their invention, as stated by their counsel, is "agitating the mixture to cause the oily-coated mineral to form a froth." As we have seen, that feature was clearly anticipated by the prior art, and when the elements of the appellees' claims are read one by one, it will be found that each step in their process is fully described in more than one of the patents of the prior art, with the single exception of the reduced quantity of oil which they use. The patentees of the appellees' patent made a valuable contribution to the art in discovering the smallest quantity of oil which would produce the desired result. In doing so they pursued the course which all skillful metallurgists would be expected to pursue. They made a series of experiments to determine how small a quantity of oil could be used successfully. They found as all must find who apply the oil floatation process, that certain oils are adapted to use with certain ores, and that a larger quantity of oil is necessary for one kind of an ore than for another. The appellees admit that for some ores they use four times as much oil as for others. Their discovery that a small fraction of 1% of oil is sufficient to produce floatation of the metaliferous matter cannot, as we have seen, be made by itself or in a combination the subject of a patent. The appellees cannot take from others the right to use oil economically. This was evidently the ruling of the Patent Office on their application for the patent. One of their claims in the original application was "the process of concentrating powdered ore, which consists in separating minerals from gangue by coating the minerals with oil in water containing a fraction of 1% of oil on the ore, and recovering the oil-coated minerals." This was rejected in view of the Cattermole patent "as expressing merely a difference of degree as to the proportion of oily matter employed." Counsel for appellees admit that the claim was properly rejected for the reason that it leaves out the agitation and froth, and say, "Our invention is something else than the mere reduction of oil."

The decree is reversed and the case is remanded with instructions to dismiss the bill.

Iron and Steel Production in France

The official reports of the Comité des Forges furnish the figures given in the accompanying tables for the iron and steel production of France in 1913, and the comparisons with the previous year. The tables show an increase of 7.5% in pig iron and of 4.7% in the production of steel ingots. The growth of the French industry has been steady for several years past, and promises to continue. Supplies of iron ore are sufficient, especially since the minette ores of the Briey Basin began to be worked; but France has no surplus of fuel.

The nature of the ores worked is such that the steel industry is essentially a basic one. The basic converter supplies nearly two-thirds of the steel. The openhearth furnace is making progress, but it is chiefly the basic openhearth furnaces which are increasing in number and output.

France is third among European nations in iron and steel production, being exceeded both by Germany and Great Britain. The production of finished steel is not yet reported.

FIG-IRON PRODUCTION IN FRANCE

	1912		1913		Changes, Tons
	Tons	Per Cent.	Tons	Per Cent.	
Foundry iron..	884,487	17.9	957,145	18.0	I. 72,658
Forge iron....	542,846	11.0	565,133	10.6	I. 22,287
Bessemer pig..	119,781	2.4	161,464	3.0	I. 41,683
Thomas (basic) pig	3,288,904	66.6	3,546,057	66.8	I. 257,153
Special irons...	103,296	2.1	81,517	1.6	D. 21,679
Total.....	4,939,314	100.0	5,311,316	100.0	I. 372,002

STEEL PRODUCTION IN FRANCE

	1912		1913		Changes, Tons
	Tons	Per Cent.	Tons	Per Cent.	
Acid converter.	124,663	2.8	122,514	2.6	D. 2,149
Basic converter.	2,812,780	63.5	2,934,312	63.3	I. 121,532
Openhearth	1,452,462	32.8	1,539,558	33.2	I. 87,096
Crucible, etc...	38,314	0.9	38,782	0.9	I. 468
Total.....	4,428,219	100.0	4,635,166	100.0	I. 206,947

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Steel Production in Germany

The figures of the German Iron & Steel Union for 1913, which have been published recently, show a gain in steel production of 9.6% over 1912. The increase is along the usual lines and does not show any notable differences, the greatest being the gradual improvement in the proportion of openhearth steel, which seems to be surely and slowly gaining on the basic converter. This is not a new development, but has been observed for several years past. It is bound to continue as long as the industry is based so largely on basic ores.

Since October last and up to the present time production and consumption in Germany have shown a declining tendency.

STEEL PRODUCTION IN GERMANY, 1913

	Acid		Basic		Total	
	Tons	Per Ct.	Tons	Per Ct.	Tons	Per Ct.
Converter.....	155,138	0.8	10,629,697	56.1	10,784,835	56.9
Openhearth....	270,826	1.4	7,339,314	38.7	7,610,140	40.1
Direct castings.	109,329	0.6	253,587	1.4	362,916	2.0
Crucible.....	99,173	0.5	.....	.....	99,173	0.5
Electric.....	101,755	0.5	.....	.....	101,755	0.5
Totals.....	736,221	3.8	18,222,598	96.2	18,958,819	100.0
Totals, 1912..	635,802	3.7	16,666,196	96.3	17,301,998	100.0

Stated comparatively, the production for two years was, in metric tons:

	1912	1913	Changes	Per Ct.
Converter	9,981,479	10,784,835	I. 803,356	8.0
Openhearth.....	6,845,489	7,610,140	I. 764,651	11.2
Direct castings.....	321,663	362,916	I. 41,253	12.8
Crucible, etc.....	153,367	200,928	I. 47,561	31.0
Totals.....	17,301,998	18,958,819	I. 1,656,821	9.8

PERSONALS

Thomas A. Varden is in New York.

Wm. F. Carroll has left Mexico and is now in Chicago.

Dr. L. D. Ricketts has been in New York for a few weeks. He will return to Arizona about the last of May.

Albert A. Corey has been appointed general superintendent of the Homestead steel works to succeed Col. Azor R. Hunt.

R. C. Cole has joined the staff of the pneumatic-tool department of the Ingersoll-Rand Co., and has been stationed in Chicago.

J. Parke Channing left on Thursday for Arizona on a trip of inspection and will return to New York about the end of May.

Homer L. Carr has returned to New York from Honduras, where he has been engaged in professional work for about two months.

Bradley Stoughton, secretary of the American Institute of Mining Engineers, sailed from New York Apr. 27 for a vacation in France and Spain.

Joseph W. Boyle, president of the Canadian Klondyke Mining Co., has returned from a two months' visit to England, and is now on his way to Dawson.

L. R. Custer has been appointed superintendent of the armor-plate department of the Homestead steel works of the Carnegie Steel Co., succeeding S. S. Wales.

Arthur Thacher, J. E. Hays, Jr., and C. W. Sexton, of New York, have completed a tour of inspection of the Empire Zinc Co.'s property, in New Mexico and Arizona.

Sydney H. Ball sailed from New York on May 5 and will spend most of the summer in Greenland, making an examination of the mineral deposits of the west coast.

Frank H. Siermans, mining engineer, formerly of Mexico City, has sailed for Costa Rica, where he will investigate various mining properties under option to Eastern people.

Roy Wethered has resigned his position with the Consolidated Mining & Smelting Co., of Canada and has opened an office as mining engineer in the Paulsen Building, Spokane, Washington.

H. A. J. Wilkens, president of the Mines Management Co., who spent two or three weeks in England and Germany in connection with the work of that company, returned to New York last week.

R. L. Downing has been appointed superintendent of the Bennett mine at Keewatin, Minn., Mesabi Range, succeeding J. M. Drake, deceased. He was formerly with the Tennessee Copper Company.

N. O. Lawton was in New York City on business the latter part of April. He left for Globe, Ariz., on April 29 to look over the district, and will return to Lawton, Mich., about the middle of May.

F. A. Jones, president of the New Mexico School of Mines, has been appointed director of the New Mexico mineral exhibit, at the San Diego Exposition, and is making a tour of the state, creating an interest in the exhibit.

Mark R. Lamb, the well-known mining engineer, who has been for several years in charge of the Santiago office of the Allis-Chalmers Manufacturing Co., expects to arrive in New York about the middle of May. F. Carl Lamb replaces Mark Lamb in Chile.

Lee W. Steele, a Dawson pioneer, who has large gold holdings in the Yukon and Alaska, was recently in Edmonton, Alberta, interesting capitalists in the formation of a company for the development of 21,000 acres of dredging leaseholds. He will shortly go to England in connection with the project.

H. W. Hardinge, mining engineer and president of the Hardinge Conical Mill Co., is planning to sail for Alaska on June 25. He is going to conduct a test in the plant of the Alaska-Treadwell Mining Co. of a Hardinge ball mill vs. stamps. The ball mill is now being installed and is expected to be ready during June.

J. E. Breakell is general manager of the Socorro Gold & Silver Mine, Ltd., at Valle de Angeles, Tegucigalpa, Honduras, and is in charge of the installation of the all-slimes cyanide plant which that company is putting in. W. S. Mann left the company at the end of last December, having finished a four months' engagement at that time.

The President has appointed William C. Edes, Lieutenant Frederick Mears and Thomas R. Riggs, Jr., members of the

Alaska Engineering Commission which is to have charge of the location of the railroads in Alaska under the recently enacted Alaskan Railroad Bill. Mr. Edes is at present chief engineer of the Northwestern Pacific R.R. in California; Lieutenant Mears is the chief engineer of the Panama R.R. and was suggested for this work by Colonel Goethals. Mr. Riggs was one of the chief engineers in the surveying work of the Alaskan-Canadian boundary.

OBITUARY

Harry Rush Gilbert died at Pittsburgh, Apr. 26, aged 69 years. He was born in Ohio and was engaged in the steel business in Pittsburgh and Youngstown for many years. For 13 years past he had been manager of the Continental works of the National Tube Co., Pittsburgh.

Godfrey Lindstrom died at Anaconda, Mont., Apr. 20, aged 42 years. Born in Sweden, he had lived in Montana, chiefly in Deer Lodge County, for 25 years. For some time past he had been working a portion of the Oro Fino property, on which he and L. F. Ireland had a contract.

Charles Bailey died at Pittsburgh, Apr. 20, aged 59 years. He was one of the oldest steel-casting manufacturers in western Pennsylvania. For a number of years he was employed by the Pittsburgh Steel Casting Co. In 1899, Mr. Bailey and Joseph A. Kelly organized the Reliance Steel Casting Co., with which he was identified the last 15 years.

Duncan McMartin, of Montreal, one of the most prominent mining financiers of Canada and a member of the Timmins-McMartin-Dunlap syndicate, died at a hospital in Toronto, May 2, from an attack of pneumonia. He was 44 years old. Mr. McMartin was a native of Glengarry County, Ont., and of Scotch descent. At the time of the first Cobalt discoveries he was in partnership with his brother John, as contractor on the Timiskaming & Northern Ry. When the blacksmith La Rose found the first silver ore, he took it to the McMartin Brothers, who in conjunction with the other members of the syndicate became interested in the property which they afterward disposed of for \$6,000,000. The syndicate was early in the field in the Porcupine area and acquired, at what were then considered high prices, the Hollinger, Miller, Middleton and Dixon claims, the results verifying their judgment. Mr. McMartin was also interested in many other enterprises, including the development of electrical power at Cobalt and Waiwaitan Falls. It is announced that his sudden and unexpected death will make no difference in the administration of any of the companies with which he was identified. He was very popular in business and mining circles, and was noted for his generosity, especially in extending help to the friends of his earlier days. He is survived by a widow and three young children.

SOCIETIES

American Institute of Mining Engineers—A meeting of the Pennsylvania Anthracite Section for organization and adoption of bylaws will be held at Wilkes-Barre, Penn., on Saturday evening, May 9. Subjects for discussion: "Mining under Heavy Wash," Douglas Bunting; "Stripping," John M. Humphrey. All members of the A. I. M. E. residing or doing business in the anthracite region of Pennsylvania are members of the section.

Association of American Steel Manufacturers—The 18th annual meeting was held in Pittsburgh, Apr. 21. The following officers were elected: President, P. E. Carhart, Illinois Steel Co., Chicago; vice-president, F. E. Abbott, Lackawanna Steel Co., Buffalo; secretary-treasurer, Frank A. Robbins, Jr., Pennsylvania Steel Co., Steelton, Penn. The retiring president, A. A. Stevenson, of the Standard Steel Works Co., was presented a silver centerpiece filled with flowers, in appreciation of his service as vice-president and president. Mr. Carhart, the new president, has served as vice-president three years. The association now numbers 34 members.

American Iron & Steel Association—The technical program for the New York meeting, May 22, besides President Gary's annual address, includes the following papers: "Modern American Blast Furnace Practice," by Herman A. Brassert; discussion by John N. Reese, Arthur J. Boynton, Edward B. Cook and Richard V. McKay; "Some Developments in By-Product Coke Ovens," by William H. Blauvelt; discussion by Carl A. Meissner; "Selling Policy as Influenced by Modern

Cost Accounting," by Thomas J. Bray; discussion by Charles S. Robinson and H. D. Westfall; "The Practical Importance of Heat Treatments in the Steel-Wire Industry," by John F. Tinsley; discussion by J. W. Smith; "Transportation," by J. Fred Townsend; discussion by Delos W. Cooke and Thomas O. Cole; "Recent Progress in the Building of Large Steam Turbines," by Francis Hodginson; discussion by H. G. Stott; "Sanitation in Panama and Alabama," by Dr. Lloyd Noland; discussion by Dr. Sidney McCurdy.

American Institute of Mining Engineers—The 108th meeting of the Institute will be held at Salt Lake City, Utah, Aug. 10-14. Although the Institute has visited Salt Lake City at various times enroute to other meetings, this is the first time in its history that a meeting has been devoted exclusively to Utah. In July, 1887, the members convened at Salt Lake City and then adjourned to Butte, Mont. Local committees have been formed under the chairmanship of R. C. Gemmill, and are already actively engaged in preparing for the entertainment and convenience of visiting members, Charles W. Goodale, chairman of the committee on precious and base metals, is in close touch with the local committees, both by mail and personal conference, and the progress already made assures an interesting technical program. In addition to the active work of the committee on precious and base metals, the committee on mining methods, the committee on mining geology, the committee on nonmetallic minerals, and the committee on mining law are securing valuable papers for the technical program of this meeting. Twenty-five papers are already in the hands of the secretary and have been accepted for this meeting by the committee on papers and publications. The attention of authors, members of committees, and members of the Institute is called to the necessity of having all papers in the hands of the secretary of the Institute before May 31, 1914. Since unexpected delays often arise, authors are urged to plan to offer their papers certainly not later than May 15. The social features of the Salt Lake meeting will include many visits to neighboring mines and metallurgical works, and it is expected that invitations will be general. Among the several points of interest which might be mentioned are: Bingham Cañon, Midvale, Lark, Murray, Garfield, Park City and Tintic.

INDUSTRIAL NEWS

The Will & Baumer Co., Syracuse, N. Y., will spend \$100,000 this year in increasing the capacity of its candle factory.

Hardinge Conical Mill Co., 50 Church St., New York, N. Y. reports that the Miami Copper Co. is at the present installing additional Hardinge Mills.

The Buffalo Foundry & Machine Co., of Buffalo, N. Y., announces that it has terminated the arrangement whereby H. E. Jacoby has been representing it in New York City and vicinity. It is now handling direct all inquiries covering vacuum apparatus, castings, patterns, and machine work.

Contract has just been awarded to the Westinghouse-Kerr Company, of New York by the Taylor-Wharton Iron & Steel Company for the erection of a 25-acre plant of the company in Easton, Penn., and for enlargements to its present plant in High Bridge, N. J.

The Aluminium Industrie Gesellschaft, which owns the works at Neuhausen, Switzerland, the largest in Europe, reports for 1913 net earnings of \$1,288,000, an increase of 45% over 1912. The dividend paid for the year was 20%, and it was decided to increase the capital stock from \$5,000,000 to \$6,750,000. Stocks of metal on hand at present are reported to be low.

TRADE CATALOGS

The Goulds Mfg. Co., Seneca Falls, N. Y., Bulletin No. 118. Centrifugal Fire Pumps. 12 pp. Illus. 10x8 inches.

The Bayonne Casting Co. East 10th St. Bayonne, N. J. Booklet. A treatise on Monel Metal. 32 pp. Illus. 8x5 inches.

The Wm. Powell Co., Cincinnati, Ohio. Booklet. The Powell "Union Composite Disk Valves," 12 pp. Illus. 6x3 inches.

The Consolidated Expanded Metal Companies, Architects Bldg., New York, N. Y. Bulletin Safety First Steel Concrete Guards. 34 pp. Illus. 5½x8 inches.

NEW PATENTS

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

ALLOY OF IRON, NICKEL, COPPER AND ALUMINUM. Edward D. Gleason, New York, N. Y., assignor, by mesne assignments, to Neu-Metals & Process Co., Long Island City, N. Y. (U. S. No. 1,093,557; Apr. 14, 1914.)

AMALGAMATOR. Sampson Beer, Greenwood, Calif. (U. S. No. 1,095,071; Apr. 28, 1914.)

BLAST-FURNACE AIR—Method of Drying Air for Blast Furnaces. Mark W. Johnson, Jr., Birmingham, Ala. (U. S. No. 1,093,859; Apr. 21, 1914.)

CLASSIFIERS—Improvements in Classifier for Crushed Ores. W. F. Deister, Fort Wayne, Ind. (Brit. No. 17,111 of 1913.)

CONCENTRATOR. William L. Card and Frank S. Card, Denver, Colo., assignors to The Card Manufacturing Co., Denver, Colo. (U. S. No. 1,094,640; Apr. 28, 1914.)

COPPER ALLOYS—Process of Producing Copper Alloys. Henry Bryda, Blackstone, Mass. (U. S. No. 1,095,078; Apr. 28, 1914.)

CRUSHING—Improvements in Roller and Ring Mills for Grinding, Crushing, Pulverizing and the Like. Firm G. Pfeiffer, Kaiserslautern, Germany. (Brit. No. 24,822 of 1913.)

DRILL—Percussive Drill. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,093,266; Apr. 14, 1914.)

DRILL—Rock Drill. Charles Ernest Youmans, Yonkers, N. Y. (U. S. No. 1,092,886; Apr. 14, 1914.)

DRILL BIT—Rock Drill Bit. Carroll R. Forbes, Rolia, Mo. (U. S. No. 1,094,063; Apr. 21, 1914.)

DRILL-BIT FORMING AND SHARPENING MACHINE. Walter L. Jackson, Quincy, Mass., assignor of one-half to Theophilus King, Quincy, Mass. (U. S. No. 1,094,655; Apr. 28, 1914.)

DRILL BITS—Process of Forming and Sharpening Drill Bits and the Like. Harry Johan Hjalmar Nalthorst and Gotthard Lundström, Geilivare Malmfält, Malmberget, Sweden, assignors, by mesne assignments, to Nya Aktiebolaget Altas, Stockholm, Sweden. (U. S. No. 1,094,807; Apr. 28, 1914.)

DRILLING—Improvements in Hand-Drilling Machines for Use in Mines. P. Marrow, Standish near Wigan, Eng. (Brit. No. 18,204 of 1913.)

DRILLS—Improved Self-Adjusting Back Center and Brake for Rock- and the Like Hand-Drilling Machines. J. E. Brown, Sheffield, Eng. (Brit. No. 12,902 of 1913.)

ELECTRIC FURNACE AND PROCESS OF HEATING SUBSTANCES. Erwin F. von Wilmowsky, Boston, Mass.; Edwin J. Prindle, executor of said von Wilmowsky, deceased, assignor to Mrs. Olga Pieper, Potsdam, Germany. (U. S. Nos. 1,094,381, 1,094,354 and 1,094,355; Apr. 21, 1914.)

ELECTROMAGNETIC SEPARATOR. Byron T. Mottinger, Youngstown, Ohio. (U. S. No. 1,093,875; Apr. 21, 1914.)

EXTRACTION—Process of Extraction of Precious Metals From Their Carrier. Ellis Edgar Howson, Salt Lake City, Utah. (U. S. No. 1,093,700; Apr. 21, 1914.)

FLOTATION PROCESS—Process for Recovering Metaliferous Constituents of Ores. Joseph T. Terry, Jr., San Francisco, Calif. (U. S. No. 1,094,760; Apr. 28, 1914.)

FUME DESTROYING PROCESS. Stewart W. Young, Palo Alto, Calif., assignor, by direct and mesne assignments, to The Thiogen Co., San Francisco, Calif. (U. S. No. 1,094,767; Apr. 28, 1914.)

LEACHING—Process for Extracting Metals from Ores. Henry S. MacKay, Norwich, Conn., assignor to MacKay Process Co., Norwich, Conn. (U. S. No. 1,094,371; Apr. 21, 1914.)

MELTING FURNACE. Grenville Mellen, East Orange, N. J., assignor of one-half to United Aluminum Ingot Co. (U. S. No. 1,092,938; Apr. 14, 1914.)

METALLURGICAL FURNACE. Utley Wedge, Ardmore, Penn. (U. S. Nos. 1,094,953 and 1,094,954; Apr. 28, 1914.)

MINERAL WAX—Process for Refining and Decolorizing Mineral Wax. Edgar Carl Walther Adolf von Boyen, Barmstedt, Germany, assignor, by mesne assignments, to the Firm of Wachs und Cerosinwerke zu Hamburg. J. Schlickum & Co., Hamburg, Germany. (U. S. No. 1,092,629; Apr. 7, 1914.)

MINING HEADLIGHT. Rudolph C. Kruschke, Duluth, Minn. (U. S. No. 1,093,339; Apr. 14, 1914.)

PIG IRON—Manufacture of Pig Iron. Francois Prudhomme, Vienne, France. (U. S. No. 1,092,168; Apr. 7, 1914.)

PREHEATER AND FURNACE SHIELD. Walter S. Rockwell, New York, N. Y., assignor to W. S. Rockwell Co., New York, N. Y. (U. S. No. 13,713; Apr. 14, 1914.)

PROPS—Improvements in or Connected with Props and the Like. Mavor & Coulson, Ltd., Glasgow, and M. Mackay, Newton Grange, Midlothian, Scotland. (Brit. No. 8097 of 1913.)

ROASTING—Improvements in or Relating to Ore-Roasting Furnaces. E. Bracq, Lens, France. (Brit. No. 26,736 of 1913.)

SEPARATORS—Improvements Relating to Magnetic Separators. Fried Krupp Akt. Grusonwerke, Magdeburg-Buckau, Germany. (Brit. No. 16,440 of 1913.)

SIGNALING—Improvements in Mine-Signaling Apparatus. R. Nicholas, Treorchy, Rhonda, South Wales. (Brit. No. 17,816 of 1913.)

SLAG—Improvements in or Relating to the Production of Porous Slag for Use as an Aggregate. C. H. Schol, Alledorf, Germany. (Brit. No. 839 of 1914.)

Editorial Correspondence

BUTTE—Apr. 29

Dredging in West Gallatin Cañon is soon to be started on a large scale. Options have been taken on a number of ranches along the river, and four have already been purchased through an attorney. Machinery is being shipped to Salesville and thence up the West Gallatin. The identity of the men interested in the project is not generally known.

Butte, Anaconda & Pacific Ry. has ordered four additional 80-ton electric locomotives from the General Electric Co., which will bring the total number of electric locomotives in operation up to 21. In addition to the four locomotives three electric trucks have been ordered. These are to be used in connection with the locomotives in the freight service, and will be coupled with them to assist in hauling on steep grades, as two locomotives are coupled. These trucks have half the power of a locomotive and are especially designed as auxiliaries to the more powerful engines.

Butte Duluth Mining Will Be Done By Contract. The work has been let to a company which has had extensive experience in railroad building, tunneling, etc. Butte Duluth mining is all open work from the surface and the contractors have undertaken to mine and deliver the ore in the bins at the mill for 18c. per ton. It is said to have cost the company 50c. per ton for the same work. The company's plant is being enlarged to 1000 tons capacity and it is anticipated that it will then earn large profits. Important capital has become interested in Butte Duluth and its bonds have been taken from the market.

Butte & Landon Development Co.'s Property has been transferred to a new corporation known as the Greendale Exploration Co. in order to facilitate the carrying out of the contract the company has with the Rainbow Development Co. Thomas F. Cole and his associates in the Rainbow have contracted for a lot of development and exploratory work in the Butte & Landon in consideration of 51% of Butte & Landon stock, but as that amount of stock could not be secured for transfer to Cole and associates without much trouble, if at all, it was decided at the stockholders meeting to transfer the property to a new corporation and issue 51% of that stock to the Rainbow company and retain 49% for the Butte & Landon, thus converting the latter into a holding company. The Butte & Landon has possession of all the Greendale stock at present and will retain it until the Rainbow company has fulfilled the terms of its contract. The Rainbow company has been slow in getting to work on the Butte & Landon property, but was finally started to unwater the mine, which has been opened to a depth of 1100 ft. It is to be sunk to a depth of 1600 ft. and the entire ground cross-cut north and south. The Rainbow company is developing a property north of and adjoining the Butte & Landon and has made a fine discovery of ore, a fact which has given confidence to Butte & Landon stockholders.

Southern Montana Ry., Right-of-Way, from Butte to Jackson, through Big Hole basin and to the mining districts of Elkhorn and French gulch, is being acquired and Governor Allen anticipates that work of construction will begin not later than July 1. The MacArthur & Perks Co. of London will build the railroad, a contract having been made with that firm by the Boston & Montana Development Co., of which the Southern Montana is a subsidiary. The MacArthur & Perks Co. is one of the greatest contracting companies in the world. It has just completed a \$42,000,000 contract at Buenos Aires, building docks and warehouses, and is engaged in driving a railroad tunnel through the Rocky Mountains for the Canadian Pacific. The company is also railroad building in Oregon, is driving a railroad tunnel through the Andes, and is a bidder for the \$150,000,000 Canadian contract to build the Georgian canal. The Boston & Montana Development Co. and Southern Montana railroad project are among the most important enterprises undertaken in Montana in years. Several mines of the company in the French gulch district have been developed to a producing stage and are awaiting railroad transportation. In the Elkhorn district a large double-track tunnel is being driven from the bed of the Wise River, where a branch of the railroad will be built, and all the veins in the group of mines owned by the company will be cut at a depth of 1500 ft. It is expected to have the Elkhorn mines in condition for heavy production by the time the railroad is built into the district.

Two Hoisting Accidents in the latter part of April occurred at Butte, both at mines of the Anaconda company. What might have resulted in a bad accident occurred in the shaft of the East Colusa mine the afternoon, Apr. 24. Six men were being hoisted on the single-deck cage at the end of the shift, when at a point near the 300-ft. level the cage was brought to a sudden and violent stop by the projecting end of a guide which had been loosened by the action of copper water on the bolts. Two of the men were slightly injured and all were shaken up, but the cable held and all were rescued after some time had elapsed while ascertaining the nature of the mishap. During this time it was rumored around the city that the cable had parted and the cage fallen to the sump. By an error in judgment the hoisting engineer at the Silver Bow mine ran the cage, containing an empty ore car, into the sheave at high speed the afternoon of Apr. 25. No one was injured, although the impact of the cage tore through the steel cap at the head of the headframe and fell 80 ft. on to the engine house, crushing timbers and throwing splinters about the engineer. Several miners working around the collar of the shaft saw the danger in time to get to a safe distance before the broken parts of the frame fell. The engineer, who was new on the job, was practicing with the engine and he apparently opened the throttle and released the brake when intending to do just the opposite. Although it has many times happened that cages at various mines have been run into the sheaves by a miscalculation of the engineer, yet seldom have they been known to go through and drop.

HOUGHTON—May 2

Reaction from the Labor Shortage during the recent strike has resulted in an overabundance of men for the mines of the Michigan district. Long before the strike was officially called off there was a superfluity of trammers, but a shortage of miners. Now there are more miners and more trammers than are needed. The result is that May is going to be a record breaker in copper rock production if it is not a record breaker in copper output. Immediately the strike was called off there was a rush for the mines from those who stuck to the cause of the Western Federation of Miners. The mine managers have shown no desire nor inclination to discriminate against any of the strikers, excepting those who were concerned in the more serious of the disturbances. In addition to this influx of capable men every train is bringing in the best type of miner, Cornishmen largely, who went to foreign fields when the strike started and decided to remain away as long as there was any semblance of a strike or any probability of trouble. They are coming back in groups every day, seeking their old positions in the mines. But the largest factor in improving the labor situation here has been the unsettled and unfortunate conditions in the iron mines of Michigan and Minnesota. In the Ironwood ranges most of the smaller iron mines have shut down entirely and the big corporations, like the Cleveland-Cliffs and the Oliver have found it necessary to curtail their forces and to cut the work down to five days per week for those who are kept on. Nearly 1000 men were let out in one lot in the Iron River district last week and about the same number in the Marquette district. Conditions in the iron mining district are bad. Practically no iron is sold in advance and the mines in some instances have all the stockpiles they dare carry. Excepting in the cases of rich corporations which can afford to keep high-class miners at work opening new ground there is nothing to do but close the iron mines.

SALT LAKE CITY—Apr. 30

Ohio Copper Co.'s New Crushing Equipment will be installed as soon as the deliveries have been made as foundations are about completed. The changes contemplated will probably be finished by July.

EL PASO—Apr. 27

Santa Eulalia Mines Are Shut Down except the Potosi Mining Co.'s mine. Most all foreigners have left throughout the state of Chihuahua with a few exceptions and these are people who are willing to take a chance among the Mexicans no matter what may happen. The general opinion among mining men seems to be that it will be no use to return unless conditions become stable.

DULUTH—MAY 2

At the Steel Corporation's Model City over 100 houses are now completed and many of them occupied. About 60 additional basements are in, and construction work will be started at once, so that by June 1, 160 homes will be built. The houses will be occupied exclusively by employees of the steel

Chicago & Northwestern Roads New Locomotives have put in an appearance on the Menominee range. One recently hauled a train of 100 steel ore cars from Escanaba & Norway, the largest train ever hauled on the division. In appearances the engines are not much larger than the Moguls, but they are more powerful. It is expected that these locomotives will haul 85 loaded cars from the Iron Mountain yards to the docks at Escanaba and no "pushers" will be required on the grades as heretofore. Heavier steel was laid and bridges rebuilt in preparation for the use of the new engines.

Contracts for Ore Cars, numbering 3500, to cost \$4,000,000 and to be put in service on the Duluth, Missabe & Northern Ry. at Lake Superior and the Bessemer & Lake Erie Ry. at Lake Erie, have been awarded by the U. S. Steel Corporation. The purchase was prompted by the hauling demands that will be made when the lease of the Great Northern ore properties on the Mesabi range expires Jan. 1, 1915. The fact that much of the ore handled by the Steel corporation after this year will no longer be carried over the Hill lines has necessitated increased equipment. The cars are to be delivered during August and September this year.

MARQUETTE—May 2

Duluth & Iron Range R.R. is a subsidiary of the U. S. Steel Corporation and few if any other subsidiaries of the company are of more importance to the region to which they are tributary. The road serves the Vermilion and part of the Mesabi district. With its 200 miles of trackage, the finest ballasted roadbed in America, the main line extending from Duluth to Winton, with a branch to Virginia and Eveleth, laid with 80-lb. steel, equipped with 36 passenger and observation coaches of steel, including mail and baggage cars, 1200 freight cars, 5300 steel ore-cars and 120 locomotives of the Consolidated, Mikado and Pacific classes, the railroad has an equipment ranking with the best of the kind on the continent. Primarily, the Duluth & Iron Range is an ore-hauling line. Nevertheless, it is the policy of the management to foster the development of the surrounding country in every way and the result is a steadily increasing traffic, notable evidences of which are the extensive operations now conducted during the winter season, whereas in years past the revenues practically came to a halt with the suspension of shipments from the mines. The tributary region is rich not only in mineral and timber, but in agricultural lands. Farming of late years has been making great strides. There are four large sawmills on the Duluth & Iron Range, the products of which are transported to Two Harbors and are shipped thence by water to lower lake ports. Pulpwood and other forest products make up a large part of the railroad's traffic, as does general merchandise. Nearly 300,000 tons of coal are handled annually. At Two Harbors, the Duluth & Iron Range has six ore docks of a combined storage capacity of 200,000 gross tons. Two of the piers are of steel and concrete. The aggregate length of the six docks is 6725 ft. The maximum height from the water is 74 ft. The docks are located in a natural land-locked harbor, having an average depth of 30 ft. of water, protected by 1500 ft. of Government breakwater, with lighthouse and fog signal for the direction of vessels. The piers are particularly convenient for the approach and departure of ships and seldom is tug service required. In addition to the ore docks there is a coal plant, with machinery for discharging a 5000-ton cargo in 10 hr.; a lumber dock, over which 200,000,000 ft. of lumber can be loaded into vessels in the course of a season for shipment to Chicago, Tonawanda and other ports; a passenger dock, and a large and well equipped railroad shop where any and all kinds of repairs and construction can be done. The shipping season usually extends from Apr. 15 to Nov. 15. The docks are operated day and night. Each is electrically lighted. The pockets into which the ore is dumped from the 24-ft. steel cars, each car with a capacity for 110,000 lb., are spaced 12-ft. centers, as are the hatches of the vessels into the holds of which the cargo is poured through steel spouts, so that extraordinary speed may be made in discharging ships. It is possible to load as much as 100,000 gross tons of ore into vessels in a single day. During the height of the season the approximate number of cars handled daily is 1500, requiring the operation of 50 trains, together with 16 switching crews in the yards tributary to the docks to sort the ore and get it together in quantities to make up the proper cargo mixtures. The sorting yards have a storage capacity of 4000 cars and

contain 35 miles of track. The company owns two tugs, one used in towing vessels and the other exclusively for fire protection.

PORCUPINE—May 2

Canadian Mines & Finance Co. controlling the Hollinger, Acme and Miller-Middleton properties in Porcupine, is installing a large compressor plant on the shores of Gillies Lake, which will be a central distributing station for these several properties. The first installation will consist of one Nordberg and one Fraser & Chalmers electrically driven compressor, each having a capacity of 4500 cu.ft. of free air per min. The Nordberg engine will operate at a constant pressure, while the Fraser & Chalmers will be equipped with a new style regulator and will operate on a variable load. The plant is designed to supply air at constant pressure. In order to do this, a shaft is being sunk to a depth of 300 ft. From the 244-ft. level, a crosscut will be driven and from the ends of the crosscut, two drifts will be driven. Stopping operations will be carried on from these drifts to provide a large chamber for the storage of compressed air. The crosscut from the shaft will be bulkheaded off with concrete and from this bulkhead, a pipe of large diameter will be carried to the shaft and then down in the form of a gooseneck and will run up the shaft at a point somewhat below the collar. The water from Gillies Lake will be allowed to flow into the shaft, and the air from the compressors will be piped into the underground chamber and will displace the water until a state of equilibrium is reached. At the times of greatest consumption, however, when the air is being drawn off faster than it is being pumped into the chamber, the water will rise and thus maintain a constant pressure. The gooseneck below the crosscut is designed to prevent any sudden expulsion of the water should the pressure in the chamber rise above 105 lb. It is an open question whether or not this system will work satisfactorily unless the chamber is lined with concrete, as it is believed that without this precaution, the loss of air would be considerable. At the plant of the Cobalt Hydraulic Co. at Hounds Chutes near Cobalt, there is a hydraulic air-compressor working on the Taylor system. It is understood that there is a heavy loss of air from the underground chamber of this plant, but as the compressed air is produced by the action of falling water, this loss is of little moment. At the plant, however, such as is being put in by the Canadian Mines & Finance Co. where the air is produced by electrically driven compressors any considerable loss would be serious. It is understood that when these two compressors are in commission a third will be installed. At present, the Hollinger is operating 43 drills and is having considerable trouble to provide reserve of broken ore over the mill requirements. On the Dixon property, 13 drills are being operated and this number is much below the requirements of the company. With the new plant in commission there should be no difficulty in supplying both the Hollinger and the Acme with all the air they need and there should also be a surplus left over to provide for the development of the Miller-Middleton.

DAWSON, Y. T.—Apr. 16

Protests Against Changing the Mining Code were made by the Yukon council of the legislature which has just finished its annual session. The council unanimously adopted a resolution protesting against the Yukon code being altered or displaced by the enactment of the proposed Dominion code, which is now in the hands of the printers at Ottawa and which is to be introduced in parliament in May. Ottawa dispatches state that the proposed Dominion code includes many objectionable features which were eliminated from the Yukon code after a great struggle. The people of the Yukon hold that they are entitled to make their own placer laws, because the Yukon produces ten times as much placer gold as all the rest of Canada and three-fifths of that from the outside of the Yukon is from Northern British Columbia, within the Atlin camp, which is in the Yukon basin, and is nearly the same as if it were a part of the Yukon Territory. The Yukon people hold that they know the peculiar northern conditions and are qualified to legislate satisfactorily for northern mining. Feeling is running high here regarding proposed changes in the Yukon code. Provisions in the new code which have particularly incensed the people are: First, the imposition of miners' licenses; second, the privilege of staking claims in any direction instead of along base lines; third, permitting only British subjects to stake claims; and fourth, requiring an assessment by day work instead of by a certain valuation as now. It also greatly increases the number of mining officials and removes the Yukon governors from the administration of the Yukon placer act. It allows concessions of large areas of land and abolishes a splendid system of keeping records.

The Mining News

ALASKA

TRACTION CATERPILLARS IN ALASKA seem to meet conditions there, according to statement that a train of 15 sleighs, each loaded with four tons of merchandise, was recently taken to foot of Lake Lebarge by caterpillar of White Pass company.

WINNER OF ALASKA SWEEPSTAKES was John Johnson, whose dog team completed the 412 miles in 81 hr. 3 min., an average of better than five miles per hour, including eating and sleeping time. Team consisted of 18 Siberian wolf-hounds. Scotty Allen and Fred Ayer were fighting it out for second place. Johnson won second place last year in 77 hr. 40 min. Fay Delezene won first place last year in 75 hr. 3 min. Blizzard which raged for two days of race was responsible for poor time this year.

ALL RAIL FROM CHICAGO TO ALASKA may be an early possibility. Plans are being made for a traffic arrangement to run trains from Chicago to St. Paul, and from that point to Canadian border over Great Northern, where connection will be made with a branch of Grand Trunk Pacific; last link in transcontinental line, which has just been completed in British Columbia. Extension of Grand Trunk Pacific, connecting with roads in United States, will be from Regina, Saskatchewan, to Northgate, a port of entry on International boundary between Canada and United States. Later a branch will be built north from main line in British Columbia, through Yukon via Dawson, connecting with proposed American railways in Alaska.

GRANITE GOLD MINING CO. (Valdez)—A gold bar, valued at \$8500, resulted from first cleanup at Tatum mine, on Hobo Bay, in Port Wells district. Company recently installed a 7-ft. Lane mill, which was operated for 12 days before making a cleanup. Ore was taken from tunnel and shaft 190 ft. below surface and averaged \$42 per ton. Ore-shoot is 7 ft. wide in bottom of shaft; on surface it was 4 to 10 in. wide and outcropped for 30 ft. in length. Vein occurs in slate, dipping toward a granite boss, which at depth was found to form hanging wall. Property was discovered in 1912 and 11 tons were shipped from rich surface crop-pings to Tacoma smelter, from which returns of \$196 per ton were received. Mill is 450 yd. from tidewater. A tram 450 ft. long conveys ore from tunnel to ore bunkers. Gas engines are used to operate mill at present, 30 men being employed.

ARIZONA

Gila County

ARIZONA COMMERCIAL (Globe)—Although it is known that after drifting 90 ft. eastward on 1300 level vein was crosscut showing 20 ft. of ore, management refuses to give any news of mine's development for publication. At present, property is shipping one carload of ore daily. Company's present plan seems to be to let 1400 level fill until final plan for handling flow of water is decided upon.

INTERNATIONAL SMELTING & REFINING CO. (Miami)—Steel for power house at smelting-plant site is arriving daily. Several carloads of tools and erection equipment arrived last week of April, so as soon as foundations are finished, Oscar Daniels company can start its work of erection. Sizes of various units comprising power plant are as follows: Boiler house 165x80 ft.; engine house 220x60 ft.; cooling pond 270x150 feet. Stack, which will be between boiler and engine houses, will be of reinforced concrete, 140 ft. in height. Main building foundations were finished last week of April. Excavation for "skull breaker," for converter slag "skulls," was also completed, as well as 70-ft. foundation pit for track scales to be installed on high line of railroad near receiving bin. Four 50-ton electrically operated slag pots are due to arrive soon and as soon as they are received delayed pouring of slag bases for reverberatory hearths will be finished. Wire-concrete fence that is to surround smelter site is now being erected so that soon all visitors will be required to obtain special permits before gaining access to property.

GIBSON (Bellevue)—Although mine is yielding 300 tons of high-grade ore monthly to lessees still busy in property expiration of present leases will mark end of unscientific "gutting" of property's richest stringers to detriment of mine's future. O. B. Kemp, G. A. Whitford, James R. Davis, and P. F. Carney have mapped out a scheme for future development and production that will place property on basis of a producer possibly for years to come and will inevitably lead to ore production by many smaller properties in that part of Miami district. Kemp says that an oil flotation plant of 100 tons or greater capacity will be built before summer is over, but that minor details of property's exploitation have not yet been fully worked out by him and his associates, who recently secured control. He said that tests at Los Angeles resulted in a copper recovery of 85%. As practically all copper in Gibson ore is in form of chalcocite, in schist, it is ideal for treatment by flotation. Kemp says it is possible that a greater supply of water will be developed on southern end of property, for although abundance of water for milling purposes could be secured by sinking main shaft necessity of a domestic supply would make development of surface supply on southern end of Gibson preferable.

INSPIRATION CONSOLIDATED (Miami)—Because of swelling tendency of ground in which main shafts are sunk difficulty has been experienced in obtaining a substantial footing and an accurate alignment of first sections of the concrete lining now being put in. Toe, however, is now in place and a 16-ft. section of concrete is being placed each three shifts. Concrete is dropped through a vertical 4-in.

pipe from surface, fall of over 300 ft. effecting required tamping much more thoroughly than could be done by hand. Because of liability of ground caving if timbers are removed, it has been found advisable to concrete around them. Erection of hoist and compressor is finished. Carpenters and corrugators are now working on conveyor housing from crushing plant to storage bin, and riveters have completed their work on main west headframes. Foundations for 90-ft. shop extension at concentrator site are being poured, and as steel is on ground, erection there will start as soon as concentrator building is completed. Exceptionally rapid progress is being made on concentrator building, two-boom traveler having finished its work Apr. 29. Locomotive crane will be able to erect what remains of upper benches, bins and trestle. Material is being got together to start concreting reservoir, just south of concentrator site. Outlet tunnel is already completed, and as soon as expanded metal reinforcing material is received concreting of reservoir proper will be started.

Maricopa County

ORO FINO (Phoenix)—Sinking will be resumed and drifting continued.

MARICOPA QUICKSILVER MINING CO. (Phoenix)—A Scott furnace may be installed.

GARCIA (Wickenburg)—Mill is being put in shape for early operation. Shaft has been unwatered and underground work will be started at once.

SUNSET (Aguilla)—Mill will be in operation within a few days. Custom ores will be treated in addition to those ores which will be obtained from claims owned by Jack Devine.

R. F. SCHAEFER (Peoria)—Has installation of a small mill on his gold property, 6 miles east of Vulture mine, under consideration. A dam has been built across a wash to furnish water.

CALIFORNIA

Amador County

HAYWARD (Ione; Manager Edward Allen)—Extraction of copper ore from this old mine near Ranlett, continues and as soon as wagon road is opened shipments will be made by rail to Selby or Mountain Copper Co. smelting plant. Mine was operated in early days by Alvinza Hayward; now owned and operated by Allen Estate.

Calaveras County

REINER (Angels)—By order of referee in bankruptcy proceedings at Stockton, this mining property, consisting of developed gravel ground and some surface improvements, has been advertised for sale on May 5. This order is outcome of complex litigation, due probably to bad management. Property is worth redeeming and operating.

Eldorado County

BIG CANYON (Shingle Springs)—Contract for 150 in. water from Diamond Ridge ditch has been made. Mine is equipped with hoist and compressor driven by water power. Main ditch is being cleared. Extensive development is contemplated.

Inyo County

MODOCK (Darwin)—Examination is being made of this mine and others in district for J. W. Kelley.

CASA DIABLO—Pipe line is being cleared of snow preparatory to necessary repairs. Development of mine will proceed as soon as snow is gone.

RIP VAN WINKLE (Darwin)—It is reported that a 2-ft. vein of good ore has been disclosed. Ore is silver-lead and said to be similar to ore of Defiance mine adjoining.

MINNIETTA (Trona)—Ore is being hauled by auto truck to Slate Range divide, and there assisted over range by mule teams. From west side of range auto truck hauls ore to Trona station of new railroad recently completed by American Trona Co., connecting with Southern Pacific at Garden station near Searles. Ralph Williams has had an examination made with a view of selling mine.

Kern County

KING SOLOMON (Randsburg)—Property has been incorporated under name of Shipsey Mining Co. Capital stock \$500,000. Mine is one of the regular producers of Randsburg district. Last milling at Red Dog mill was 40 tons of medium-grade ore.

CONSOLIDATED (Randsburg)—New electric pump at Wedge shaft recently installed is supplying ample water for stamp mill at Good Hope. Source of this water is still undetermined, but flow is and for some time has been greater than demand.

Nevada County

GOLDEN CENTER (Grass Valley)—Last cleanup of mill was valued at \$3250. Mine is producing this amount monthly.

DELHI—Breaking of compressor shaft caused temporary suspension of mining. Immediate repair followed and operations will be resumed.

NORTH STAR (Grass Valley)—Annual report shows total yield of \$1,200,096 in 1913. Dividends totaled \$300,151. Total production since 1884, \$15,245,180 and total dividends \$4,087,040.

CHAMPION (Grass Valley)—Good ore is reported on 1350-ft. level of Merrifield, and satisfactory development on 1000-ft. level of Ural is also reported. The 40-stamp mill is running steadily on average ore.

Placer County

POVERTY BAR DREDGE (Auburn)—Dredge has dug out flotation pond into which it was launched and is now working in river. This is third successful gold dredge built on middle fork of American River, and second one now in operation.

Shasta County

MIDAS (Knob, Harrison Gulch District)—Fire on 1200-ft. level, supposed to have been caused by leaving a burning candle close to a timber, was discovered on Apr. 23, and was reported still burning at last accounts. Three miners who had been overcome by smoke and heat were rescued by H. L. Waste, mine superintendent. No lives were reported lost. It was impossible to enter mine just after men were brought up. Only a portion of mine is timbered, but timbered portion is likely to be completely destroyed. There are two shafts, one 1300 ft. deep, other 600 ft. deep, connected by crosscuts and drifts. Smoke and fumes issue from both shafts. Midas is one of the oldest producers in Shasta County and is mine that put Harrison Gulch on the map. A new cyanide plant was recently built.

Tuolumne County

CALIFORNIA CONSOLIDATED MINING CO. (Tuolumne)—Articles of incorporation have been filed. Directors are Ryson A. Whittaker, Frank E. Boitano, of Tuolumne; J. F. Maganini, Quinto E. Maganini, Leonora I. Maganini, of Oakland. Capital stock, \$62,500 at 25c. per share. Principal place of business, Oakland.

RAWHIDE (Jamestown)—It is reported that mine has been sold to Eastern men by Alex Chalmers, representing Central Land & Trust Co., of Fresno. This mine and App, also Moore mine in Amador County were property of Captain Nevills, who died about time trust company took them over. App was operated to within a short time prior to Nevill's death, and was reported sold, but sale was not made. Rawhide has been idle for several years. Both were large producers.

COLORADO**Gilpin County**

GOLDEN ROD (Apex)—After two years' crosscutting, lode has been cut in 1600-ft. adit at depth of 375 feet.

PIONEER MILL (Pine Creek)—Old mill is being overhauled and up-to-date concentration methods will be adopted.

MCGREER CONCENTRATOR (Pine Creek)—Foundations are in for a 60-ton mill to treat ore from a group of mines.

ROCKY MOUNTAIN CONCENTRATOR (Black Hawk)—Plant has been leased by Arapahoe Mining & Milling Co., and is being remodeled and equipped for amalgamation and concentration; will run on custom basis for a time.

LONDON (Twelve Mile)—Mine and mill will start soon as roads can be shoveled out. Bottom of shaft and main drifts show 18 in. copper-iron sulphide of smelting grade, with 4 ft. of good concentrating ore. Cordwood will be used for fuel until an electric transmission line can be built this summer.

Lake County

VINNIE (Leadville)—Leasing company is driving from old workings on seventh level of Ibez No. 4 shaft to reach point under Vinnie shaft, whence a raise will be made to connect. Company expected to develop several shoots that were encountered and partially mined in other levels.

Summit County

WELLINGTON (Breckenridge)—An 8-ft. shoot of galena-sphalerite ore was recently opened in first level east. Wet mill will start as soon as roads will permit hauling of products.

IDAHO**Coeur d'Alene District**

FEDERAL MINING & SMELTING CO. (Mullan)—Because of low price of lead, Morning mine and mill were scheduled to be closed down May 1 for repairs. Among improvements contemplated is installation of a new air compressor underground at No. 6 station, which will be either 30 or 40 drill capacity. This new compressor will furnish additional air to ventilate properly extensive underground workings which Grouse Creek compressor was unable to supply.

MILITARY (Burke)—This group of claims at head of Military gulch, lying above Missoula Copper Co.'s ground, has been bonded to F. Cushing Moore and associates, of Wallace, for \$100,000. According to agreement, 5% of amount is to be paid on or before Aug. 1, 1914, 5% on or before Feb. 1, 1915, 5% by Aug. 1, 1915, 10% before Feb. 1, 1916, and balance of 75% on or before Aug. 1, 1916. Work will be started this spring. Work on Missoula and other properties in copper belt seems to have made this property an attractive one and same veins that have been opened in these properties may possibly be found in Military.

MICHIGAN**Copper**

MULES FOR UNDERGROUND TRAMMING are to be introduced in Lake Superior copper mines, according to local press notes. Mules, it is said, are being tried by Calumet & Hecla.

Iron

NEWPORT (Ironwood)—Hoisting record at this mine was again broken recently, when 4065 tons of iron ore came to surface during one 8-hr. shift, bulk of which came from a depth of 2000 ft. During March 80,000 tons were hoisted.

CASPIAN (Iron River)—First of McDermott ore-loading machines, designed by Capt. Henry McDermott, has been received from builders, Wellman-Seaver-Morgan Co., and is now being tried out at Caspian stockpile. It is designed for stockpile or underground use.

OLIVER IRON MINING CO. (Negaunee)—A steam shovel was placed at work at Prince of Wales shaft of Queen group this week. This is first Oliver property on Marquette range

to start shipping this year. A boat was to come in last week to take 8000 tons that is now being loaded.

TRADERS (Iron Mountain)—Republic Iron & Steel Co. will resume work at this pit mine, and water will be removed at once. A contract has been awarded to Hoose & Persson to strip 20,000 yd. of overburden from east part of property. Sales of ore amounting to 100,000 tons have recently been made for shipment this year.

CLEVELAND-CLIFFS IRON CO. (Ishpeming)—This company's storage reservoir was so low a few weeks ago that it was feared that steam turbines would have to be started and part of water-power plant at Marquette shut down. Water had all been drained and regular flow of Carp River was not sufficient for all purposes. Rains of late were so heavy that basins are filled to overflowing.

INDIANA (Iron Mountain)—After 35 years of idleness, this property is to be reopened by Thomas Furnace Co., of Milwaukee, which recently secured a lease from John T. Spencer, who took an option two years ago from Keweenaw Association. Spencer has done considerable development work and opened an orebody a short distance to west of old workings, which are filled with water at present. Shaft will be unwatered and a drift driven to new find. Part of machinery that will be required has been shipped from Milwaukee. Ore is low in iron, with little phosphorus.

MINNESOTA**Cuyuna Range**

CUYUNA IRON & MANGANESE ORE CO.—Drilling will soon be discontinued, pending outcome of negotiations with Eastern men for disposition of product. This company's explorations in recent months have substantially added to Cuyuna ore reserves.

DULUTH-BRAINERD (Ironton)—Shaft is 128 ft. deep. Construction of a spur line of Northern Pacific has been started by McCullough & Cheney, contractors. This short line will open up new territory, and is being constructed at great expense, as it cuts across part of Manohmen Lake, necessitating a large amount of piling.

LENOX DEVELOPMENT CO. (Brainerd)—Company just incorporated to develop lands on south range, south of Barrows mine; holding 254 acres; capitalization, \$100,000. President E. W. Thomas, Brainerd; vice-president, E. P. Adams, Little Falls, Minn.; secretary-treasurer, A. A. Arnold, Brainerd. Company will also plat Lenox townsite.

CUYUNA-DULUTH IRON CO. (Ironton)—At stockholders meeting, held in Duluth, Apr. 11, consolidation with Cuyuna-Mille Lacs Iron Co. and Dunbar Furnace Co. to form the American Manganese Mfg. Co., was ratified. T. W. Stevenson, Minneapolis, and C. B. Rowley, Brainerd, Minn., were chosen as company's representatives on merger board.

AMERICAN MANGANESE MFG. CO.—Edward E. Marshall, Philadelphia, has been chosen president, and L. R. Wister, vice-president of newly organized \$1,200,000 manganese company. It is understood that complete details of organization and financing have not yet been worked out. Scheme of organization places a valuation of \$2,605,000 on holdings of Dunbar Furnace Co., \$10,150,000 on Cuyuna-Duluth mine and \$20,350,000 on Cuyuna-Mille Lacs mine.

WILCOX (Brainerd)—Shaft now down 35 ft. Entire surface equipment has been ordered, and part is now on ground. This shaft will mark beginning of mining in a new district, it being six miles from nearest producing mine, the Rowe at Riverton. Canadian interests allied to mining company, have contracted for entire output for several years. Adjacent ground has been explored from time to time, and sufficient tonnage is indicated in vicinity to assure additional mining operations in the future. A townsite, Woodrow, has been platted on adjoining ground, midway between Brainerd and Deerwood, on line of the Northern Pacific Ry.

Mesabi Range

SLACK IRON ORE DEMAND is indicated by number of mines in Eveleth district, which have laid off night shifts and reduced day shifts. Labor is plentiful throughout entire district. At Buhl, Kinney mine is first and only shipper so far this season. Two Harbors dock opened for season Apr. 22, when 33 cars were received from Petit mine. However, several boats wintered at this dock and were loaded during winter. All have cleared for lower lakes.

Vermilion Range

VERMILION & MESABI IRON CO.—Drift from shaft toward orebody, on 300 level, is in 80 ft., and it is expected to encounter ore within a few feet.

MISSOURI-KANSAS-OKLAHOMA**Joplin District**

LONGACRE-CHAPMAN (Miami, Okla.)—Good run of zinc ore has been encountered by drifting.

AMERICAN LEAD & ZINC CO.—Extensive drilling campaign will soon be started at Aurora, Mo. Several drill holes found zinc ore at deep level.

ORONOGO CIRCLE (Oronogo, Mo.)—Production at this mine has been curtailed, due to low ore prices. Company has temporarily laid off 180 men and is operating only part of one shift.

WINGERT LAND (Joplin, Mo.)—Presence of ore in first drill hole put down by A. Scherl, M. Scherl and B. P. Ellis prompted sinking of a second. Both lead and zinc have been found. Tract in virgin mining territory.

CAMERON (Sarcoxis, Mo.)—Mine has been leased to J. W. Boyd of Sarcoxis; includes 400-ton concentrator. New machinery is being installed, but operations will be deferred, pending improvements in ore market; it once was operated profitably.

CHURCH-MABON CO. (Miami, Okla.)—Contract for 9000 ft. of drilling has been awarded. Company has 400 acres leased, entire tract virgin, but near McConnell & Barnes mine, now producing. Lease is also held on 40-acres near Bluebird mine and contract for 2500 ft. of drilling there has been awarded.

MONTANA

Deer Lodge County

GEORGETOWN GOLD MINING CO. (Georgetown)—Patent has been granted for six claims, covering an area of 54 acres, located close to Cable and Southern Cross mines, latter being worked by Anaconda Copper Mining Co. Some 1500 ft. of development work has been done. Ore assays up to \$30 per ton in gold.

COPPER EXTRACTION CO. (Anaconda)—Plant where Bradley process was being tried out has been closed down since Apr. 22, 1913.

Granite County

COYLE (Harmark)—Inclined shaft sunk on vein by Courtney Bros., lessees, is being provided with a gasoline hoist. Vein is 10 ft. wide and ore extracted in development work is shipped to smelters.

Lewis & Clark County

HELENA MINING DISTRICT—A campaign, launched several months ago by Helena mining men and citizens, resulted in raising a fund of \$54,000 for development of promising properties in Helena district. Plans of committee in charge of enterprise provide first for a listing of all mining properties in district, the owners of which want them developed or hold them for sale, owners signing a contract stating on what terms they will do business. A competent mining engineer is to make a selection whereupon development company will carry on work over a period of three years. Should such work result in discovery of valuable orebodies or in sale of property at a good price, it would prove a good investment to subscribers to fund, although investment feature is not principal object of enterprise. It is expected that development of promising properties will attract capital and ultimately result in increased activity in mining and other industries about Helena.

Missoula County

AMADOR—It is reported that at a recent meeting of stockholders ways and means were discussed for reopening this mine, west of Missoula. Years ago considerable money was spent for surface plants, including a large power plant, a 50-ton smelter and a 10-mile railroad, before mine had proved capable of furnishing necessary ore. These expenditures threw mine into litigation and caused it to be closed down. Present plans for reopening include erection of a concentrator and adjusting of machinery to development work planned for future.

Powell County

ELK GOLD MINING CO. (Deer Lodge)—Ground involved in case of this company vs. Timothy Buckley was recently inspected by Register Binnard and Receiver Freeman, of Helena land office, to decide on merits of company's claim that land in dispute was more valuable for mining than for agricultural purposes. Portion of land was originally filed on as a homestead by Buckley. Samples from property taken by officials of land office showed \$2.40 to \$20.15 per ton. This caused these officials to declare in favor of mining company.

Silver Bow County

ANACONDA COPPER MINING CO. (Butte)—On morning of Apr. 21, an ore train of Anaconda company, consisting of 60 loaded cars, en route from Butte to Anaconda, was wrecked near Gregson Springs; 18 cars jumping rails were piled into a mass of twisted steel. It took all day and part of next day to clear track of some 800 tons of ore and wreckage. Passenger trains between Butte and Anaconda were run over Northern Pacific tracks by way of Montana Union tracks.

NEVADA

Elko County

NEVADA'S SOAP MINE, according to a San Francisco press statement, several years ago produced a few hundred tons of soap for commercial purposes. The mine has been sold to San Francisco men who held an option. Property will be incorporated under name of Nevada Natural Products Co. with a capital of \$250,000. Several years ago Pullman Car Co. contracted with mine owners for a year's supply of soap, but refused to renew contract, as soap was either carried off by passengers or sold to them by porters for its souvenir value. [Statements about this soap mine have appeared from time to time in Western newspapers for last six months. Is this one of those fake news stories launched by a joksmith of Winnemucca? Imagine the sneezing attending drilling in dry soap formation; such a mine might be expected to yield "Cast steel" soap, or make a bubble and burst.]

Esmeralda County

GOLDFIELDS ORO MINING CO. (Goldfield)—Shaft is now 820 ft. deep. At 805-ft. point a vein, lying almost horizontal, was struck, and has been penetrated for 15 ft. Station is being cut at 810-ft. level and shaft will be sunk 15 ft. deeper for sump.

FLORENCE-GOLDFIELD (Goldfield)—Development work is being continued with satisfactory results in ore shoot recently discovered between 150- and 100-ft. levels north. Good grade ore, 8 ft. wide, is being stoped above and below 100-ft. level. This same shoot has been opened on 50-ft. level. On 250-ft. level, 3-ft. hanging-wall shoot, of good grade is being developed.

Lander County

GLASGOW & WESTERN (Battle Mountain)—Decision of case of this company against defendants it alleges jumped its claims has been decided as follows: As regards Evening Star and Midas claims court upheld that locations were valid lode locations, but that they could not have been made in good faith as discovery points were not in center of claims, discovery of Evening Star being 93 ft. to one side of center of that claim, and in case of Midas 107 ft. from center. In case of Salt Lake No. 3 original discovery point was covered up when a leaching plant was constructed thereon in 1912, and as actual buildings of this leaching plant only extended 100 ft. from east side line of claim in question court decided that not more than 300 ft. of

claim in question could stand westerly from site of plant. This decision means that Salt Lake west side line has to be drawn in 200 ft., and must parallel east side line when thus drawn in, and that west side line of Midas must be drawn in 107 ft., and east side line of Evening Star similarly treated to extent of 93 ft., result of which action is to give to defendants 850 ft. of gulch in which placers are situated. Glasgow & Western Exploration Co. proved that lode discoveries were valid, and that usual conditions relating to corner posts were complied with and will carry case to court of appeals.

Lincoln County

YUBA LEASING CO. (Pioche)—Ore is now being hoisted at No. 3 hoist. Second shift of miners has been put on.

AMALGAMATED PIOCHE (Pioche)—Stringers of lead-zinc sulphide were cut recently in crosscut, being driven to Raymond & Ely fissure, on 14th level of No. 1 shaft. This is considered an encouraging indication. Second pump was installed on 14th level; this, it is hoped, will be able to handle additional flow from crosscut.

Mineral County

NEW CAMP OF BOVARD, about four miles from old town of same name, is springing up rapidly. Considerable good-grade gold-silver ore is being hauled to Gillis station on the Nevada & California R.R., from where it is shipped to Thompson smelting plant.

CHAMPION (Luning)—Property consists of seven patented claims and has been developed to a depth of 400 ft. Considerable ore has been shipped and there are 2000 tons of commercial ore on dumps at present.

AURORA CONSOLIDATED (Aurora)—Extension of option to Goldfield Consolidated has been refused and control of property will remain with Knight Investment Co., of Salt Lake City. All machinery for mill is on ground and is being installed. Mill, which will have capacity of 500 tons daily, will be in operation by June, it is expected. Electric haulage will be used in mine, motors hauling six, 2½-ton cars. Daily mill tonnage can be supplied in eight hours.

ALAMEDA GROUP (Luning)—C. R. Dwight and T. R. Davies have recently undertaken development of this property under a lease and bond. The 13 claims comprising group include old Lime Point mine that is credited locally with a production of \$800,000. Present operators are developing two veins, outcrops of which are traceable on surface for 2000 ft. These are apparently fissure veins in limestone, and recent work indicates that property has merit; 73 tons of copper ore, carrying 8% copper and 4 oz. silver, extracted during development work was shipped to smelters early this year.

SHIPPERS COPPER MINING CO. (Luning)—Company owns two claims 3¼ miles southeast of Luning. Traversing claims in a northeasterly direction are two and sometimes three parallel outcrops, readily traceable for 3000 ft. and showing copper ore at intervals. They are in dolomite though a bed of blue limestone may ultimately prove to be hanging wall. An incline shaft has been sunk to 400-ft. level, giving a vertical depth of 300 ft. below surface, and several hundred feet of laterals have been driven. This work has demonstrated that veins cut limestone beds at a slight angle and that grade of ore is better a little below than at surface, though veins still show evidence of prolonged leaching. Crosscuts will be driven to determine width of mineralized zone, and work on a 3000-ft. adit will be commenced early this summer. This tunnel will develop property 900 ft. below present workings and preliminary work has shown that ore of shipping grade occurs at point selected to begin operations. Property has been a producer for last two years and has shipped \$17,000 worth of ore.

NEW MEXICO

Grant County

CENTER STAR (Lordsburg)—Property has been bonded to El Paso men.

CLIFFORD GROUP (Stelns)—Property is said to be under bond and lease to Thomas Lester, of Lordsburg. Pay streak was recently discovered.

CHINO COPPER CO. (Hurley)—Additions are being made to power plant. It is rumored that upon completion of crushing plant at Santa Rita another unit will be added to mill. Company is setting out trees and generally improving appearance of its camp.

Socorro County

PACIFIC MINES CO. (Mogollon)—It is reported that contract has been closed with Confidence mine whereby latter will furnish current from its hydro-electric plant on White-water. Stope below 250-ft. level continues to furnish high-grade mill ore.

EBERLE (Mogollon)—Cars, track and other equipment have been ordered and will be installed immediately upon arrival. Work has been started cleaning out South tunnel and grading for ore bin and tramway. Good ore is exposed in a crosscut 300 ft. from portal. Work in North tunnel will be started soon. All ore extracted from development will be shipped to custom mill. Work is being conducted by Oaks Co., which holds an option on mines.

OREGON

Jackson County

CASADAGA GOLD MINING CO. (Ashland)—New machinery is to be installed in this mine this spring.

EAGLE—Braden estate has given a lease on this property to G. A. Richter, of Troutlake, Wash., and W. F. Teeple, of Marysville, Wash., who will operate it for season.

ST. ALBANS—If summer's work on this property in Blue mining district turns out as well as present indications portend, a concentrator will be built and machinery installed.

Josephine County

OPP—This property in Jacksonville district has been purchased by O. Jackson. Mine is now equipped with considerable machinery, and it is new owner's intention to operate steadily.

UTAH

Beaver County

CEDAR-TALISMAN (Milford)—Connections are being made between Cedar inclined shaft and incline drift on vein. This work, when completed, will do away with donkey engine now in use; and permit mining ore which heretofore could not be handled.

SHEEP ROCK LEASING, MINING & MILLING CO. (Beaver City)—This company has been recently incorporated to take over a three-year lease on Sheep Rock property. Much development is planned, and mill is to be enlarged. At present 5-stamp mill is treating nine tons of ore daily.

MOSCOW (Milford)—Shaft, which is being sunk to 1000 level is down 700 ft.; a station has been cut on 600, and drifting is being done on ore opened by shaft. Small bunches of galena have been encountered below 600. When shaft has been completed and connections have been made with old workings cost of mining will be less. Owing to low price of lead and to development in progress, April output will not equal that of March, which amounted to 12 cars.

Juab County

TINTIC DELMAR (Eureka)—Work has been resumed at this property in North Tintic.

COLORADO (Silver City)—During March nine cars of silver-lead ore were shipped by lessees.

RIDGE & VALLEY (Eureka)—First shipment in over a year was made week ended Mar. 13. Work is carried on through Gemini.

SCRANTON (Eureka)—Zinc ore is being mined on the upper levels, and development work on the 600, lowest level in mine, is encouraging.

OPOHONGO (Mammoth)—Ore-carrying gold and some copper is being opened between 600- and 700-ft. levels. So far as developed it is up to 12 ft. in width.

GOLD CHAIN (Mammoth)—A winze has been sunk from 950 level, and work from winze has opened promising ore in west vein. Ore carries lead and silver. Present shipments, amounting for week ended Apr. 17, to eight cars, are coming largely from 700-ft. level.

GRAND CENTRAL (Eureka)—Ore running well in gold and silver has been produced recently from 700-ft. level. High-grade ore is from 2 to 4 ft. in width, and two cars monthly of ore of this character are shipped. Shipments for the week ended Apr. 17 were 11 cars.

EAGLE & BLUE BELL (Eureka)—New oreshoot on 1550 has been opened by a winze 14 ft. below level. Ore is a lead-carbonate, carrying silver and gold. A raise is up 50 ft. in ore. Winze will be continued, and shaft may be sunk to greater depth, should development warrant.

DRAGON CONSOLIDATED (Silver City)—A shipment of lead-silver ore will be made soon from strike on 800. Vein is from 6 in. to 3 ft. wide. Copper ore is being mined from northern end of property through Black Jack. Work is being done on south, through Iron Blossom No. 1 shaft.

GODIVA (Eureka)—Work is to be started soon by a leasing company, which will operate mine and mill. When mine was productive several years ago, large bodies of low-grade ore were opened between 700- and 900-ft. levels. Shaft was sunk to 1200, and work discontinued before much prospecting had been done. This level will receive especial attention.

GEMINI (Eureka)—During March, 2600 tons of ore were produced. Property is being operated under leasing system. According to J. C. McChrystal, manager, ore averages \$26.82 per ton, gross. About 150 lessees are at work between 400 and water level, which is a little below the 1600. Much new ore has been opened. April shipments are expected to be same as those for March.

Summit County

THOMPSON-QUINCY (Park City)—Seven mine cars of first-class and 10 of milling ore were produced from development work week ended Apr. 12.

ONTARIO (Park City)—Report for 1913 shows 1184 tons of ore to have been mined and shipped. A large amount of mill ore was handled, greater part of which was left in stopes. Work during year has been confined to opening up and prospecting old stopes on and above 1500-ft. level. Three stopes were opened, but particular attention was given to one stope, in which considerable ore was developed. Connections were made from this stope from 1500- to 1100-ft. level. Ground opened during year is being sampled. Indications are favorable, and it is expected that it will be possible to ship considerable ore from this territory, as well as to mine a large amount of milling ore. Receipts were \$47,324, there being \$16,359 from ore sales, \$4059 in royalties from Mines Operating Co., \$12,356 from rents and royalties, \$10,197 from interest, and miscellaneous receipts amounting to \$4351. Disbursements were \$49,010, and year closed with cash assets of \$338,678.

WASHINGTON

Chelan County

HOLDEN GOLD & COPPER CO. (Chelan)—This company, Walter J. Nichols, president, is planning development of claims near Chelan. Some improvements are being made.

Ferry County

PHOENIX—Great Northern Ry. Co. is contemplating construction of a spur to this mine, which will benefit others in same district.

Stevens County

JAY GOULD (Chewelah)—This property, which has been in hands of a receiver for several years, has been bonded to G. Broulet and others, who are making preparations for improving it.

UNITED COPPER (Chewelah)—Recent strike of high-grade copper ore has done much to stimulate operations in district, and several other properties are making preparations for development work.

WISCONSIN

Zinc-Lead District

DUGDALE LEAD & ZINC CO. (Platteville)—Company has resumed development work on Dugdale farm, four miles east of Platteville.

VINEGAR HILL ZINC CO.—A new run has been proved on Kennedy tract, one-fourth mile north of Unity mine, and mill equipment from Unity No. 1 will be removed.

WISCONSIN ZINC CO.—Company has leased Campbell separating plant, at Cuba City, to treat blende concentrates from Federal, Winskill, Champion and other mines.

LONGHENRY BROS. (Benton)—A good run of zinc ore 2½ miles south of Benton has been opened; a tract of 110 acres has been prospected by extensive drilling and four shafts have been sunk to ore.

CANADA

Alberta

ATHABASKA MINING CO., LTD. (Edmonton)—Company has been incorporated with capital stock \$1,000,000, to explore all that country contiguous to Lake Athabaska and Great Slave Lake. Company owns 800 acres of nickel claims, 160 acres of iron claims, and various materials for carrying on of its work. No development has yet been done, policy of syndicate having been to secure by staking and prospecting as large an area as possible, but it is intention that amount raised by present issue will be devoted to development of properties.

British Columbia

BRITISH COLUMBIA COPPER CO. (Princeton)—Quarters for staff are being erected at Princess camp, Copper Mountain.

PORTLAND CANAL TUNNELS—A shoot of ore ranging in width from a few inches up to 4 ft. has been followed for 200 ft.

STANDARD SILVER-LEAD MINING CO. (Silverton)—Regular monthly dividend of \$50,000, or 2½ c. per share on issued stock, has been declared for April.

SLOCAN STAR (Sandon)—Ore has been struck in east crosscut of No. 10 level. Vein is 3 ft. wide and was reached 700 ft. from main deep-level adit. This gives stoping ground up to No. 8 level, nearly 200 ft. West drift has been in ore for some time.

GOLDEN DREAM MINING CO. (Lillooet)—Company has just completed a wing-dam on South Fork of Bridge River at a cost of \$10,000 for purpose of reclaiming some of best placer ground on river. Dam is 410 ft. long, 14 ft. wide at base, 12 ft. wide at top and 14 ft. high.

GRANBY CONSOLIDATED (Grand Forks)—Stockholders will be asked, at a meeting, to be held May 13, to authorize directors to borrow to extent of \$3,000,000 when necessary. At present directors are authorized to borrow to extent of \$1,000,000, but as company's shipments from now on will be twice as large as those heretofore made, it may be necessary for management to borrow money on metal in transit to a greater extent than is now done. Company has \$3,500,000 6% bonds in treasury, but these bonds will be used only for acquisition of new properties, etc.

Ontario

SENECA SUPERIOR (Cobalt)—Ore-dressing plant of 30 tons daily capacity is being built.

DOME (South Porcupine)—Annual meeting will be held June 26. New mill should be in operation by that time.

CHAMBERS FERLAND (Cobalt)—Minority shareholders are organizing to oppose sale of property to Aladdin Cobalt.

COBALT TOWNSITE (Ontario)—New hoist has arrived at Cobalt and is one of the largest in camp. It is expected that new shaft will be ready for hoisting of ore by end of June.

CROWN RESERVE (Cobalt)—Company has shipped 20 tons of 4000-oz. ore to Saxony; estimated value is over \$50,000.

VIPOND (Schumacher)—A proposal has been put forth to form a new company and issue 750,000 shares for assets of present company on basis of three shares of new company for eight of old. It is proposed to issue 300,000 shares at 30c. to provide funds to put mill in shape and carry on operations.

TIMISKAMING (Cobalt)—Report by new management states there is no ore above 400-ft. level and no high-grade ore available below 400. There is, however, considerable mill ore and possibilities of encountering new high-grade ore are good. Mill should be able to pay for current expenditures, but resumption of dividends will not be considered. Available balance is \$116,304.

COSTA RICA

AGUACATE MINES (San Mateo)—Orders have just been placed for 6x12-ft. Chalmers & Williams tube mill, 10x20-ft. Dorr thickener, and Dorr, Type C thickener, to separate sands and slimes. Crushing plant is at 700-ft. level and ore is crushed in water; 1500 tons are now being reduced monthly. Ore is crushed in a gyratory crusher, fines bypassed to a Huntington mill and coarse ore goes to 10 heavy stamps. When new tube mill arrives, ore will be crushed by stamps and Huntington mills to ¼ in., and fed to tube mill, which will grind to 120-mesh. Amalgamating plates will then be placed at head of cyanide plant, in which sands and slimes will be treated separately, sands by percolation and slimes by air agitation and decantation, for the present. Developments in mine during last eight months have been exceedingly satisfactory, and since February mine has been making a profit over all expenses and new equipment.

SALVADOR

BUTTERS DIVISADERO CO., LTD.—A new shaft is being sunk near mill, production from lower levels through old shafts having been interfered with by ground conditions. New shaft, which is expected to be completed in August, is down 200 feet.

The Market Report

METAL MARKETS

NEW YORK—May 6

The metal markets have not been especially active, but have not shown any serious losses, fluctuations in prices being small.

Copper, Tin, Lead and Zinc

Copper—Following the activity at the end of April, the leading producers, having sold considerably at 14¼c., delivered, usual terms, raised their asking price to 14¾c. A few transactions were made around 14.30c., and then the demand petered out completely and the market became extraordinarily dull. Offers to sell at 14¼c. were made by smaller agencies, and then at 14½c., delivered, usual terms, at which price copper was available at the close. It is generally believed that quantities in second hands are not large and that as soon as any sizable demand makes its appearance, second-hand copper will be quickly absorbed. The average of quotations for the week is 14.046c. Lake copper is reported sold in small quantities on the basis of 14¼c., net cash, New York.

The standard market has been quiet and weak. On Apr. 30, spot was £64; three months, £64 5s. It declined 5s. on May 1 and further 6s. 3d. on May 4. On Wednesday, May 6, spot closed at £63 5s., and three months at £63 10s. per ton.

Base price of copper sheets is now 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15¼@15½c. per lb., carload lots at mill.

Copper exports from New York for the week were 10,536 long tons. Our special correspondent reports exports from Baltimore for the week at 2681 tons.

Visible Stocks of Copper in Europe on May 1 were: Great Britain, 11,520; France, 2310; Rotterdam, 3400; Hamburg, 4450; Bremen, 1100; other European ports, 600; total, 23,380 long tons, or 52,371,200 lb. This is an increase of 1530 tons over the April 15 report. In addition to the stocks given 2500 tons are reported afloat from Chile and 5000 from Australia, making a total of 30,880 tons.

Tin—Ignoring entirely the favorable American statistics published at the beginning of this month, the market continued on the decline. Although transactions on the London Metal Exchange for the greater part of last week were not heavy, support was entirely absent, and values crumbled easily. Domestic buyers took advantage of the lower prices to buy future metal on a liberal scale. The market closes steady at £149 15s. for spot and £151 15s. for three months, and about 33c. for May tin here.

Corrected shipments of tin from the Straits, two months ended Feb. 28: United States direct, 4309; Great Britain, 5911; Continent of Europe, 1632; India and China, 327; total, 12,179 long tons, an increase of 1360 tons over last year.

Tin production of the Federated Malay States, three months ended Mar. 31, was 11,506 long tons in 1913, and 11,679 tons in 1914; an increase of 173 tons.

Visible Stocks of Tin on Apr. 30 are reported as follows: London, 10,096; Holland, 1059; United States, excluding Pacific ports, 4292; total, 15,447 long tons, a decrease of 1542 tons from Mar. 31. Of the London stock, 3622 tons were Straits, 2920 standard tin and 3554 tons afloat.

Messrs. L. Vogelstein & Co., New York, estimate supplies of standard tin in April at 8255 tons; deliveries, 9858; stocks, Apr. 30—including tin afloat—16,597 tons. These figures include Bolivian and Chinese tin.

Lead—The market has been steady at unchanged prices, a fair volume of business being reported. The St. Joseph Lead Co. is soon to bring out a new brand of lead. This will be known as the "Doe Run." It will be desilverized Missouri lead.

The London market is slightly easier, Spanish lead being quoted £18 15s.; English lead, 7s. 6d. higher.

Exports from Baltimore for the past week included 56,066 lb. lead to Hamburg, Germany.

Spelter—In the early part of the week the market suffered a further relapse, some sizable lots being sold at 4.82½c. There was an improvement in the demand and a considerable tonnage sold at 4.85@4.90c. The largest consumer was a buyer during the week. Buyers generally are believed to be poorly covered, and it is generally recognized that the present price of spelter is low.

The London market is somewhat easier; good ordinaries being quoted £21 7s. 6d.; specials, £21 15s. per ton.

Base price of zinc sheets is now \$7 per 100 lb. fo.b. Peru, Ill., less 8% discount, with the usual extras.

DAILY PRICES OF METALS

NEW YORK

Apr. May	Sterling Exchange	Silver, Cts. per Oz.	Copper		Tin		Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.		
			14.10						4.97½	4.82½
30	4.8745	59½	@14.20	34½	3.90	3.80	@5.00	@4.85		
			14.05						4.97½	4.82½
1	4.8740	59½	@14.15	34	3.90	3.80	@5.00	@4.85		
			14.00						4.97½	4.82½
2	4.8755	59½	@14.10	34	3.90	3.80	@5.00	@4.85		
			14.00						5.00	4.85
4	4.8750	59½	@14.05	33½	3.90	3.80	@5.05	@4.90		
			13.95				5.00	4.85		
5	4.8755	59½	@14.00	33½	3.90	3.80	@5.05	@4.90		
			13.95				5.02½	4.87½		
6	4.8770	59	@14.00	33	3.90	3.80	@5.07½	@4.92½		

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

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

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15¼c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12¼c.; New York-Bremen or Rotterdam, 15c.; New York-Havre, 16@17½c.; New York-London, 16c.; New York-Hamburg, 18c.; New York-Triests, 22c.

LONDON

Apr.-May	Copper				Tin		Lead		Zinc		
	Silver	£ per Ton	Cts. per Lb.	3 Mos.	Best Sel'd	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
30	27½	64	13.90	64½	68½	156½	158½	18½	4.07	21½	4.67
1	27½	63½	13.85	64	68	155	157	18½	3.99	21½	4.67
2	27½	63½	13.85	64	68	155	157	18½	3.99	21½	4.67
4	27½	63½	13.78	63½	67½	153½	155½	18½	3.96	21½	4.64
5	27½	63½	13.76	63½	67½	150½	152½	18½	3.96	21½	4.64
6	27½	63½	13.74	63½	67½	149½	151½	18½	3.96	21½	4.64

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 = 2.17½c.; £15 = 3.26c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21½c.

Other Metals

Aluminum—The market has been more active and sales have been larger than for some time past. Prices are a shade firmer, 18@18½c. per lb. being quoted for No. 1 ingots, New York. The foreign market is reported stronger.

Antimony—The market continues quiet, with little or no change and only a moderate business. Cookson's is firmer at 7.40@7.50c. per lb. and Hallett's at 6.90@7.10c.; while 5.75@6c. per lb. is named for Chinese, Hungarian and other outside brands.

Quicksilver—Trade continues fair and prices are unchanged. New York quotations are \$38 per flask of 75 lb. for large lots and 54c. per lb. for jobbing orders; San Francisco, \$38 for domestic orders, and special terms—usually about \$2 less—for export. The London price is £7 per flask with 16 17s. 6d. asked from second hands.

Exports of Metals and Minerals from Spain in January, as reported by "Revista Minera" in metric tons:

	Metals		Ores	
	1913	1914	1913	1914
Iron.....	1,430	242	813,152	642,769
Copper.....	1,833	1,552	15,348	13,655
Copper precipitate.....	372	985		
Lead.....	15,473	16,138	189	120
Zinc.....	7	36	12,687	12,077
Quicksilver.....	2			
Manganese.....			2,291	2,757
Pyrites.....			294,066	228,633

Exports of salt for the month were 37,150 tons in 1913, and 54,776 in 1914; an increase of 17,626 tons.

Gold, Silver and Platinum

Gold—The demand for gold on the open market in London is still strong, and as high as ¾d. premium was paid over the Bank price of 77s. 9d. per oz. for bars. India, Russia and France were the chief buyers. In New York, \$1,000,000 gold was taken for export to Paris.

Gold in the United States May 1, as estimated by the Treasury Department: In Treasury against gold certificates outstanding, \$1,158,997,869; in Treasury current balances, \$170,792,785; in banks and circulation, \$612,771,453; total, \$1,942,562,107, an increase of \$15,382,889 during May.

Iridium—With a moderate demand quotations remain \$75@78 per oz. for pure metal, New York.

Platinum—The market is quiet but steady, and no change can be reported in prices. Dealers ask \$43@44 for refined platinum and \$46@49 for hard metal.

Our Russian correspondent reports, under date of April 23, that the market is steady and prices are unchanged. The quotation at Ekaterinburg is 9.65 rubles per zolotnik for crude metal, 83% platinum; at St. Petersburg 37,100@37,200 rubles per pood for the same grade—equivalent to \$36.26 and \$36.41 per oz., respectively. From Ekaterinburg it is reported that developing and prospecting work on the platinum mines is started and will be carried out on a larger scale than in the previous year. Many placers heretofore allotted to the staratelli will be worked by the owners themselves. Almost all the dredges are now in operation.

Silver—The market for silver has ruled steady and quiet around 27½d. in London. The stoppage of shipments from Mexico has had a bullish influence.

Shipments of silver from London to the East, Jan. 1 to Apr. 22, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India.....	£2,501,300	£2,306,500	D. £194,800
China.....	166,000	40,000	D. 126,000
Total.....	£2,667,300	£2,346,500	D. £320,800

Exports of gold from London to India for the week were £317,000 in all.

Coined Silver in the United States May 1, as reported by the Treasury Department: Standard dollars, \$565,792,263; subsidiary coins, \$180,764,269; total, \$746,556,532. Of the silver dollars \$467,033,000 are held against silver certificates outstanding.

Zinc and Lead Ore Markets

Blende sold as high as \$43, the assay base being \$35@40 and the metal base \$34@37 per ton of 60% zinc. Calamine sold at \$20@22.50 per ton of 40% zinc. The average price of all grades of zinc is \$35.92 per ton. Lead sold up to \$47.50 on a base of \$45@46 per ton of 80% metal content, \$1 advance being made in midweek. The average of all grades is \$45.46 per ton.

Dissatisfaction with the receding price of medium and low grades of zinc ore is causing increasing talk of closing down. Rumor was current today that some mines would close down tonight, but it could not be verified.

SHIPMENTS WEEK ENDED MAY 2

	Blende	Calamine	Lead	Value
Totals this week	12,234,700	555,980	1,847,590	\$271,775
Totals 18 weeks	188,831,690	11,956,370	32,180,940	\$4,650,210
Blende value, the week, \$223,830; 18 weeks, \$3,729,260.				
Calamine value, the week, \$5935; 18 weeks, \$134,565.				
Lead value, the week, \$42,010; 18 weeks, \$786,385.				

PLATTEVILLE, WIS.—May 2

The base price paid this week for 60% zinc ore was \$39 per ton; 80% lead ore sold at a base price of \$46@48 per ton.

SHIPMENTS WEEK ENDED MAY 2

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week.....	3,112,430	68,150	847,000
Year.....	50,974,470	2,080,420	16,155,420
Shipped during the week to separating plants, 3,084,420 lb. zinc ore.			

IRON TRADE REVIEW

NEW YORK—May 6

The iron and steel trades remain generally quiet, with comparatively few new orders coming forward, except in a few lines.

The steel companies have been curtailing operations to some extent both at mills and blast furnaces.

Lake Superior ore interests have announced 1912 ore prices as the basis on which they are ready to do business for 1914, thus effecting reductions of 65c. on bessemer and 55c. on nonbessemer from the 1913 prices. Usually the price announcement is accompanied by sales of round tonnages, but at this time the market is very quiet. Pig-iron and steel prices have declined to such an extent as to discount fully the ore reduction. Indeed, when the reduced prices of 1912 were named, pig-iron and steel prices had just begun an advance that was destined to continue for months.

It is not thought that pig-iron and steel prices will be affected by the reduction in ore prices for 1914 as compared with the 1913 prices. Pig-iron prices are only a shade higher than they were on Mar. 20, 1912, when similar ore prices were announced, but coke is now costing the furnaces more money. Finished-steel prices are only a shade higher, also, and in both pig iron and finished steel there has meanwhile been an advance in wages which is claimed to involve 50 to 75c. a ton in pig iron and \$1.25 to \$1.75 in finished steel, or much more than the margin by which prices are higher now than in March, 1912. The fact has been much advertised of late that merchant furnaces have been selling pig iron at a loss of about a dollar a ton. As a matter of fact, this represented merely a discounting of the present ore reduction, as the furnaces knew their ore piles could be replaced for considerably less than they paid in 1913.

With regard to the proposed changes in the Pennsylvania Steel Co., it is definitely stated that W. H. Donner, president of the Cambria Steel Co., will become chairman of the board of directors of the Pennsylvania Steel Co. It is understood that Mr. Donner was solicited to assume this position by Pennsylvania R.R. and Philadelphia & Reading interests, the two railroads together owning most of the stock of the Pennsylvania Steel Co., while the former alone has more than a controlling interest. It is expected that no important changes of officers of any of the interested companies—the Cambria, Pennsylvania and Maryland Steel—will be made for the present at least. Later there may be an actual consolidation of the companies, but this is not yet decided.

PITTSBURGH—May 5

There is no improvement in steel demand, but on the other hand, demand for some products seems to have experienced a further decrease. Taking everything into consideration, there are many good judges of the situation who admit frankly that the situation, as to conditions and prospects, is worse now than it was in December when the market was at a low point as regards demand and prices.

Steel orders are not averaging more than 50% of capacity, and production, which was at 75% of capacity early in

March, continues to decline until it is variously estimated at 50% or 66% of capacity, with the tendency still downward. The Steel Corporation has blown out 10 furnaces in the past 10 days, while other steel interests are also curtailing.

Pig Iron—The market is absolutely stagnant; sales are small in tonnage and infrequent. Prices, however, are well held, and it is claimed that no declines are to be expected. Only six out of the 15 merchant furnaces in the Mahoning and Shenango Valleys are in blast, but they are barely able to prevent stocks from accumulating. We quote: Bessemer, \$14; basic, \$13; malleable, \$13.25; No. 2 foundry, \$13.25@13.50; forge, \$12.75, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—There are rumors of additional shading in ferromanganese, but in general the market seems quotable at the old figures of \$38@39, Baltimore, for English or German, prompt or forward.

Steel—There is no interest in the market, which remains quotable at \$20 for billets, \$21 for sheet bars and \$26 for rods, at maker's mill, Pittsburgh or Youngstown.

IRON ORE

Although no large reservations have been made, the season's ore prices are reported fixed by some small transactions. The 1914 prices of Lake Superior iron ore delivered at Lake Erie ports are \$3.75 for Old Range bessemer and \$2.50 for Mesabi bessemer; \$3.05 for Old Range and \$2.85 for Mesabi nonbessemers. This is a reduction from 1913 of 65c. on bessemer ore and 55c. on nonbessemers. These prices, of course, apply only on merchant ores, or not more than 30% of the total.

Imports at Baltimore for the week included 16,850 tons iron ore from Cuba; 6500 tons manganese ore from Bombay, India.

COKE

Coke production in the Connellsville region is decreasing. For the past week the "Courier" reports the output at 313,757 short tons; shipments, 310,209 tons. Production in the Greensburg and Upper Connellsville districts was 44,635 tons.

Connellsville Coke—None of the furnaces uncovered for May on furnace coke has put out an inquiry for the month. Business amounting to about 20,000 tons a month, which was under contract for April at \$2, has been arranged to be continued in May for as long as the consumers need the coke. Prompt lots can be had at \$1.85@1.90, but there is hardly any demand. The leading operators who have been adhering to \$2 are still naming this price.

German Coal Production two months ended Feb. 28, in metric tons:

	1913	1914	Changes
Coal mined.....	32,145,071	31,833,712	D. 311,359
Brown coal mined.....	14,211,756	15,096,023	I. 884,267
Coke made.....	5,247,510	5,256,842	I. 9,332
Briquettes made.....	4,395,167	4,638,603	I. 243,436

Of the briquettes reported this year, 3,724,582 tons were made from brown coal, or lignite.

German Foreign Trade in Fuel, two months ended Feb. 28, in metric tons:

	Exports	Imports	Excess
Coal.....	6,116,622	1,329,072	Exp. 4,787,558
Brown coal.....	16,131	940,209	Imp. 924,070
Coke.....	942,480	69,339	Exp. 873,141
Briquettes.....	544,859	32,592	Exp. 512,267
Total.....	7,620,092	2,371,212	Exp. 5,248,880

Of the briquettes exported 172,213 tons were made from brown coal, or lignite.

CHEMICALS

NEW YORK—May 5

The general markets have been rather quiet, showing little change in conditions.

Arsenic—Business is still quiet and no changes are reported. Current quotations are \$3 per 100 lb. for both spot and futures.

Copper Sulphate—On a fair business there is no change in prices, which remain at \$4.80 per 100 lb. for carload lots, and \$5.05 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is quiet, but with fair sales for the season. Quotations are 2.22½c. per lb. for spot; 2.20c. for May; 2.17½c. for June; 2.15c. for deliveries from July forward.

Pyrites—Imports at Baltimore for the week included 6888 tons iron pyrites from Huelva, Spain.

PETROLEUM

The monthly report of the "Oil City Derrick" shows new wells completed in April as follows, the statement not including California: Pennsylvania grade, 683; Lima-Indiana, 146; Central Ohio-Gas, 31; Kentucky, 21; Illinois, 192; Kansas-Oklahoma, 1241; Texas-Louisiana, 193. A grand total of 2507 wells was completed with an initial production of 124,624 bbl. There were 504 dry holes and 175 gas wells. Compared with the March report, there was an increase of 371 in completions and a decrease of 6979 bbl. in new production. There were 121 more failures and 57 more gas wells. At the close of April the new work consisted of 710 rigs and 2570 drilling wells.

Petroleum production in California in March is reported at 8,941,024 bbl.; shipments, 8,867,052 bbl. Both production and deliveries are the largest ever reported.

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.

	December	January	February	March	April
Alaska shipments	3,104,155	2,701,258	1,803,579	2,069,960	22,900,000
Anaconda.....	25,100,000	24,400,000	21,300,000	23,800,000	.....
Arizona, Ltd.....	2,920,000	3,474,000	3,062,000	3,286,000	.....
Copper Queen.....	9,033,459	8,796,358	6,987,366	7,637,042	17,562,723
Calumet & Ariz.....	5,230,000	5,975,000	5,590,850	5,875,000	.....
Chino.....	4,390,018	6,488,220	5,642,426	5,369,814	.....
Detroit.....	2,021,034	1,590,681	1,814,214	1,973,725	1,790,926
East Butte.....	1,324,560	1,256,000	1,193,960	1,546,180	.....
Giroux.....	197,649	148,411	90,017	287,980	.....
Mason Valley.....	1,372,000	944,000	1,254,000	1,250,000	.....
Mammoth.....	1,400,000	1,625,000	1,400,000	1,800,000	1,850,000
Nevada Con.....	5,343,862	5,791,122	4,588,243	5,218,257	.....
Ohio.....	722,940	700,728	582,000	597,520	.....
Old Dominion.....	2,613,039	2,797,000	3,066,000	2,997,000	.....
Ray.....	5,075,202	5,005,000	5,432,000	6,036,908	.....
Shannon.....	1,078,000	937,432	903,761	1,082,000	1,012,000
South Utah.....	242,362	275,569	338,874	406,381	.....
Tennessee.....	1,700,000	1,474,890	1,232,812	1,262,184	.....
United Verde*.....	3,000,000	3,000,000	2,700,000	3,100,000	.....
Utah Copper Co.....	10,306,646	10,329,564	9,207,111	12,323,493	.....
Lake Superior*.....	5,600,000	7,400,000	8,500,000	11,000,000	.....
Non-rep. mines*.....	6,250,000	6,200,000	5,600,000	6,200,000	.....
Total prod.....	98,024,926	102,100,233	92,290,213	102,536,667	.....
Imp., bars, etc.....	23,578,938	24,504,249	19,918,448	.....	.....
Total blister.....	121,603,864	126,604,482	112,208,661	.....	.....
Imp. ore & matte.....	12,205,187	10,893,969	9,713,164	.....	.....
Total Amer.....	133,809,053	137,498,451	121,921,825	.....	.....
Miami†.....	3,210,000	3,258,950	3,316,482	3,361,100	3,130,772
Shattuck-Arizona	1,050,781	1,276,636	1,134,480	1,136,458	.....
Brit. Col. Cos.:					
British Col. Cop.....	795,004	607,930	.....	.....	.....
Granby.....	1,605,382	1,793,840	1,661,212	1,775,852	.....
Mexican Cos.:					
Boleof.....	2,315,040	2,369,920	1,984,080	2,535,680	.....
Cananea.....	3,646,000	3,460,000	2,688,000	4,260,000	.....
Moctezuma.....	3,139,613	3,024,556	2,642,543	2,882,884	2,654,926
Other Foreign:					
Braden, Chile.....	2,122,000	2,430,000	2,362,000	1,810,000	.....
Cape Cop., S. Af.....	683,200	519,680	459,200	.....	.....
Kyshtim, Russia.....	1,742,720	1,559,040	1,534,400	.....	.....
Spasky, Russia.....	900,480	902,720	902,720	.....	.....
Exports from:					
Chile.....	10,640,000	5,488,000	6,720,000	6,944,000	.....
Australia.....	6,720,000	7,712,000	7,952,000	8,176,000	.....
Arrivals—Europe†	13,787,200	8,599,360	18,354,560	17,572,800	.....

† 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'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
V, '13.....	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI.....	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII.....	138,074,602	58,904,192	78,480,071	52,814,606	77,904,000	124,808,606
VIII.....	131,632,362	73,649,801	73,263,469	53,594,945	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	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII.....	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	869,062,784	.....	.....	.....
I, 1914.....	131,770,274	47,956,955	87,955,501	91,438,867	53,916,800	145,355,667
II.....	122,561,007	47,586,657	83,899,183	87,296,685	50,108,800	137,405,485
III.....	145,651,982	69,852,349	89,562,166	78,371,852	47,376,000	125,747,852
IV.....	.....	.....	.....	64,609,319	46,435,200	111,044,519
V.....	.....	.....	.....	.....	52,371,200	.....

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

Assessments

Company	Delinq.	Sale	Amnt.
Advance, Ida.	Apr. 15	May 15	\$0.003
Alta Cons., Utah	.....	.....	0.05
Belcher, Nev.	May 4	May 26	0.10
Bullion Beck & Champion, Utah	Apr. 24	May 25	0.20
Bullion, Ida.	Apr. 11	May 11	0.005
Cedar Creek, Ida.	Apr. 27	May 26	0.01
Challenge, Nev.	May 12	June 2	0.05
Chollar, Nev.	Apr. 28	May 21	0.03
Confidence, Nev.	Apr. 21	May 11	0.10
Cons. Imperial, Nev.	Apr. 28	May 20	0.01
Davis-Daly, Mont.	.....	June 1	0.25
Diamond Black Butte, Mont.	Apr. 10	May 14	0.005
Florence, Ida.	Apr. 19	May 11	0.001
Gruttl, Utah	May 16	June 3	0.002
Hypothek, Ida.	Apr. 9	May 11	0.01
Idaho-Nevada, Ida.	May 7	June 1	0.001
Iron Mask, Ida.	.....	May 16	0.002
Montello, Utah	Apr. 25	May 16	0.005
Overman, Nev.	May 8	May 28	0.05
Rescue Eula, Nev.	.....	May 28	0.01
Royal, (formerly Penn.), Ida.	Apr. 23	May 18	0.0015
Samson, Ida. postponed	.....	May 28	0.002
Slavonian, Ida.	Apr. 30	May 30	0.002
Snowshoe, Ida.	Apr. 28	May 28	0.005
Tar Baby, Utah	May 1	June 1	0.005
Tintic Standard, Utah	May 11	June 1	0.005
Torino, Ida.	Apr. 16	May 16	0.001
Victoria, Mich.	Apr. 15	May 24	1.00
Wasatch-Utah, Utah	Apr. 6	May 11	0.01
Wisconsin, Ida. post'd.	.....	June 5	0.003

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	28.284	27.416	26.958
May	60.880	60.361	.....	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	14.223	16.767	14.772	71.741	64.304
February	14.971	14.491	15.253	14.929	65.519	65.259
March	14.713	14.131	14.930	14.625	65.329	64.276
April	15.291	14.211	15.565	14.563	68.111	64.775
May	15.436	.....	15.738	.....	68.807	.....
June	14.672	.....	14.871	.....	67.140	.....
July	14.190	.....	14.563	.....	64.166	.....
August	15.400	.....	15.904	.....	69.200	.....
September	16.328	.....	16.799	.....	73.125	.....
October	16.337	.....	16.913	.....	73.383	.....
November	15.182	.....	16.022	.....	68.275	.....
December	14.224	.....	14.904	.....	65.223	.....
Year	15.269	.....	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	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	38.038	213.615	173.619
April	49.115	36.154	224.159	163.963
May	49.038	.....	224.143	.....
June	44.820	.....	207.208	.....
July	40.260	.....	183.511	.....
August	41.582	.....	188.731	.....
September	42.410	.....	193.074	.....
October	40.462	.....	184.837	.....
November	39.810	.....	180.869	.....
December	37.635	.....	171.786	.....
Av. year	44.252	.....	206.279	.....

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

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	3.810	4.242	3.687	17.597	18.225
May	4.342	.....	4.226	.....	18.923	.....
June	4.325	.....	4.190	.....	20.226	.....
July	4.353	.....	4.223	.....	20.038	.....
August	4.624	.....	4.550	.....	20.400	.....
September	4.698	.....	4.579	.....	20.648	.....
October	4.402	.....	4.253	.....	20.302	.....
November	4.293	.....	4.146	.....	19.334	.....
December	4.047	.....	3.929	.....	17.798	.....
Year	4.370	.....	4.238	.....	18.743	.....

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

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.583
February	6.239	5.377	6.089	5.227	25.338	21.413
March	6.078	5.250	5.926	5.100	24.605	21.460
April	5.641	5.113	5.491	4.963	25.313	21.569
May	5.406	.....	5.256	.....	24.583	.....
June	5.124	.....	4.974	.....	22.143	.....
July	5.275	.....	5.128	.....	20.592	.....
August	5.658	.....	5.508	.....	20.706	.....
September	5.604	.....	5.444	.....	21.148	.....
October	5.340	.....	5.188	.....	20.614	.....
November	5.229	.....	5.083	.....	20.581	.....
December	5.156	.....	5.004	.....	21.214	.....
Year	5.648	.....	5.504	.....	22.746	.....

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

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
	January	\$18.15	\$14.94	\$17.35	\$13.23	\$18.59	$13.90
February	18.15	15.06	17.22	14.12	18.13	14.09
March	18.15	15.07	16.96	13.94	17.53	14.18
April	17.90	14.90	16.71	13.90	16.40	14.10
May	17.68	.....	15.80	.....	15.40	.....
June	17.14	.....	15.40	.....	15.10	.....
July	16.31	.....	15.13	.....	14.74	.....
August	16.63	.....	15.00	.....	14.88	.....
September	16.65	.....	15.04	.....	14.93	.....
October	16.60	.....	14.61	.....	14.80	.....
November	16.03	.....	13.91	.....	14.40	.....
December	15.71	.....	13.71	.....	14.28	.....
Year	\$17.09	.....	\$15.57	.....	\$15.77	.....

STOCK QUOTATIONS

COLO. SPRINGS May 5		SALT LAKE May 5	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	\$.02	Beck Tunnel	.04
Cripple Crk Con.	\$.007	Black Jack	.06
C. K. & N.	\$.07	Cedar Talsman	.00
Doctor Jack Pot.	.05	Colorado Mining	.10
Elkton Con.	.43	Crown Point	.02
El Paso	2.08	Daly-Judge	5.00
Findlay	.01	Gold Chalk	.12
Gold Dollar	.03	Grand Central	.59
Gold Sovereign	\$.02	Iron Blossom	1.27
Golden Cycle	\$.15	Little Bell	.15
Isabella	.11	Lower Mammoth	.01
Jack Pot.	.06	Mason Valley	2.25
Jennie Sample	\$.05	May Day	.06
Jerry Johnson	\$.03	Nevada Hills	.27
Lexington	\$.003	Prince Con.	.16
Old Gold	\$.01	Silver King Coal'n.	3.05
Mary McKinney	.47	Silver King Cons.	1.95
Pharmacist	.01	Stoux Con.	.03
Portland	1.06	Uncle Sam	.04
Vindicator	.05	Yankee	.02

TORONTO

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.02	Foley O'Brien	.15
Conlags	7.00	Hollinger	15.40
Peterson Lake	.43	Imperial	.01
Right of Way	.04	Jupiter	.10
T. & Hudson Bay	75.00	Pearl Lake	.06
Timskaming	.13	Porcu. Gold	.09
Wetlaufer-Lor.	.05	Preston E. D.	.01
Big Dome	9.75	Rea	.15
Crown Chartered	\$.00	Swastika	.02
Dome Exten.	.08	West Dome	\$.11

SAN FRANCISCO

Name of Comp.	Bid.	Name of Comp.	Bid.
Comstock Stocks	.....	Misc. Nev. & Cal.	.....
Alta	.01	Belmont	7.25
Belcher	.36	Jim Butler	.99
Best & Belcher	.03	MacNamara	.63
Caledonia	.48	Midway	.7
Challenge Con.	.02	Mont-Tonopah	.54
Chollar	.03	North Star	.29
Confidence	.24	West Eud Con.	.89
Con. Virginia	.09	Atlanta	.20
Crown Point	.27	Booth	.07
Gould & Curry	.01	C.O.D. Con.	.05
Hale & Norcross	.02	Comb. Frac.	.07
Mexican	.89	Jumbo Extension	.24
Occidental	.68	Pitts-Silver Peak	.30
Ophir	.12	Round Mountain	.28
Overman	.12	Sandstorm Kendall	.17
Potosi	.01	Silver Peak	.05
Savage	.08	Argonaut	2.50
Sierra Nevada	.05	Bunker Hill	\$.19
Union Con.	.07	Central Eureka	.52
Yellow Jacket	.15	So. Eureka	\$.15

N. Y. EXCH. May 5 BOSTON EXCH. May 5

Name of Comp.	Cig.	Name of Comp.	Cig.
Amalgamated	72	Adventure	1
Am. Sm. & Ref. com.	62	Ahmeek	270
Am. Sm. & Ref. pf.	100	Alaska Gold M.	26
Am. Sm. Sec. pf. B.	81	Algonah	.95
Anaconda	33	Allouez	40
Batopilas Min.	85	Am. Zinc	16
Bethlehem Steel, pf.	85	Ariz. Com., etis.	4
Chino	40	Bonanza	.51
Colo. Fuel & Iron	27	Butte & Blak.	2
Federal M. & S. pf.	32	Calumet & Ariz.	.65
Great Nor., ore, etf	32	Calumet & Hecla	425
Guggen Exp.	53	Centennial	16
Honestake	114	Chit.	1
Inspiration Con.	17	Copper Range	36
Mex. Petroleum	58	Daly West	2
Miami Copper	22	East Butte	.02
Nat'l Lead, com.	43	Franklin	5
National Lead, pf.	107	Granby	80
Nev. Consol.	14	Hancock	16