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Lead, Zinc and Copper Smelting in America—II

SYNOPSIS—A continuation of F. Heberlein's observations and comments on current American nonferrous metallurgical practice.

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Hand furnaces for roasting blende I have not seen anywhere in my travels. For this last purpose, the well known Hegeler furnace is used, even where it is not intended to utilize the sulphur of the blende which is most usually everywhere the case. Outside of the Hegeler furnace we find a whole series of Zellweger or Cappeau furnaces in operation. The latter is a kind of Ropp furnace altered to suit mechanical blende roasting. Neither of

with us. Even in zinc works, regenerators or recuperators are seldom used. In some places natural gas is still to be had at comparatively cheap prices, for instance in Pennsylvania, Kansas, Oklahoma, etc. The gas contains about 94% hydrocarbons (almost exclusively marsh gas), 1% CO and 4% N, and costs about 1/8c. per cu.m. Nearly 600 cu.m. of gas are equivalent in calorific value to about 100 kg. good coal corresponding to a coal price of \$1.25 per ton. A particular advantage of natural gas is that the cost of construction of the furnaces in which gas is burned is cheap and the operating of the furnaces is particularly clean on account of the absence

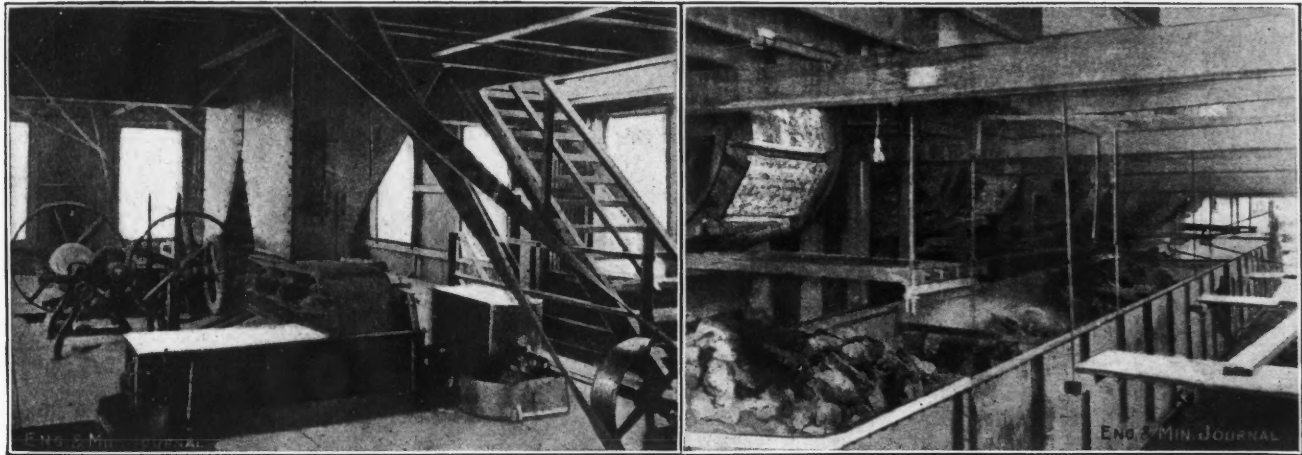


FIG. 1. DWIGHT-LLOYD STRAIGHT-LINE ROASTING PLANT

these furnaces has muffles, but a direct grate fire.

In reverberatory smelting for copper it is necessary to put the roasted ore as hot as possible into the furnace. The roasted ore from the Herreshoff and similar furnaces is dropped into skips suspended on an aerial ropeway, which delivers it, red hot, into the hoppers of the furnace. Moist ores intended to be smelted in the reverberatory furnace must undergo a previous sharp drying operation in a mechanical furnace. At one works I saw a Wedge drying furnace capable of drying 160 tons of copper concentrate with 7% moisture in 24 hr., and heating it up to 350° Centigrade.

CHEAP FUEL LEADS TO DIFFERENCES IN PRACTICE

As mentioned in the preamble, fuel is comparatively cheap in most reduction works of North America. The consequence of this circumstance is that not so much attention is paid to a thorough utilization of the fuel as

of ashes and dust. Through the growing consumption of natural gas for lighting cities, for the generation of steam, etc., not only the gas pressure, but also the volume of gas, is rapidly getting less, so that the life of the gas wells is comparatively short and the plants relying upon them have to be amortized rapidly.

In some states, for instance, in California, Texas and Utah, oil is used as fuel for metallurgical furnaces and the experience had with this kind of fuel is exceedingly favorable even where the application of oil does not recommend itself by its cheapness. Not taking into account the clean work, easy transportation to the reduction works and inside of them, the easy handling of the oil, the flame can be regulated with great facility in regard to degrees of heat as well as to oxidation and reduction processes. Considering that a large copper reverberatory furnace consumes 80 tons of coal daily, of which about 16 tons are reproduced as waste in the shape of ashes, it will be readily understood what saving there will be effected in transportation by replacing coal by oil.

Note—Abstract by O. H. Hahn, of F. Heberlein's "Eine Exkursion auf nordamerikanische-mexikanische Blei-, Zink- und Kupferhütten," in "Metall und Erz," 1913, p. 717.

One of these large copper-smelting reverberatories, 6 m. wide by 33 m. long, consumes with a daily smelting capacity of from 350 to 400 tons of ore between 45 and 50 tons of oil. The gases escaping at the end of the furnace pass through flue boilers and generate sufficient steam for 600 hp. Dust coal heating plants are few and far between, probably on account of the heavy cost of installation and because the flue ashes are too apt to settle on the metal and slag baths, thereby not only toughening, but also contaminating them.

Without doubt the metallurgy of copper is an art in which the American metallurgists excel, and nowhere can the most modern devices of copper works be studied better than in North America. The great evolution of this industry during the last 10 years is founded on the most varied occurrences, and the manifold working conditions have raised the metallurgy of copper to a high state of perfection. Not only has the yield in metal constantly increased, but the working costs have been steadily decreasing, so that today copper ores may be beneficiated which 15 years ago nobody would touch. The great perfection of copper-smelting methods has deprived the wet methods formerly employed on a large scale of much of their prestige, so that today, whenever possible, preference is given to the dry methods.

COPPER SMELTING STILL AHEAD OF HYDROMETALLURGY

From the literature of the past years the various appliances and furnaces of a copper smeltery are well known to all, so that I can restrict myself to making some general remarks on the principles of copper extraction in use at the present day. As a general thing the sulphide ores are treated separately, according to their size. Coarse ores above $\frac{3}{4}$ in. are consigned to the shaft-furnace without previous roasting and are there subjected to a kind of pyritic smelting for a 40 to 45% matte, if possible. About 75% of the sulphur burns off in this operation, passing as SO_2 into the open or into sulphuric-acid chambers.

While the matte accumulates in the forehearth the waste slag with about 0.4% copper is run into slag pots, the liquid contents of which are emptied over the dump. The fine sulphide ores below $\frac{3}{4}$ in. are roasted, if high enough in sulphur, or if poor, assigned to the reverberatory-smelting operation along with the roasted ore. These modern mammoth reverberatories are at the present moment popular with copper smelters, particularly where oil is cheap. The products are likewise waste slag with about 0.4% copper and a matte with 40 to 45% copper. The latter is, with that from the forehearths of the shaft furnaces, tapped into ladles and poured while liquid into the converters with the addition of acid copper ores. By blowing, a blister copper with about 96% Cu and a varying tenor of precious metals is obtained, which by means of ladles and casting machines, is cast into blocks and molds.

BASIC CONVERTING

A few years ago basic converters began to replace those with acid lining for blowing copper matte. Their greater durability has rapidly contributed to their general introduction. While with the acid converters formerly only three charges were blown, yielding in the most favorable case 150 tons; today in similar converters with a basic lining, as much as 6000 tons of blister copper may be produced. Recently experiments have been made in sev-

eral places with a view to blow lead-copper matte, even with low copper content, in the basic converter. Technically, these experiments are said to have been successful, but on the economy of blowing lead matte poor in copper, the opinion of the profession is much divided.

The further treatment of the blister copper by electrolysis takes place for the most part in refining works, situated in the vicinity of New York. The method most used is the multiple one, the series being the exception. There are electrolytic works with a daily capacity of 500 tons electrolytic copper. Some refining and wire-bar furnaces put through more than 300 tons copper per 24 hr., while the capacity of the copper blast and reverberatory furnaces in smelting ore rises to 800 tons and 500 tons, respectively¹. Excepting the Mansfeld works, which smelt the largest tonnage in Europe, a single American furnace would almost suffice to smelt the entirety of the copper ore put through in Europe in one day.

The lead-smelting works of North America may be divided into two groups, "to wit," such as treat ores rich in



FIG. 2. 20-FT. COPPER CONVERTER

lead (with 65% Pb) by themselves, and such as treat a smelting mixture poor in lead in conjunction with silver-gold ores poor in copper. The smelting plants for rich lead ores are mostly situated in the Missouri district, and produce about 130,000 tons of commercial lead per annum. From the second group about 250,000 tons lead will probably originate, which would correspond to about 1.8 to 2 million tons of smelting charge.

SMELTING NON-ARGENTIFEROUS LEAD ORES

The Missouri ores contain so little silver that the resulting lead bullion shows only 2 oz. Ag per ton. For this reason, it is not desilvered, but refined directly by poling with steam and air. Small quantities of copper, therefore, remain in the lead besides the silver, rendering it unfit for the manufacture of white lead, but desirable for rolling.

The rich lead ores are either pre-roasted in a Scotch hearth and thereby liberated from 50% of their lead content, to be subsequently smelted in the shaft furnace; or, these ores are roasted, for instance, in the H.-H. circular furnace or in H.-H. converters, or directly with addition of silica and some flue dust in the Dwight-Lloyd machine (Fig. 1), whereupon the reduction in the shaft furnace follows:

¹The smaller blast furnaces at the Washoe works have a capacity of about 1600 tons of charge per day; the large one about 3000 tons.—Editor.

The shaft furnaces are almost exclusively of rectangular section, being 96 to 144 in. long by 36 to 42 in. wide at the tuyere level. The number of tuyeres ranges from 12 to 18 with a mouth of about 4 in. The pressure of blast applied varies between 120 and 160 cm. water column. The consumption of coke is generally given in solid carbon and amounts to about 12% of the latter, calculated on the smelting charge, in which, however, the slag returned to the furnace is not included. Despite the small copper content and the kindly nature of the Missouri ores, the amount of matte falling and the consumption of coke are exceedingly high in my conception. In my opinion, this is due principally to the difference of the European way of roasting as compared with the American.

The ores poor in lead, with about 4½% sulphur, go directly to the shaft furnace; with a higher percentage of sulphur they are, like the ores rich in lead, roasted and sintered either by the H.-H. or by the Dwight-Lloyd method prior to being sent to the shaft furnace. It is claimed that for good work in the latter, the smelting mixture must not contain less than 10 to 12% lead and that a good extraction of gold and silver can only be attained if the weight of lead bullion plus matte produced amounts to at least 18% of that of the smelting mixture. The matte is from time to time caught in a forehearth (Fig. 3), and the poor slag runs from it into slag pots which are taken to the dump. The first matte scarcely ever runs higher in copper than 10 to 12%. With a higher percentage than that it is difficult to keep the automatic tap from clogging. This first matte is ground, roasted and sintered in the above mentioned apparatus and concentrated in the shaft furnace to 40 or 45% Cu when it goes to the copper smeltery.

The lead bullion of the many smelting plants in the United States is refined in large desilvering establishments, much in the same manner as with us. As fuel for refining and cupeling furnaces and zinc-distillation retorts oil is used altogether of late. For taking off the zinc alloy the Howard press is used exclusively, also the Howard mixer for stirring the zinc into the lead bullion.

ZINC METALLURGY

The zinc smelteries of the States have been located preferably in places where cheap coal or natural gas is at hand. The sulphur of the blende is, as mentioned already, hardly utilized anywhere not even where roasting is performed in the Hegeler furnaces which are provided with muffles. The Zellweger roasting furnaces are about 35 m. long and have a height of not less than 7 ft. at the highest point of the arch. In 24 hr. about 30 tons of raw blende are put through with a consumption of gas amounting to 600,000 cu.ft. corresponding to an approximate calorific value of 30 tons coal or 100% of the weight of the ore. The roasting is nevertheless cheap and good. Nor are the losses in metal high. Much less gas is consumed by the Capean furnace (with a height of arch of 3 ft. 7 in.). In this furnace the consumption of gas on 25 tons of raw blende amounts to only 300,000 cu.ft., equal to 15 tons of coal and corresponding to 60% of the weight of the ore. The zinc-distillation furnaces on the basis of natural gas and also the Hegeler furnaces are operated without regenerator and recuperator systems, but put through large quantities of ore per furnace, to wit, in 860 muffles upward of 18,000 kg. One peculiarity of the furnaces is the ab-

sence of *allonges*, as the receivers which are partially protruding from the furnace are pretty cool. There is hardly any *poussière* (zinc dust) produced.

The discharge of the muffles is mostly performed by squirting water or steam into them and subsequent scraping out of the adhering slag. Usually each furnace is in a building by itself.

The fuel consumption of the distillation furnaces is, of course, considerable and may approach 180% of the weight of the roasted blende.

WET PROCESSES

Among the wet processes the cyanidation of gold and silver stands in the front rank. Frequently mercury is added from the start to the cyanide solution in the process of crushing the ore. The ores of the Cripple Creek district which were formerly worked by the Plattner chlorination process are also cyanided at the present time after the sulphides and tellurides have been decomposed by roasting. Even from the arsenic-cobalt ores rich in silver, the precious metals are extracted by amalgamation in combination with cyanidation. The extraction of copper by chloridizing roasting of burnt pyrites and poor



FIG. 3. FOREHEARTH AND SLAG POT

ores which cuts such a figure in Europe is at present only carried out at Philadelphia on a large scale. Much was said about many new copper-leaching processes at the International Congress, but as to their success the future must decide. Owing the large annual production of precious metals in the United States, the parting of gold and silver plays a very important part. Much to my surprise I found that the large parting establishments have returned from the electrolytic to the sulphuric-acid process. As far as I could gather, the latter process gives quicker results and therefore saves interest on capital. For the refining of gold with recovery of the metals of the platinum group at the same time the Wohlwill process is exclusively used.

During the last few years the greatest attention has been paid in the United States to the problem of flue-dust condensation and large sums of money have been expended for experiments and plants in this direction. Contrary to our European practice, to condense wet as much as possible, in the United States, preference is given to the so called baghouses or sack filters which, in some parts, are automatically shaken up. They undoubtedly work well where very acid gases do not come into play. However, the space they require and their cost of

construction is a matter of serious consideration (Fig. 4). The flues which may be cheap in construction and good in cooling effect are built on the catenary plan. The old Friedrichshütte wire chambers are also popular and are said to give good results.

At some works experiments have been made with the Cottrell method to precipitate flue dust by a high-tension direct current which gave good results, especially with wet gases. An oxidation of SO_2 to SO_3 and condensation of the latter was not attained by this process. As several large works had been obliged to suspend operations on account of fume damages, many experiments to render the sulphurous acid harmless have been carried out. Yet an economically successful method of rendering gases poor in SO_2 innocuous has not even been discovered in America. The only remedy I see in that case is to dilute the SO_2 with air till it reaches the limit of innocuousness. Professor Young proposes to render concentrated SO_2 gases harmless by reducing them at a high temperature with hydrocarbons and in the presence of a catalysator to elemental sulphur. Young's method is said to work well on gases with high SO_2 and a low O content, but it will prove too expensive on poorer gases.

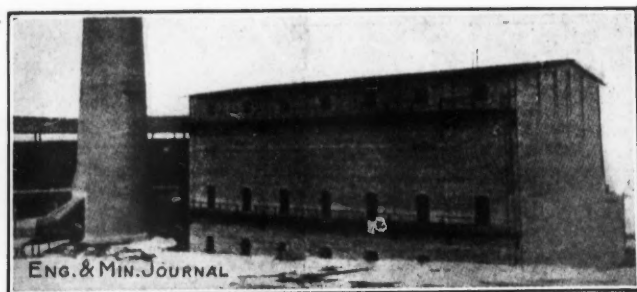


FIG. 4. TYPICAL BAG HOUSE

Much was said at the Congress of Chemistry about new methods for the preparation of potash salts from phonolites and leucites. I have not heard anything, though, about the economy of these processes. However, it is a sure thing that great efforts are being made in the United States to become independent of the German potash market.

Much work is being done on the preparation of high-grade fertilizers from crude phosphate without the use of sulphuric acid. Accordingly a mixture of phosphate with lime is to be burned at a high temperature, yielding an excellent fertilizer with phosphoric acid soluble in citric acid, but not in water.

There is not much to be said about the sanitary arrangements at American reduction works. Although the regulations of the health officers are not so strictly carried out as with us, the correctness of the principle that employees can only perform a maximum task if the fundamental conditions of good work are present, that is, if light and pure air are abundant and that it is to the best interest of the employers to provide for good, well lighted working rooms with sufficient ventilation, has been recognized.

One word about technical bookkeeping. I had occasion at some works to gain an insight into it and have had the very best impression of it. Not only is the control of workmen, ore and stores carried out minutely, but the daily reports enable the manager to make an almost exact calculation of his costs at any time.

As a result of my observations, I must say that the Americans are far ahead of us in the metallurgy of copper. In regard to the beneficiation of large quantities of smelting mixtures poor in lead, no comparison can be drawn, because the conditions for such work are wanting in Europe. However, this work is carried out admirably in America. In regard to the treatment of ores rich in lead, we European smelters can stand a comparison with our American colleagues very well. In the metallurgy of zinc we are somewhat ahead of the Americans in the quality of the work (that is the extraction of metal and consumption of coal). Thanks to their cheap fuel many of their zinc works work cheaper than ours.

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Nature of Porcupine Gold Occurrence

Writing in *Economic Geology*, August, 1913, Reginald E. Hore outlines some of the characteristics of the Porcupine deposits. The ore is native gold in pyritic quartz. The quartz occurs as: (1) Single fissure fillings or true veins; (2) a series of fissure fillings or a vein system; (3) quartz-ferrodolomite lodes in which quartz veins penetrate bands of ferrodolomite; (4) irregular quartz masses in the form of chimneys, kidneys, etc. The quartz in the veins is readily divided into two classes, the coarse and the fine, the grains in the former being about 10 times the size of the grains in the latter. The microscope shows gold occurring in the following forms: (1) A grain of gold completely inclosed in a grain of the coarse quartz; (2) gold in spaces between grains of the coarse quartz; (3) gold in crystals and grains of pyrite; (4) gold grains in calcite, completely or partly inclosed; (5) gold among grains of the fine quartz.

The explanation of the formation of the deposits supposes the gold to have been in solution with iron, sulphur, silica, potassium and carbon dioxide. The potassium and carbon dioxide escaped into the wall rock to aid in the formation of sericite and ferrodolomite. Part of the iron and sulphur similarly escaped to form pyrite and ferrodolomite. The rest of the iron and sulphur with most of the gold and silica was deposited in the fissures. The more ready penetration of the wall rock by the carbon dioxide, potassium, sulphur and iron, left the gold more concentrated in the solution and consequently more easily precipitated. The pyrite first formed in the veins was poorly crystallized, being quickly formed; that in the wall rock and that in the veins which is of secondary origin, formed slower and shows better crystals. In the first crystallization, the gold and pyrite tended to segregate here and there, the proximity of pieces of inclosed rock favoring deposition. After filling, the fissures were shattered, and in the crushed zones, secondary minerals, including sericite, chlorite, calcite, ferrodolomite, pyrite and some gold, were again deposited. Probably these originated in the vein and in the wall rock. This gold is coarser and probably grew slowly by accretion of small particles. The fine gold in the vicinity probably contributed to its growth, thus leaving low-grade quartz in the neighborhood of coarse gold. While showy, this coarse gold is subordinate in amount to the fine, although some of the fine gold also may be secondary. There is nothing to indicate great changes in the character of the deposits since glacial erosion, and there is no relation between the character of the ore and the present surface. The secondary changes are not surface alterations.

The Buckeye-mobile

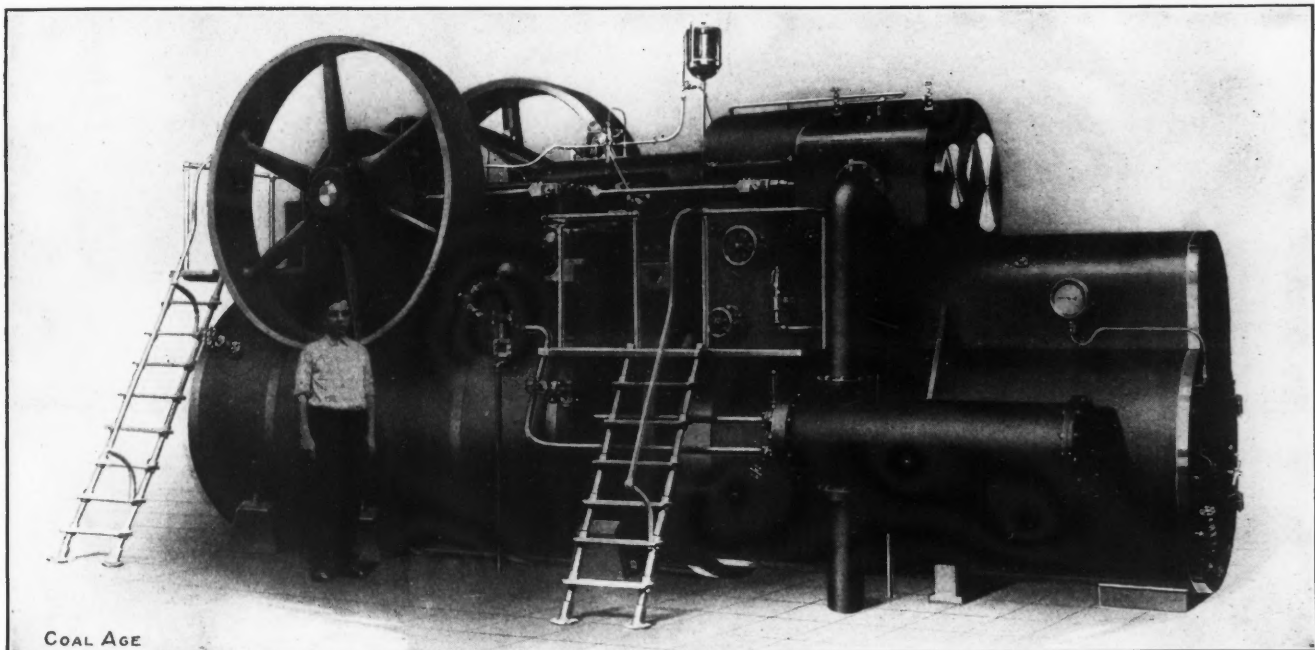
SYNOPSIS—A self-contained superheated steam-driven unit which turns out an indicated horsepower on a trifle over a pound of coal per hour, in sizes of less than 200 horsepower capacity.

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The type of prime mover known variously in Europe as the "locomobile," "overttype," and "semi-fixé" is a complete self-contained power plant, consisting of a boiler on which is mounted a compound engine, the cylinders of which are inclosed in the smoke box. These cylinders are equipped with piston valves adapted for the use of highly superheated steam. The smoke box also contains a superheater, a reheater and the necessary piping for leading the steam from the boiler through the initial superheater to the high-pressure cylinder and from it through the secondary superheater or reheater to the low-pressure cylinder.

necessary. In order that the boiler may be thoroughly inspected and cleaned, the furnace and tubes are made removable by simply unscrewing a row of bolts on each end of the boiler.

The amount of fuel used by these units is surprisingly small, and it was the adoption of a self-contained steam plant of this sort for its propulsion that gave the name Locomobile to a well known American motor car. These units, not at all of the rough-and-ready order of the ordinary portable outfit, but highly finished and adapted to the ornate surroundings of the high-class continental power plant, are in common use abroad. The economical results obtained by this device have been so marked that the Buckeye Engine Co., of Salem, Ohio, has made careful and thorough investigation of the principles employed with a view of offering to the American power-using public a machine of equal merit.



THE COMPLETE SELF-CONTAINED UNIT. NOTE SIZE OF BOILER COMPARED TO ENGINE

The superheaters are inclosed in a special casing whereby the hot gases emerging from the boiler tubes are compelled to traverse first the initial superheater and next the reheater before being discharged into the smoke box proper.

The unit comprises also a boiler-feed pump driven directly from the engine valve gear, a closed feeder-water heater in the exhaust line from the low-pressure cylinder and a suitable jet or surface condenser with a rotary air pump driven from the main shaft of the engine.

The initial superheater is a single coil of seamless steel tubing through which the steam passes in a direction counter to that of the hot gases. The reheater consists of two headers joined by a large number of small seamless tubes. An effective steam-jet blower enables the operator to remove all soot and dust from these superheaters as well as the boiler tubes as often as may be

This unit through its effective utilization of heat makes possible a power cost hitherto unobtainable by any type of small or moderate-sized steam plant. Small installations as a rule are wasteful of fuel, coal consumptions of 5 to 8 lb. per horsepower-hour being common. The cause for this may be found in the disposition to employ simple high-speed noncondensing engines using 30 lb. of steam or more per horsepower-hour and the failure to provide the heat-saving auxiliaries commonly installed in large plants. Radiation losses are relatively greater in small engines, boilers and piping than in large plants.

Economy tests of the Buckeye-mobile show that one horsepower can be generated on between 9 and 10 lb. of steam per hour or a trifle over one pound of coal. The fuel consumption curve is nearly flat, that is to say, this excellent economy is obtainable not only at normal load but at practically all loads above 50% of the rating and therefore the efficiency of the plant is varied but little by a changing load factor.

Note—Abstracted from "Power," May 20, 1913, and "Coal Age," Sept. 13, 1913.

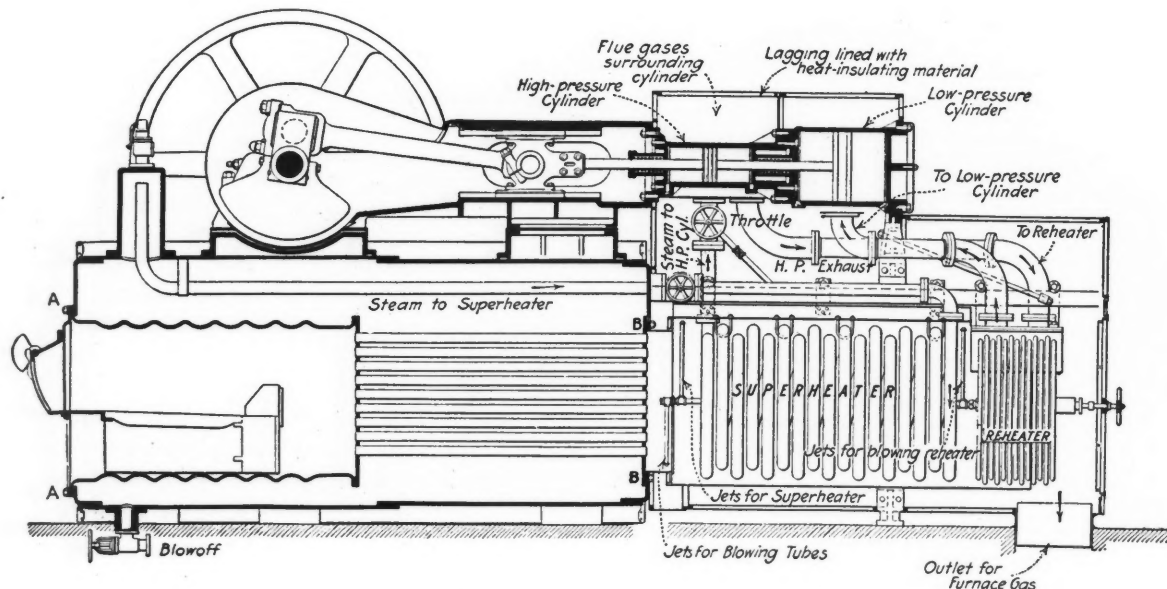
Since one manufacturer makes and delivers the complete unit a division of responsibility between the makers of the various elements which enter into the usual type of power plant is avoided. Owing to the compactness of the plant, its simplicity and high efficiency, the cost of operation and maintenance is materially reduced, the fact that a small quantity of fuel has to be handled makes it possible to decrease greatly the labor cost usual to power-plant operation.

ONLY A SMALL FLOOR SPACE IS REQUIRED

The floor space required by a plant of this design is about one-half that required by any other form of steam plant making any pretense to economy. The unit is accessible in all its parts and has shown in practice a reliability fully equal to any other prime mover. It is built in sizes from 75 hp. to 600 hp. and is applicable to all power purposes. It ordinarily operates condensing, but where exhaust steam is required for heating purposes the machine operates non-condensing with moderate increase in fuel consumption. In contrast with the inter-

Explosion during Aluminum Granulation

During the granulation of some fused aluminum in a steel works of Austria, a peculiar explosion occurred which has been much discussed at the Technical High School of Vienna on account of its wide interest, according to *Engineering*, Aug. 15, 1913. The aluminum was used for steel refining and had been granulated in the same way for over a year without giving any trouble, when an accident occurred, which injured four men seriously, two of whom died. Ordinarily, about 10 kg. of the aluminum in lumps are put into a graphite crucible and melted. The metal is then poured from the crucible through a sieve consisting of the perforated bottom of an old graphite crucible, resting on a tub containing about 60 gal. of water. The fused aluminum passes through the holes of the sieve and the latter is tapped with a hammer to hasten the operation. On the day in question a small explosion was heard as the metal dropped into the water and a second explosion followed



CROSS-SECTION THROUGH MACHINE, SHOWING THE VARIOUS ELEMENTS

nal-combustion engine the Buckeye-mobile is capable of utilizing any available fuel, coal, oil, lignite or refuse.

In the Buckeye-mobile, owing to the intimate connection between all the elements of the plant, there is no radiation loss from pipe lines, since all steam lines with their fittings and valves are located in the smoke box and jacketed by the hot flue gases. Radiation from both high- and low-pressure cylinders is prevented by the same means, since both the cylinders and their valve chests are exposed to a current of hot waste gases. Radiation losses from the boiler are reduced to a minimum through the adoption of an internal furnace and effective jacketing of the boiler shell.

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The Franklin Mine, in Fanquier County, Va., is one of the earliest profitably operated gold mines in the Southeast. It was worked up to the beginning of the Civil War, but not since. There was no underground working, all ore coming from open cuts. The mine was operated continuously for about 10 years; the ore being milled in a 10-stamp mill having wooden stamps.

soon after when the operation was repeated. In their report on the accident, in *Zeitschrift für Angewandte Chemie*, June 13, 1913, Bamberger and Jüptner express the opinion that it was simply a steam explosion, not one of hydrogen, since hot aluminum does not decompose water. Aluminum, they point out, melts at 650° or 660° C., according to various estimates. The melting point thus does not lie very high, but the latent heat of fusion of aluminum is large, 80 Cal. per kg., and one kilogram of aluminum yields 239.4 Cal. on being cooled from 626° to 0 C. According to Favre and Silbermann, one kilogram of water, of 99.81° C., absorbs 535.77 Cal. in being turned into steam, and it requires 85 Cal. to heat it from 15° up to boiling, a total of 620 Cal. Thus one kilogram of fused aluminum could generate 650 liters of steam from water at 15° at atmospheric pressure, and as this generation would be almost instantaneous, the steam pressure might momentarily rise to 1600 atmospheres.

Although the melting point of iron is far higher, 1400 to 1500° C., the granulation of iron would be a much less risky operation than that of aluminum, because fused iron yields only 32 Cal. for grey cast, or 20 Cal. for steel, in cooling. Experiments with 250 grams of aluminum, made by the investigators, led to discordant results. Sometimes violent explosions were observed, particularly when they were using only a small amount of water. At other times, however, no explosion took place, although the aluminum was superheated to 1050° C. They therefore concluded that the accident might be due to the Leidenfrost phenomenon. The first minor explosion, they say, startled the men, who possibly left some lumps of aluminum and little water in the tub. When the new metal was poured in, some water was caught in a hollow and exploded, after the temperature had sufficiently decreased. Cavities were seen to form in cooled lumps of aluminum. The investigators mention that, according to a new process for which patent protection has been applied, aluminum can be granulated by allowing it to cool to a certain degree, and then stirring it with a metallic rod.

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Drilling in the Michigan Copper Mines

The following discussion of the one- and two-man drill is taken from the report of the Copper Country Commercial Club on the Michigan strike:

It is claimed by the Western Federation of Miners and its members that the one-man drill, so called, has placed a burden upon the miners in the copper mines of Michigan which is not commensurate with the wages paid. In this connection, in order to clarify the situation, it may be stated that drilling originally was done by hand. In the early days this work was done by two or more men, one of the men holding the drill while other men acted as strikers. As the mining industry developed, a power drill was introduced which was operated by two men. The introduction of the first power drill operated by two men met with the same resistance which is now being offered to the one-man drill. The claim was made that it would put a great many men out of employment, which same claim is also made at the present time in reference to the one-man drill.

It may be stated generally that in the Lake Superior copper district the average copper contents of the rock decreases with depth. This has been the history of the district and the cost of mining increases proportionately with depth. As has been shown briefly in this report by tables, the Michigan copper mines are operating with rock carrying lower copper contents than the other copper-mining districts of the United States, and the Michigan copper mines are operating at greater depth and consequently at greater cost than the other copper mines of the United States. In order to compete with the other copper districts of the United States, the above facts have made it absolutely imperative that the mines of Michigan should be operated with the closest economy. The committee believes that the tables, hereinafter given, of wages paid in the Michigan copper district will demonstrate the fact that the operators in Michigan have attempted to practice their greatest economy in the way of improved machinery and equipment and the greatest step that has been made in this direction in recent years is the installation of the one-man drill. The standpoint of the operators in regard to the one-man drill cannot be given any more clearly than in quoting from a statement made by the superintendent of one of the mines, as follows:

The necessity for further close economy in the operation of our mines forced us to go into the market for a more efficient drilling machine and, if possible, a machine that could be operated with one man, as compared with two, which was standard practice. After about 18 months of experimenting we adopted our present machine. Our intention was to divide the benefits accruing to us from the use of the one-man machine with the men. This benefit to take the form of higher wages to machine operators (called miners). That we have carried out this plan is shown by the following table, which shows the increase in wages to the men operating one-man drills over wages made when operating two-man drills.

STATISTICS ON ONE-MAN DRILL AND TWO-MAN DRILL FOR YEAR ENDED DEC. 31, 1912

	Amt.				Av. Wage
	Shifts	Rec'd	Supplies	Total per Shift	
Two-man drill..	350,012	\$1,024,802	\$291,526	\$1,316,328	\$2.83
One-man drill...	54,758	193,936	94,058	287,994	3.34

The miners' wages largely depend upon the efficiency of the man, as our work is all on the bonus system and is so arranged that increased efficiency is of mutual benefit to the employer and the employee. We have a fixed contract which is not cut as the efficiency of the employee increases. It is also one of our rules that in case a man does not make what we call a fair rate he is paid off at a rate of not less than \$65 per month, but this ruling affects a small portion of our employees. In fact, for the month of June this year it was not necessary to use this minimum wage for a single employee. The one-man drill has resulted in a decided increase in efficiency, which, with further experience, will increase and will result in not only lower costs, but in higher wages to the men. What is more, the drill is popular with the good miners and any sentiment against it is made from without. Any attempt to return to the two-man drill would be a backward step in industrial progress and would work untold hardship to this district in its competition with other copper-producing districts. It is as little to be thought of as the elimination of any other labor-saving device. If copper mining in Michigan is to be a progressive and permanent institution, we must shape our methods now to be able to work deposits of a still lower grade than have been worked up to the present time, and the one-man drill and the further possible increase in the efficiency along this line is the most important step now before us.

This committee, in order to understand the drill and its workings, inspected the drill at work underground in four of the mines. The members of the committee talked to men operating it. They operated it themselves, they saw the drill taken down and set up. The committee talked to a number of miners who were operating the one-man drill, and in no case found any specific objection to its use. In a few instances the men claimed that it was difficult to set up in some places, but the committee found that it is a practice among the miners for one man to help another whenever necessary. The one-man drill operators interviewed invariably admitted that they are making more money on the one-man drill than they were on the two-man drill, and not in a single instance did the committee find a man that would give up his one-man drill to go back to the two-man drill. The committee found in some cases men who said that two men should be on the drill, but when requested for their reasons and asked of what assistance the second man would be in operating the drill, they were unable to give any except that the assistance would be given to set up the drill in the morning and to take it out of the way before blasting. The committee on one of its trips underground saw one man set up his drill in nine minutes, but from what the committee has been able to ascertain, the average time required by miners to make their places of work safe by barring down loose rock, preparing the place for the drill and setting up the drill seems to be about one and one-half hours.

The claim has also been made to the committee that a great many men would be thrown out of work by the adoption of this drill, but mining men and engineers in this particular district claim that the installation of this one-man drill will permit mining companies to work poorer ground than has ever before been handled in the district and that instead of throwing miners out of employment it will create a demand for more miners.

On its trips underground the committee took occasion to ascertain whether or not the mining companies were operating in accordance with the law passed at the recent session of the Legislature in reference to the one-man drill, namely: the act providing that men operating these machines should not be stationed more than 150 ft. from the place where other employees were at work, and the committee found, as a matter of fact, that the mining companies generally were operating in accordance with this act.

From its investigation the committee has concluded that the one-man drill in this district is an economic necessity and that the mining companies operating in the district will insist on continuing its use. The average weight of the two-man drilling machine is 290 pounds, that of the one-man drilling machine is 150 pounds.

The committee made some inquiry as to how the one-man drill is received by miners in other copper districts, especially the Bisbee district of Arizona, and quotes herewith from a letter received by it dated Sept. 29, 1913, from one of the mining engineers of the property of the Calumet & Arizona mine:

The company has in operation at the present time 100 one-man drills, which is 90% of the total number of drills now in development work. Sixty-five of these drills were purchased during the last four months. The miners have no complaints to make relative to these drills and in the majority of cases prefer these to any larger drill. The one-man drill will no doubt replace all other larger drills in the near future. I cannot understand why the Michigan miners should object to the drill when the Bisbee miners can find no fault whatever.

War-Time Railroading in Mexico

Maj. Charles DeLano Hine, who recently resigned as vice-president and general manager of the Southern Pacific R.R. of Mexico, entertained the members and guests of the St. Louis Railway Club on Oct. 10 with some interesting reminiscences of his experience in operating a railroad during the Mexican Revolution. An abstract¹ of Major Hine's paper is given below:

In the 20 months since February, 1912, when the second of recent Mexican revolutions was started, the Southern Pacific of Mexico has been in full operation only six months. During the other 14 months from 10 to 80% of its mileage has been out of commission at various times and in various places.

At first the officials, who are all Americans, and the employees, who are nearly 90% Mexicans, strained every nerve to crib bridges and to resume traffic. As time has worn on, however, all reserve energy has naturally been dissipated, the abnormal has become the normal, and the exceptional has lapsed into the routine. A train dispatcher is not startled if his wire suddenly goes down before the orders are completed. He knows from experience that the wire may not come up until perhaps tomorrow, next week, or mayhap next month or next year.

Occasionally the attacking band will take possession of the locomotive and burn some or all of the cars in the train. Usually, however, in the course of a week or two the wire comes up and a conductor asks for running orders from an office many miles from where he was last located.

Such primitive conditions have developed splendid initiative and resourcefulness on the part of officials and employees of all grades. From the president (Epes Randolph, a famous engineer and railway builder), who happened to be on the first train held up by armed force, down to the humblest laborer, all have followed Rule L of the standard code, reading: "In case of danger to the company's property, employees must unite to protect it."

Oftimes this has meant dauntless and unflinching exposure to rifle or cannon fire. Habitually, it has entailed inconvenience and physical hardship. Officials who normally use comfortable business cars have taken to small motor cars, to track velocipedes, to push cars, or have traveled many miles on foot.

On one occasion my own motor car was run by a man who has been a railroader, a frontier deputy marshal and a chauffeur. For the particular trip in question he united the desirable qualities of a careful motorman, a crack shot and a good cook. The first night was spent in a tool house, one night in a freight house, another in a waiting room and still another in the open country. The car was towed around burned bridges through the arroyos (channels of dry streams).

On another trip a good-sized river had to be crossed, the long trestle approach to the steel bridge having been burned some weeks before. Visions of swimming the river like Funston in the Philippines were ended when the thoughtfulness of an assistant superintendent showed a section gang as water rats towing a raft made of ties.

This interchangeability of function is typical of the all-around training inculcated on the Southern Pacific of Mexico by the unit system of organization. Two years of complete and consistent application of the underlying principles of this rational and practical system have produced gratifying results. Today every department, including traffic and accounting, has available from one to three developed and tested understudies for every official position. Coincidentally during the only period of eight months when conditions approached normal, the operating ratio with normal maintenance charges fell from 97 to 78%.

In May, 1912, after operation of the Sinaloa division had been suspended for over three weeks, it was deemed advisable to move all obtainable equipment north to Empalme, Sonora, near Guaymas, where conditions were tranquil. There were only a dozen locomotives at division headquarters in Mazatlan, Sinaloa, 275 miles south of San Blas, Sinaloa, the north end of the division, and a total of some 500 cars within reach. It was feared that insurrectos might cripple the movement by burning bridges between trains. Not only did bridges have to be hurriedly cribbed, but water tanks had to be repaired, some having been riddled with bullets.

On Monday morning the procession started with a train order reading somewhat as follows: "All engines on division

run extra to San Blas with right over all southbound trains until 10 p.m., Friday, May 10, and protecting carefully against following trains." Some 60 hours later the senior vice-president, renewing his yardmaster days, tied up the last train on the main track, at San Blas, and then issued an order congratulating the Sinaloa division, through its superintendent, on a performance easy anywhere else, but most difficult under the circumstances.

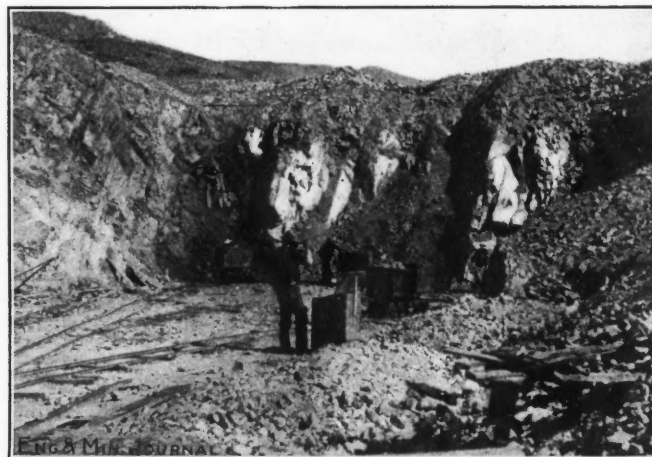
Regular traffic was not resumed for several weeks. Meantime a "cruiser train" was put on. Passengers rode in the caboose. No cars were left at stations, but freight offered was loaded in empties in the train. After cruising all day, the train tied up wherever night overtook it. The danger of encountering a hole instead of a bridge precludes much night running in times like these.

On Mar. 5, 1913, the state of Sonora revolted against the newly established Huerta government, and seized that portion of the Southern Pacific of Mexico lying north of Empalme. For six weeks the officials of the road were powerless. Operation was carried on from Hermosillo, the capital of the state of Sonora, by the state officials, with six locomotives and other equipment forcibly seized. Methods of alleged confiscation of railway property in the United States are perhaps crude after all. Six weeks of such operation gave the state officials their fill. Outgo so exceeded income that the road was unconditionally returned to its owners.

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Open-Cut Copper Mining at Butte

For many years, Butte has known of the existence of the vast body of oxidized ore lying along the base of the low hills near the Pittsmont smelter. From time to time shipments of the higher-grade material have been made for direct treatment in the blast furnace. Within the past two years, plans have been made to mine and treat these ores by hydrometallurgical methods.



BUTTE & DULUTH OPENCUT

The ore consist of the usual Butte granite, stained or enriched by copper minerals, chiefly chrysocolla and malachite. There are no well defined limiting walls to these deposits, and, owing to their proximity to the surface, mining is being carried on open-cast. The accompanying illustration shows a face of ore now being mined on the property of the Butte & Duluth company. The ore goes about 2% copper, and is of such character as to yield readily to wet treatment processes.

Two leaching plants are now in operation, having a combined capacity of 300 tons. These are the Butte & Duluth and the Bullwhacker. They were designed as experimental plants and are to be enlarged, if things turn as well as is hoped. The crushed ore is treated with weak sulphuric acid, readily dissolving out the copper. From the resulting solution the copper is deposited electrolytically.

¹Prepared by "Eng. News." The paper is printed in full in the "Railway Age Gazette," of Oct. 17.

Grinding Ores for Cyanidation—II

BY HERBERT A. MEGRAW

SYNOPSIS—Continuation of the discussion of grinding machines. Comparison methods of crushing efficiency valued. The crushing-surface diagram used to locate the department of highest efficiency of grinding mills. Suggestion of most economical systems for reducing ores.

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EFFICIENCY OF GRINDING MACHINES

The comparison of the efficiency of grinding machines is a point upon which discussion has been energetically carried on for several years, and began to bear fruit in May, 1910, when H. Stadler proposed his method of energy-unit calculations. Mr. Stadler, in a lengthy paper read before the Institution of Mining and Metallurgy, in London, proposed a system by means of which the energy expended in producing fine material of certain grades could be represented by a number. It is not my intention to review Stadler's work extensively at this time, but the basis of his suggested comparison may be briefly stated.

The mechanical work done is represented by the product of the force by the distance, but as in a regular scale of reduction by volume the diameters of the particles decrease at the same ratio as the area of fracture increases, the product, or the mechanical work required for reducing the volume (or weight) of the unit from one grade to the next following, is a constant for each grade, called the crushing or energy unit (E.U.). The same conclusion is also arrived at by application of Kick's law, which reads: The energy required for producing analogous changes of configuration of geometrically similar bodies of equal technological state varies as the volumes or weights of these bodies.

The volumes of the particles decrease from grade to grade at the same ratio as the number of the particles, constituting in their total the volume of the unity, increases, and the product of the volumes into the number of the particles of that grade is, therefore, constant for each grade. As in conformity to the above law, the amount of energy absorbed is proportional to the volume of the body to be crushed, it follows again also that the total energy required for reducing the weight of the unit is constant for each grade.

In a separate table, Stadler gives the constant, or energy unit, corresponding to all the screens in ordinary use, and also those recommended as test sizes by the Institution of Mining and Metallurgy. For obtaining the relative mechanical value of dry pulp containing any mixture of sizes, it is only necessary to multiply the percentage of each grade by the corresponding energy unit of the respective grade and add the products. In other words, a screen analysis is made, ascertaining the percentage of the ground material remaining upon each screen of the series, from the coarsest down to that which is —200-mesh grade, and each of these percentages is multiplied by its corresponding energy unit. The energy unit of that product is thus obtained, and the sum of all the energy units of the separate products in the screen analysis, represents the energy unit of the total pulp.

Note—This is the fourth of a new series of articles by Mr. Megraw. The series deals with comparative details of cyanide practice, discussing points of possible improvement. Preceding articles of this series appeared in the issues of Sept. 6, 1913, Oct. 4, 1913, and Nov. 1, 1913. The next article will deal with "Slime Agitation for Cyanidation," and will appear in the issue of Dec. 20, 1913.

DEL MAR VARIES STADLER'S METHOD

This method of comparison has been largely used and has served a useful purpose in comparing the efficiency of any grinding machine with that of any other. In extending Stadler's work, Algernon Del Mar¹ states that as the work done in crushing is proportional to the surface exposed, and as Rittinger states that the work required for crushing is proportional to the reduction in diameter, then both statements are identical, or the same idea may be stated thus: "The work required to crush rock is very nearly proportional to the reciprocals of the diameters crushed to." That the law is not exact is mainly due to the fact that the amount of ore crushed by a given amount of power often depends upon the size of the particle being crushed, and this is particularly true of the finer meshes where an approach is made to the colloidal state. Del Mar believes that 5% would be sufficient allowance to cover the inaccuracies in the calculation.

In this method of comparison it is only necessary to obtain the reciprocal of the aperture of the screen to which the material is crushed, and multiply by the percentage remaining on the screen. This affords a simple and easy way of comparing efficiencies. Del Mar illustrates his method of comparison by contrasting the results obtained in various mills. The method may be used, with some reservations, of course, for comparing the work done by grinding machines of different kinds.

GATES' GRAPHIC SYSTEM

A later development of these methods of comparison is given by Arthur O. Gates,² who published in the *JOURNAL* a method of illustrating graphically the work done in crushing. By this means it is comparatively simple to understand at a glance the difference in the work done by two crushing machines, and to see at which point one is better than the other. Gates claims that Kick's law, though frequently referred to in connection with the subject, especially since the publication of Stadler's work, does not properly apply and that Rittinger's law is the one most applicable. Rittinger's law, as has already been stated, is interpreted to mean that the work done in crushing is proportional to the surface exposed by the operation, or better expressed for this purpose, the work done on a given mass of rock is proportional to the reciprocal of the diameter of the final product, assuming that all the mass has been reduced to one exact size, which is only theoretically possible.

COMPARISON OF MACHINES DIFFICULT

These three methods of comparison having been examined, it ought to be easy to compare the efficiencies of various grinding machines upon ores in general. The factors which interfere with the accuracy of such determinations are several, but the principal one is the difference in cohesion between the particles of different rocks. Were experiments to be made upon the same rock by different machines and compared by these methods, there

¹"Eng. and Min. Journ.," Dec. 14, 1912.

²"Eng. and Min. Journ.," May 24, 1913.

would be no difficulty in ascertaining which was the more efficient.

Another difficulty which confronts the investigator who wishes to compare results of different machines from published accounts giving the screen analyses and other data, is the fact that screens have not yet been so standardized that for any particular stated mesh, one would know exactly what the aperture is. Of course, in the finer meshes there would be little difference between the different apertures for any given mesh, because the wires could not differ greatly in size. On coarse screen, however, the differences might be important.

TABLE V. MECHANICAL CRUSHING EFFICIENCY—HARDINGE VS. CHILEAN MILLS

Mesh	Hardinge				Chilean			
	Reciprocal of Average Size	Feed %	Relative Surface in Feed	Product %	Relative Surface in Feed	Product %	Relative Surface in Feed	Product %
+4	4.1	12.9	53	0.0	13.9	57	0.0	.....
+10	7.2	47.3	341	0.0	47.5	342	0.0	.....
+20	18.3	26.8	490	0.2	22.9	419	2.3	42
+30	37.7	5.0	189	3.2	121	5.2	196	11.8
+40	58.4	0.8	47	4.9	286	0.9	53	6.7
+60	83.6	0.8	67	13.8	1154	1.0	84	11.4
+80	138.0	0.4	55	10.4	1435	0.5	69	6.7
+100	163.0	0.3	49	8.6	1402	0.4	65	5.4
+150	220.0	0.3	66	8.0	1760	0.5	110	6.3
+200	303.0	0.5	151	10.0	3,030	0.7	212	7.2
-200	400.0	4.9	1960	40.9	16,350	6.5	2600	42.2
.....	.....	100.0	3465	100.0	25,552	100.0	4207	100.0

SUMMARY

	Hardinge	Chilean
Units of work in product.....	25,552	24,084
Units of work in feed.....	3,468	4,207
Units of work done by mill for uncorrected capacity.....	22,084	19,877
Units of capacities of 2.50 and 2.25 tons per h.p.-day respectively.....	55,210	44,723
Excess unit of work done by Hardinge mill.....		108.47
Excess efficiency, assuming method correct.....		23.45%
Excess efficiency, assuming 5% as limit of error.....		18.45%

Both Del Mar's and Gates' system can be used in combination to compare results, and it will be interesting to note the work of different machines according to data published and additional facts which may be obtainable from private sources. Setting aside Stadler's method for the present, we will use Del Mar's and Gates' system of comparison.

EFFICIENCIES OF MACHINES SHOWN

In order to show the comparative efficiency of the work done by various grinding machines, there is herewith shown in Table VI the efficiency, according to Del Mar's method, of some of the machines whose general characteristics have already been shown in Tables I, II and III, that is,

TABLE VI. CRUSHING EFFICIENCIES OF VARIOUS MACHINES

Plant	Machine	Relative Surface in Feed	Relative Surface in Product	Index of Work done by Machine
Goldfield Con.....	Stamps.....	100	14,007	13,907
Dome.....	Stamps.....	100	18,036	17,936
Goldfield Con.....	High-speed chilean.....	720	27,239	26,519
Mogal.....	High-speed chilean.....	100	22,835	22,735
Gold Belt.....	Slow-speed chilean.....	100	32,913	32,813
Sta Elena.....	Slow-speed chilean.....	75	35,640	35,565
La Union.....	Slow-speed chilean.....	100	37,140	37,040
Llano.....	Slow-speed chilean.....	100	33,108	33,008
Bolivia.....	Wheeler pan.....	18,363	36,678	18,315

stamps and the fast- and slow-speed chilean mills. With most of these we have a close approximation of the size of the material sent to the machine, and the total efficiency of both feeds and products may be worked out. By subtracting the numerical value of the feed from that of the product, the number representing the work done by the machine is arrived at. Of course, it is to be remembered that the data upon which these calculations are

based is from information which has been published or volunteered, and as the screen sizes are usually stated in meshes, the exact size of the screen aperture cannot be stated with perfect accuracy. It is, however, near enough to give us a superficial comparison. When one considers that these efficiencies are on different kinds of ore, and have already an inaccuracy introduced by the different screens already mentioned it will be understood that too much dependence must not be placed upon them. They are used here simply as an indication of what may be expected with machines of each particular style. Together with these are figures showing the effect of stamp-mill work, as derived from published accounts which give the size of feed and screen test of the product.

The great trouble with most published accounts, particularly where various machines are compared, is that there is usually a tendency to eulogize one machine at the expense of another. Even where there is no particular attempt to do this, the operator's natural inclination is likely to have some effect on his results. Of course, where the investigator is an employee or interested in the company which manufactures a certain machine, his results indicate what he desires to prove. It may be said that while such accounts may, and probably do, contain a large amount of useful information, final determinations ought to be based solely upon work performed by oneself upon the ore which is to be handled. In this way the probable effect of each machine may be truly estimated and no mistake will be made.

AN EXAMPLE OF COMPARISON

A recent publication has given such an interesting account of the comparative work done by two machines in the same place and upon the same ore that it will be advantageous to use the information given in it as an example in this discussion. I refer to the paper on Hardinge mills vs. Chilean mills, by Robert Franke, read at the Butte meeting of the American Institute of Mining Engineers, August, 1913. The article has been abstracted and published in the JOURNAL³ on account of the interest of the comparison. It is based upon the work done at the Miami Copper Co.'s mill by the two machines mentioned.

The plant was at first equipped with chilean mills on account of the definite knowledge of the fine-grinding qualities of the machine, and at the same time one section of the plant was equipped with Hardinge mills to serve as a test for the guidance of future installation. After a test of 1.5 years' duration, the operators have come to the conclusion that the Hardinge mill is best suited to their work, and a detailed comparison is made in this article.

In view of the fact, however, that the conditions at the Miami mill are somewhat different from those which might be found at other mills, and are certainly different from those which are found in the ordinary cyanide plant, it is possible to accept the data published and to still believe that the same conclusions would by no means apply in the latter case. There is no doubt that the Hardinge mill is an extremely good machine for producing fine, granular product suitable for concentration, but it has not yet succeeded in producing slime or colloid material satisfactory for agitation and cyanidation. It is

³"Eng. and Min. Journ.," Sept. 13, 1913.

rather interesting, therefore, to discuss this article from the viewpoint of the cyanide plant.

HARDINGE AND CHILEAN MILLS USED

Briefly stating the conditions, it may be said that the conical mill used was the 8-ft. Hardinge pebble mill having a cylinder 22 in. in length. The cylindrical portion of the mill was lined with cast-iron plates and the conical part with silex bricks bound together by cement. Lining plates carried a lifter, the function of which was to increase the height of drop when lifting material. Danish No. 5 pebbles, obtained from the coast deposits of Denmark, were used for the grinding. The chilean mill used is a fast-running, three-roller, 6-ft. Saturn mill, with screens of 0.037-in. opening. The feed to these mills is the oversize of Callow screens, having 0.029-in. openings, which follow roll crushing to 0.5 in. The ore of the mine is a moderately hard but fissile schist, impregnated with finely disseminated granular chalcocite.

In presenting primarily the advantage of the Hardinge over the chilean mill, this article states that discharge screens, dies and mullers are eliminated, and in their place more desirable crushing equivalents are substituted. Thus, the screen of the chilean mill is replaced by a perpetual device; the dies by linings which have long life, and the mullers by flint pebbles, which are replaceable without interruption to operation. The statement is also made that with chilean mills the total delay amounts to 2.11% of operating time, and with the Hardinge mills 1.29%.

The argument is made that with the Hardinge mill the repair delays are mainly due to relining, at which time the mill has to remain standing 48 hr., so as to allow the cement of the lining to set. Attention is called to the fact that this could be avoided by having extra shells already relined which could be swung into place of a shell whose lining had been worn out. This argument seems to me to be entirely without force as an argument against chilean mills because the lined shell is about all there is of the Hardinge mill, and having an extra machine ready for emergency will apply just as well to chilean mills as to any other.

Screen delays are charged against the chilean mill as is also the cost of the screens and their replacement, while with the Hardinge mill it is claimed that the screen is avoided and no such charges are made against it. This may be true, but in an advertisement of a screening machine appearing in a technical journal a short time after this article was published, it is stated that "the scope of this popular device has been widened by the use of screenless mills of the tube-mill type in the place of the chilean type of mill for granular crushing, the 'Blank' screen being used as a guard, screening the product of the mill to a positive size and returning the oversize for regrinding." It certainly looks as if the product of the Hardinge mill had to be screened and the oversize returned, and if this is true, the cost of screening ought to be charged against the mill and not dropped out simply because a separate machine happens to be called upon to do the work.

EFFICIENCY BY NUMBERS AND BY GRAPHICS

The mechanical crushing efficiency of the Hardinge and chilean mills at this plant, published in the article mentioned, is reprinted in Table V, the calculation being made after the method of Del Mar. This table shows that

the relative surface in the product of the two machines, which is proportional to the work done, is more by 18 to 23% with the Hardinge than with the chilean mill. This is apparently true under the circumstances, but these circumstances could not be transferred to the cyanide plant and made to work out the same way. In the first place, the product of the Hardinge mill is not what is desired in the cyanide plant. And in the second place, the material fed to the chilean mill is not that calculated to make use of its efficiency to the greatest extent. The greater part of the feed to the chilean mill is four-mesh material, and this, as has already been mentioned in this article, is not best adapted to successful chilean-mill grinding. Even under the circumstances, however, it is seen that the amount of 200-mesh material, which is what the cyanide plant wants, is greater in the product of the chilean mill than in the product of the Hardinge, and it may be shown that the highest efficiency of the chilean mill is along toward the 200-mesh end of the product.

This can be clearly and easily shown by making use of the crushing-surface diagram of Gates, for which purpose I append here Fig. 1, a diagram showing graphically the work done by these two machines. The diagram is on the especially-ruled logarithmic paper supplied by the W. S. Tyler Co., for plotting the curve of materials separated by their standard testing screens. It applies to this case excellently and gives a clear analysis of what each one of these mills succeeds in doing. From these diagrams it will be evident that the Hardinge mill produces a large proportion of fine granular material, as shown by the width of the diagram at the point of the small-aperture screens, while the chilean mill produces a large quantity of —200-mesh material and has its greatest efficiency at the fine end of the diagram, as shown by its much greater width at and below the —200-mesh point. It is probable that the best efficiency of the chilean mill is in the production of a maximum amount of —200-mesh product, which has heretofore received little attention from investigators. It seems that this exposition should remove the uncertainty about the most efficient field for Hardinge and chilean mills. The Hardinge is undoubtedly better for producing a fine granular product with a minimum of slime for concentration, while the chilean is clearly superior for producing a maximum quantity of —200-mesh material for agitation in the cyanide plant.

If the material fed to the chilean mill in question here had been much larger in size, the mill would have shown a much higher mechanical efficiency. In this connection, compare the efficiencies shown in Table VI for the high-speed and slow-speed mills already mentioned. It will be found that many of them exceed that of the Hardinge materially. When one considers the cost of slow-speed milling as against that of high-speed, the conclusion is forced upon us that this is apparently about the most economical one could use for the purpose.

It may be that in my advocacy of the slow-speed chilean mill I fall into the error of exhibiting undue partiality. I am, however, convinced that this is not the case, because previous to my personal experience with these machines I was rather prejudiced against them, but after having given them a fair trial, I reached the conclusion that in many instances they will do better and cheaper work with more convenience than any other machine that I know of. I do not, by any means, recommend the chilean mill or any other mill for any service without giving it a thor-

ough trial on the material which it will have to handle. That is the point which ought always to be settled in advance, but I do believe that the chilean ought to be considered as a possible factor in grinding and ought to be included in the list of machines which are given a trial. Too often stamps or some other favorite machine is installed without any trial at all, simply taking popular opinion of what ought to be done under the circumstances.

IMPOSSIBILITY OF COMPARING COSTS

The cost of ore breaking, crushing and grinding in the various plants is interesting to note, and for that reason

more careful and more efficient work than that accomplished in another camp, where the cost was only half that amount. If one regards these costs simply as interesting facts or records of what is being done, there is no harm in it, but as soon as one regards them as indices of efficiency at the various mills, damage results.

TUBE MILLS ALREADY FULLY DISCUSSED

Little has been said in this article about the tube mill or its work, but the machine is so well known and so well adapted to its peculiar functions, that there is nothing more to be said in regard to it. The cost of tube-mill

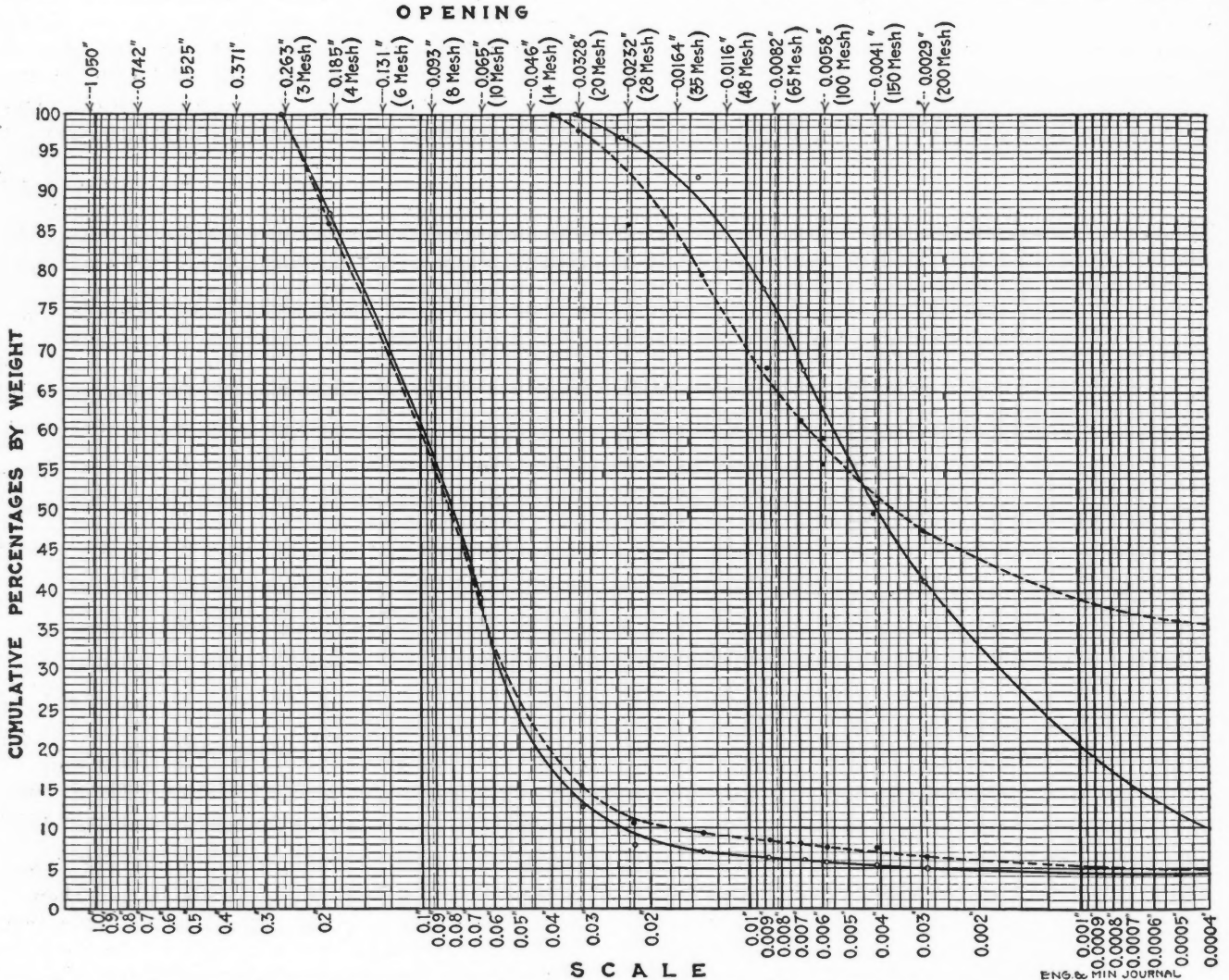


FIG. 1 CRUSHING SURFACE DIAGRAM OF WORK DONE BY HARDINGE MILL (FULL LINE) AND CHILEAN MILL (DOTTED LINE)

Table VII, showing them, is appended herewith. It is to be understood, however, that this is done simply as a matter of interest, so that operators may know what is being done at these mills which are more or less well known to everyone. Comparisons cannot be made from this table, nor from any published cost data. One cannot insist too strongly upon the fact that the comparison of costs at different mills, in different parts of the country, upon different ores, handled by labor of different classes, with different efficiency, can never, by any possible means, be a fair test of the work which is being done. It ought to be perfectly evident to engineers that a cost of \$1 per ton in one camp might be the result of much better,

work and notes of its efficiency have been published widely and all operators interested in cyaniding are perfectly familiar with the facts concerning it. With the other machines mentioned, however, this is not so much the case. Rolls and chilean mills have not received that degree of careful attention which has been given to stamp and tube mills, and have not as yet reached the degree of popularity which they deserve.

On ordinarily hard ores, my choice for a milling installation would begin with gyratory breakers followed by jaw-type machines feeding into rolls or chilean mills. In the case of rolls, the product could be separated into a portion fitted for direct reduction in the tube mill and

another for reduction in chilean mills, or the whole could be finely reduced in the rolls that it could all be handled in a tube mill. In the case of the chilean mill replacing the rolls, it should be fed with material varying from 1/2- to 1-in. size for maximum pieces and the product, which would consist largely of slime should be separated in a classifier and either reground in tube mills or leached directly, the slime being agitated.

TABLE VII. COST DATA AT VARIOUS MILLS

Plant	Breaking Cents per Ton	Crushing Cents per Ton	Grinding Cents per Ton	Method
Homestake.....	6	34.6	25.7‡	Stamps, pans and tube mills
Goldfield Con.....	3.8	13.4	10.6 chilean and tube	Stamps, chilean and tube mills
West End Con., Tonopah.....	10.3*	24.8	49.2	Stamps and tube mills
Hollinger.....	7.3	18.1	27.7	Stamps and tube mills
Wonder, Nev.....	12.1*	29.5	41.8	Stamps, tubes and high-speed chileans
Liberty Bell.....	7.25	19.08	7.69	Stamps and tube mills
Independence.....	16.33	52.17‡		Rolls and high-speed chilean
Nevada Hills.....	7.1	24.7	29.3	Stamps and tube mills
Black Oak.....	5.74	11.26	7.99	Stamps and tube mills
Sta. Elena.....		21.22‡		Slow-speed chileans
La Union.....		21.46‡		Slow-speed chileans

* Includes conveying. † Only part of material reground. Cost per ton reground. ‡ Separate treatment plant. Cost includes rolls and chileans. § Includes both crushing and grinding.

In cases where leaching is possible, I can imagine nothing more simple or economical, both to install and to operate, than the chilean-mill plant, which takes its feed directly from the breaker and delivers directly to the treatment system, after classification. No doubt, more careful study will be necessary before a great change is made in the method now followed of crushing and grinding, but I predict with the greatest confidence that in the not far future, rolls and chilean mills, the latter especially of the slow-speed variety, will be much more widely used and will be an important factor in reducing the cost of cyaniding.

Co-operation in Geologic Studies

BY F. W. DE WOLF

A significant and important field conference of geologists interested in problems of the Mississippian formation met Oct. 10 to 12, in Missouri. The purpose was to plan coöperation between the several states and the U. S. Geological Survey in all future work in Mississippian formations. The states represented were as follows:

- Arkansas, Purdue.
- Illinois, DeWolf.
- Indiana, Barrett, Beede.
- Iowa, Kay.
- Missouri, Buehler, Hughes.
- Ohio, Prosser.
- Oklahoma, Ohern, Snider.
- Tennessee, Purdue.

The U. S. Geological Survey was represented by David White, chief geologist, and W. H. Herron, geographer in charge of the central section.

Mining engineers and geologists who have been confused by the rapid invention of geologic-formation names will approve of this effort to get together regardless of state lines.

The discussion showed clearly the evils of independent work in adjoining states without knowledge of work already done or in progress in adjacent territory. Since the next few years will see considerable work done on the Mississippian formations, it is highly important

that the new names for units of formation shall be duly considered in the light of past usage and general, rather than local, needs. A permanent committee of the states concerned was provided for, to act in coöperation with the U. S. Geological Survey. The directing committee includes H. A. Buehler, of Missouri, G. F. Kay, of Iowa, and A. H. Purdue, of Tennessee.

This proposed coöperation is significant since it fore-shadows an attempt to get together on all problems of broad interest, rather than to continue work at cross-purposes and occasionally with considerable friction. In the past there has been too little consideration for neighboring states and too little coöperation of the state and the Federal surveys.

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Food Prices, Michigan and Butte

A committee was appointed on Sept. 13, 1913, by the board of directors of the Copper Country Commercial Club, to investigate strike conditions in the Michigan copper region. The Copper Country Commercial Club is an organization of 500 men of Houghton and Keweenaw Counties, and an attempt was made by its committee to make unbiased comparisons. The following is the Committee's report on food prices:

Under the heading of living conditions in the Michigan copper district, and of value when considering the wages paid in the Michigan copper district, will be the following table giving the prices of various food stuffs and staple articles. Inasmuch as the scale of wages that is demanded by the Western Federation of Miners is the scale which is in vogue in the Butte district, Montana, a comparison of prices between the Michigan district and the Butte district is given.

MEATS				
Articles	Michigan Price	Butte Price	Butte Price % Excess	
Steak, round.....	22c.	28c.	27	
Steak, sirloin.....	24c.	30c.	25	
Steak, porterhouse.....	25c.	30c.	20	
Pork chops.....	22c.	25c.	13½	
Veal steak, leg.....	30c.	35c.	16½	
Lamb steak.....	25c.	35c.	40	
Roast beef.....	24c.	28c.	16½	
Legs lamb.....	25c.	25c.	0	
Hamburger steak.....	20c.	25c.	25	
Pork sausage.....	18c.	25c.	38½	
Mutton chops.....	20c.	25c.	25	
Rib roast beef.....	22c.	28c.	27	
GROCERIES				
Articles	Michigan Price	Butte Price	Butte Price % Excess	
Flour, 100 lb. best.....	\$3.00	\$3.75	25	
60 lb. potatoes (1 bu.).....	0.75	1.05	40	
Eggs, per dozen.....	0.28	0.40	43	
100 lb. sack gran. sugar.....	5.40	6.80	26	
Kerosene oil, per gal.....	0.15	0.30	100	
Lard, 5 lb. (Silver Leaf).....	0.75	0.90	20	
Karo syrup, 5 lb.....	0.25	0.35	40	
Baked beans, best.....	0.10	0.12½	25	
Navy beans, per lb.....	0.06	0.08½	39	
Red kidney beans, lb.....	0.06	0.08½	39	
Premium butter, per lb.....	0.41	0.45	9½	
Barley (pearl).....	0.05	0.08½	66.67	
Bran, 100 lb.....	1.40	1.50	7.14	
Codfish, per lb.....	0.10	0.12½	25	
Cottolene, 4 lb. tin.....	0.60	0.70	16½	
Salmon, 1 lb. can.....	0.15	0.20	33½	
American cheese, per lb.....	0.22	0.26	18.18	
Molasses, per gal.....	0.45	0.65	44.44	
English breakfast tea, per lb.....	0.50	0.60	20	
1 bu. beets.....	1.00	2.00	100	
Cabbage, 100 lb.....	2.75	3.25	18	
Standard cereals, per pkg.....	0.10	0.12½	25	
Rollod Oats, 5 lb. pkg.....	0.25	0.35	40	
Tomatoes, 24 cans.....	2.35	2.75	17	
Standard canned fruits.....	0.20	0.25	25	
Dry raisins, per lb.....	0.10	0.12½	25	
Prunes, per lb.....	0.10	0.12½	25	
Currants, per lb.....	0.12½	0.15	20	
Dates, per 2 lb.....	0.25	0.35	40	
Bananas, per dozen.....	0.25	0.35	40	
Apples, 1 bu.....	2.00	3.25	62½	
Chocolate, Baker's, per lb.....	0.40	0.50	25	
Pepper, 16 oz.....	0.30	0.40	33½	
Blueing, 1 qt. bottle.....	0.10	0.15	50	
Average excess.....			34.82	

Note.—In Michigan a discount of 2 to 3 per cent. on the prices listed above is given when bill is paid. The Butte prices are taken from a store that gives no such discount.

Articles	FUEL	
	Butte Price Per Ton	Michigan Price Per Ton
Hard coal	\$16.00	\$8.00 to \$8.50
Soft coal	7.00 to 7.50	4.50 to 5.00

From the above tables it would appear that on a grocery and meat bill of \$35, which is fairly approximate for an average miner's bill, there is a saving in Michigan of 25 per cent. over the Butte prices; in other words, the same articles in Butte would cost \$8.75 more.

Iron-Ore Mining in Algeria

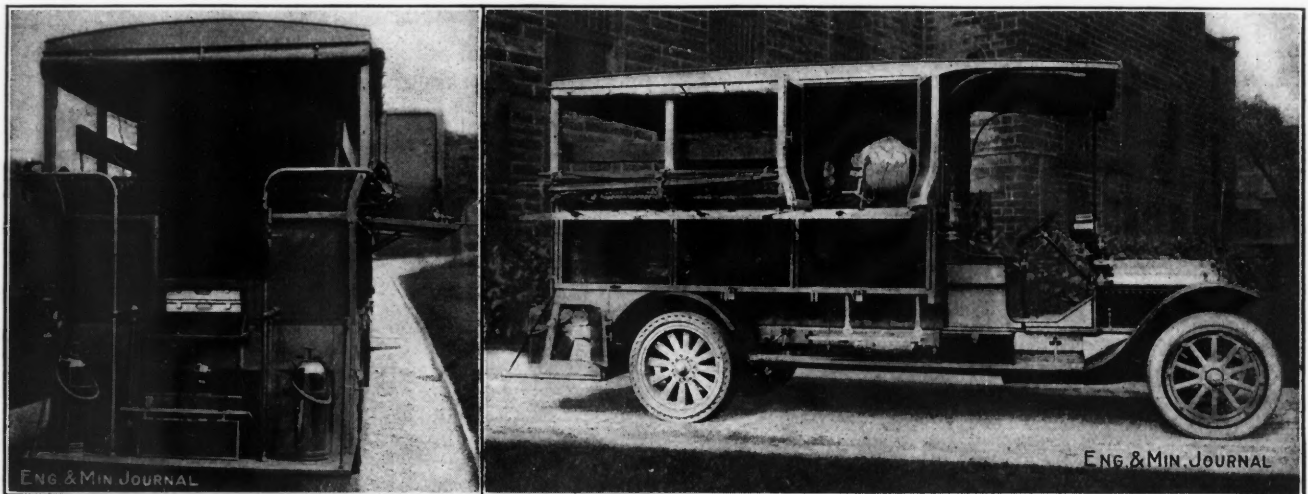
Great satisfaction is felt throughout Algeria at the news from Paris that after more than 10 years' conflict the question of the development of the important Ouenza iron-ore deposits, near Tebessa, at the south of the Province of Constantine, has been solved favorably to the colony (*Daily Consular and Trade Reports*, Nov. 6, 1913). Under auspices of the government an agreement has been arrived at by the two groups, consisting of the Société d'Etudes and the International Syndicate, formed to work the mines, by which one franc (\$0.193) per ton

Motor Truck for Rescue Work

The Bureau of Mines has evolved a new plan of relief work, involving the extensive use of motor rescue trucks equipped with all paraphernalia for relief work. The first vehicle of the new type, built according to government specifications, was constructed by the White Co., of Cleveland, Ohio, and delivered to the Bureau of Mines, in Pittsburgh, Penn. It is a veritable hospital, carrying all portable equipment that is useful in administering first aid.

Included in the equipment are two pulmotors, six oxygen tanks, 50 regenerators, an oxygen pump, two stretchers, a life line, box of explosives, lanterns, tents, fire extinguishers, complete telephone system and a full complement of hose, axes, saws, miner's tools and medical and surgical supplies. The equipment is complete even to the extent of providing for the bird and cage that are used in detecting poisonous gases in mine shafts.

Inasmuch as instant access to everything is essential, the truck body has been built with a special place for



MOTOR TRUCK FOR MINE-RESCUE WORK

on the output (with a minimum of 750,000 fr. (\$144,750) per annum), together with 50% of the net profit, is assured to the colony. It is expected that the production of the Ouenza mine alone will amount to over 1,000,000 tons per annum, and the important revenue arising therefrom will prove a valuable aid in the development and prosperity of Algeria.

In addition to the Ouenza mine arrangements are being made to work the neighboring mines of Bou-Kadra, Kouif and Djebel Onk, and it is anticipated that eventually not less than 4,000,000 tons of ore will be extracted annually from this district for exportation. A 137-mile railway is to be constructed, probably by the colony, and this will also prove a fruitful source of revenue. The ore will be shipped at Bona, where considerable extensions have been made to the port to enable it to deal with the increased traffic. The proprietors of the Kouif mine have already ordered equipment to ship their ore at the rate of 8000 tons per day.

Mine Telephones Have Long Been acknowledged to be of decided value in the operating system of mines of medium and large size. A somewhat novel use of them, however, which has not yet been widely practiced, but which may be of some value, is to use them for listening, at the surface, to the shot firing in a distant heading. The telephone is left in condition at a safe distance from the heading, and the shots may be easily heard and counted at the surface.

everything it carries. The entire carrying space, except for the crew of trained rescuers, consists of compartments of varying size and odd shape nearly all opening on the outside of the truck by means of snatch hooks.

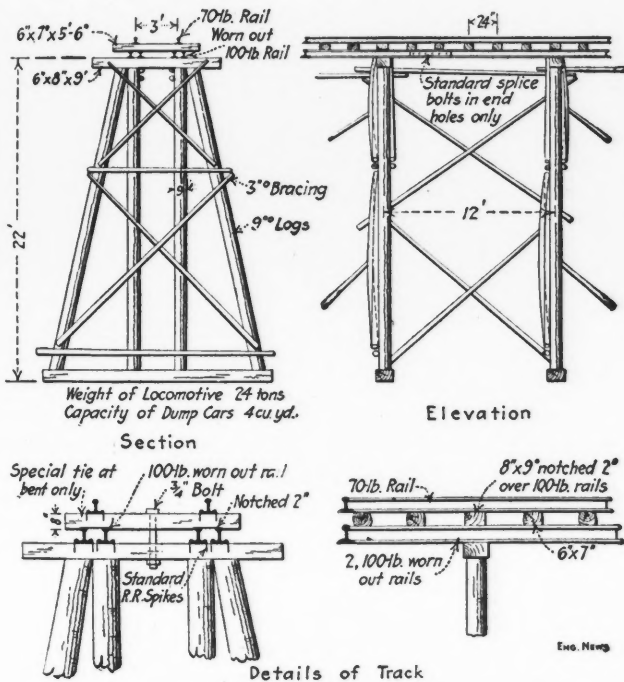
Under the driver's seat are 10 Draeger reviving outfits. Six oxygen tanks are carried beneath the body, the tanks lying crosswise of the truck, so that they may be pulled out quickly when necessary. On the left side of the chassis frame there is an oxygen pump operated by the power of the motor. Back of the driver's seat there are hooks for 5-ft. crowbar and tent poles. Immediately back of the driver's seat and extending the full height of the truck there is a series of compartments opening on the outside of the truck. These compartments carry a tent, 22 ft. of hose, three miner's picks, three miner's shovels, one 4-lb. sledge and two hand axes. Back of these compartments are two seats, arranged lengthwise, with folding lazy-backs, and beneath the seats there is a series of smaller compartments. Beneath the rear steps there is another compartment with doors at each side and in the end. There are also shallow drawers to take saws, hose couplings, reducers, spanners and 200 ft. of 1/2-in. rope. The central compartments along the sides of the body contain all other implements pertinent to the function of the truck.

DETAILS OF PRACTICAL MINING

Old Rails as Trestle Stringers

In the reconstruction of the line of the Pennsylvania R.R. at Rahway, N. J., the Keystone State Construction Co. has a considerable length of timber trestle in which the stringers are made of old rails discarded by the railway. These trestles, states *Engineering News*, are of two types, one used as a construction railway and the other as a filling trestle which is covered by the fill as it progresses.

The construction railway trestle is the heavier of the two and is shown in the accompanying illustration. It is made up of the usual framed bents with round log uprights and sapling braces and a squared 6x8-in. cap.



CONSTRUCTION TRESTLE WITH RAIL STRINGERS

On this cap run the stringers, four old 100-lb. rails, in groups of two, spanning the 12-ft. opening between bents. These rails are spiked with standard railway spikes to the cap and are spliced wherever the breaks come with the standard rail splices with bolts only in the end holes.

The 3-ft. gage construction track is built of old 70-lb. rails spiked to 6x7-in. ties with an 8x9-in. tie dapped 2 in. over the stringer rails at the bents. These latter ties are bolted with 3/4-in. bolts to the bent caps, and this is the only fastening of the track to the bents or stringers.

In the filling trestle, the track rails also act as stringers. This track is of 3-ft. gage and is made up of old 100-lb. rails, spiked to 6x7-in. ties, which act merely as spacers between bents and as caps at the bents. The dirt train is backed onto the trestle and the cars are dumped at the edge of the fill so that no load but that of empty

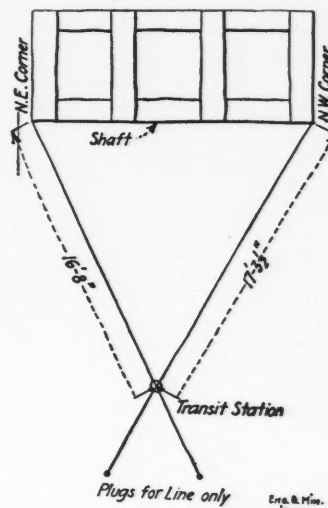
cars comes on the trestle. The ties and rails remain in the fill and form the construction track on the embankment.

Giving Line for Raising to Shaft

BY A. CARR HARRIS*

In extending shafts at Cananea, it is customary to raise with temporary timbering, hole through as soon as possible and proceed downward with the permanent shaft timbering. This is a much simpler operation from the surveyor's point of view than carrying the permanent shaft timbers up with the raise.

To give line for starting, the surveyor selects a point convenient to the raise and calculates bearings and distances to two corners corresponding to corners of the shaft above. Backsights are established to give line to



FOREMAN'S LINES FOR RAISE

the corners and a sketch is made for the use of the foreman similar to that shown herewith. The transit point is set some distance, 15 to 40 ft. from the shaft, so as to prevent its being shot out.

Carrying the permanent shaft timbers up with the raise requires a degree of accuracy in starting, which is not necessary with this method. Setting such permanent timbers usually necessitates a special survey. Other considerations, also, not connected with the surveying, render it preferable in many cases to set only temporary timber while raising.

Safety of Gasoline Mine Locomotive

In conjunction with the article descriptive of internal-combustion mine locomotives in the *JOURNAL*, Aug. 23, 1913, the following opinion in regard to their safety published by *Coal Age*, Oct. 11, 1913, is of interest. Except

*Mining engineer, 445 Piccadilly St., London, Ont., Canada.

for the absence of explosive mine gas, the same considerations apply to metal mines:

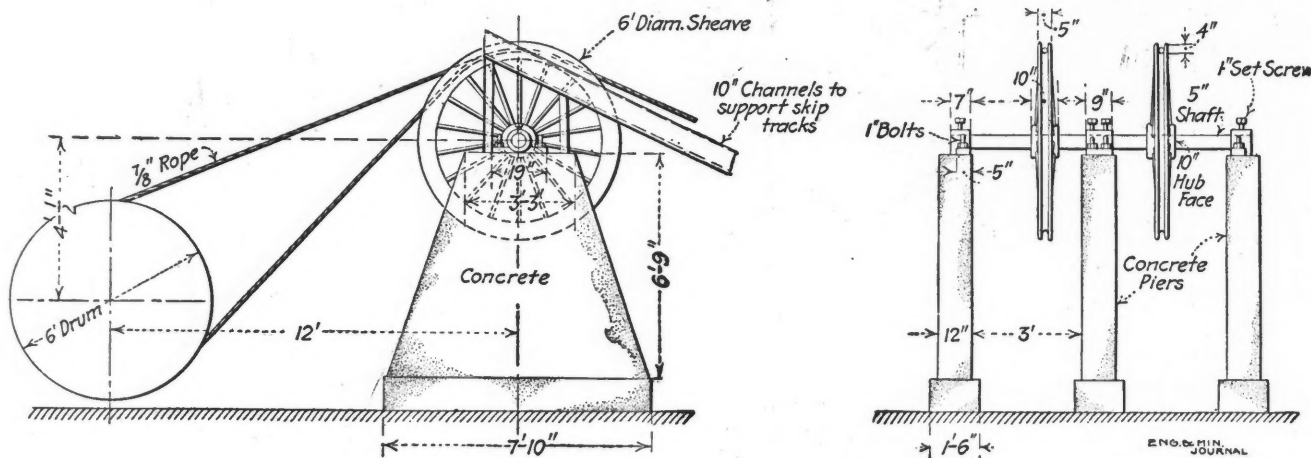
Opinions vary in regard to the question of safety, in respect to installing a gasoline locomotive in a coal mine, particularly a gaseous mine. There is, naturally, a strong objection to permitting so large a quantity of so explosive a liquid as gasoline, to be taken into the mine. For the purpose of haulage, the gasoline is handled in sealed tanks, which are taken into the mines and installed under heavy covers near the center of the machine, to guard against possible accidents and the ignition of the gasoline, due to the breaking of the tanks in the event of collision.

It is claimed that with reasonable care the gasoline mine locomotive, as now built, is safer than the electric locomotive used for the same purpose, in mines. It cannot be denied, however, that the presence of gasoline in the quantities required for mine haulage is and must necessarily be regarded as a menace to the safe working of the mine. The majority of mine accidents are due to carelessness or neglect; and, to avoid disaster from these sources, all explosive material should be kept out of the mine, as far as possible. Many mines, however, are

Concrete Headframe with Fleeting Device

BY L. O. KELLOGG*

The flat-lying shaft of the Sterling Iron & Railway Co. reaches the surface at an angle only a little greater than the slope of the ground. The hoist is set on the hill about 100 ft. above the collar and the dump, bin and headframe built in this space, at no place rise more than 12 or 15 ft. above the ground. There is thus no use for a high headframe and all that is used is a concrete foundation under the sheaves and some channels to support the track. The general arrangement is shown in two elevations in the accompanying drawing. The 10-in. channels extend toward the shaft collar and carry cross-ties on which the rails rest. The centers of the sheaves and the drums being so close together and the 2500 ft. of rope requiring several wraps on the 3x6-ft. drums, it is evident that smooth winding could not be had without some provision for taking care of the fleet. For this reason, the sheaves are made to revolve on the shaft which is held fixed, contrary to the more usual



FLEETING DEVICE

operating gasoline locomotives successfully, and it may be said that few serious accidents have resulted.

In this connection, another danger, aside from that of fire and explosion, must be considered. When a gasoline motor is not working properly, the combustion in the cylinder is incomplete, and the exhaust gases then contain appreciable amounts of carbon monoxide. In the normal working of the engine, the exhaust gases consist chiefly of nitrogen and carbon dioxide, with water vapor. The possibility of poisonous gases in the exhaust, though comparatively slight, may result in fatal consequences under the varied conditions in coal mining. In well ventilated workings there is little danger to be anticipated from the exhaust of the engine; but the poisonous effect of the gases should be thoroughly understood by all concerned in the operation of this class of motors. When the engine is working properly, there is little smoke or odor noticeable in the exhaust; and when these are observable, they indicate incomplete combustion in the cylinder, which should be remedied in order to avoid danger and also in order to obtain the highest efficiency of the machine.

practice of keying the sheave to the shaft and allowing the latter to revolve in bearings. The sheave is consequently free to move laterally and thus follow the rope in its travel across the face of the drum. The correspondence is not perfect, the 10-in. hub of the sheave reducing its possible lateral travel to 28 or 30 in. while the rope travels 36 in. across the drum. In practice, however, the rope winds perfectly.

The sheave hub is lined with brasses about 1/4 in. thick and lubrication is had by means of two grease cups in the middle of the hub, diametrically opposite. The shaft is 5 in. in diameter and is held in the castings which rest on the concrete piers, by means of setscrews.

Although the cars on the incline are hoisted at rather a slow rate of speed, the dumping point is so near the sheaves and the sheaves so near the drums, that the danger of an overwind with serious results is rather greater than is usually the case. Provision against this danger, however, is taken. The hoist is of Lidgerwood make operated by a General Electric motor. The latter

*Of editorial staff, "Engineering and Mining Journal."

is rated at 54 amp., 2200 volts, 225 hp., 600 r.p.m. under no load and 575 r.p.m. under full load. It operates on a 60-cycle, three-phase current. A band brake on the motor shaft is actuated by a weight which is usually kept suspended by connection to a bar through a solenoid. There is a trigger on the mounting of the hoisting-indicator which is tripped by the indicator as it passes a certain point. This shuts off the current from the motor and from the solenoid. The bar is therefore allowed to drop, and the weight applies the brake at the same time that the power is shut off. The relatively high speed of the motor shaft makes this rather light brake both powerful and rapid. With this safety device in use, only a high speed on the car would enable it to come over the sheave into the hoist room. If this should happen, there would still be no danger of injury to the engineer, as his platform is set on one side and rather high. The same platform also extends to the sheaves which are thus easy of access.

A countershaft between the motor shaft and the drum shaft gives a double reduction of speed. Of the drums, themselves, one is fixed to the shaft and the other is clutched in and out. For the ordinary manipulation of the hoist, regulation post brakes are used. An additional safety precaution lies in the "dead man" switches—aptly called. There are two of these set in the platform floor, one in front of the brake and reverse levers and the other in front of the controller box. These are the two points where the engineer may be standing while running the hoist. His foot must be on one switch or the other in order to complete the circuit of the current through the motor. In case of vertigo or any other incapacity of the engineer, the switch flies open and the power is shut off.

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Safety Rules—Timbering*

(1) Each miner should see that his timbering is safe. Ground should not be broken in advance of the timbering for a greater distance than the space necessary properly to install one set of timbers.

(2) No defective timber should be sent down in the mine.

(3) Ash, birch, balsam and poplar should not be used as caps.

(4) The captain should see that there is a sufficient supply of timber at all levels and places wherever needed.

(5) Miners are warned to secure the roof of their working place by extending poles from the cap timbers of the foremost set into holes picked into the ground ahead. In case this cannot be done, use props or head boards. These should be left as lagging when the permanent set is put in. All holes above drifts and slices should be blocked or lagged.

(6) All timbers should be securely wedged in position and set in a proper, straight, safe manner.

(7) Great care should be exercised in picking the loose material from the back or sides, particularly after each blast.

(8) In stopes timbered with square sets the working floors shall be closely and securely lagged over.

(9) Lagging shall be long enough to reach clear across the caps.

*From Inland Steel Co.'s book of rules.

(10) When working in raises miners should put in stage poles, one on each side of the raise, and about 2½ ft. apart, vertically.

(11) Cribbing in all raises should be solid.

(12) Winzes opening directly from the floor of the drift or stope should be kept covered by rails and protected by a guard railing to prevent persons falling therein.

(13) When placing timbers, see that the staging and platforms are secure and safe.

(14) In sinking, not more than sufficient room for another set of timber shall be left unprotected at the bottom of the shaft, except in extremely hard and firm ground, when timber shall be kept as close to the shaft bottom as good practice will permit.

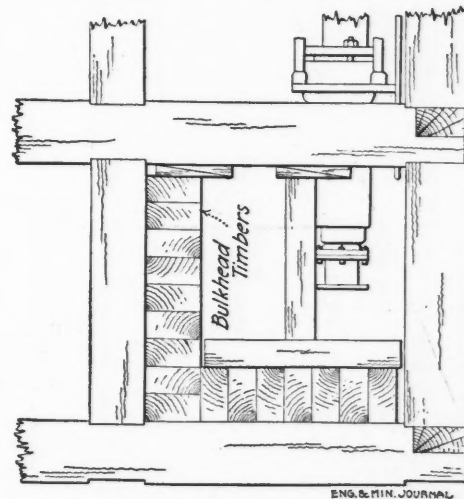
(15) Timbers should be hoisted or lowered through a compartment equipped with a ladder only when absolutely necessary, and then after timber is hoisted or lowered, the ladder should be inspected to see that it has not been broken.

(16) Spikes and nails should be removed from all planking not in use, to avoid danger of stepping thereon.

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Sinking Pump Bulkhead

Pumps used in sinking at Butte are protected against blasting by a bulkhead of the type shown in the accompanying illustration. As the bulkheads have to be low-

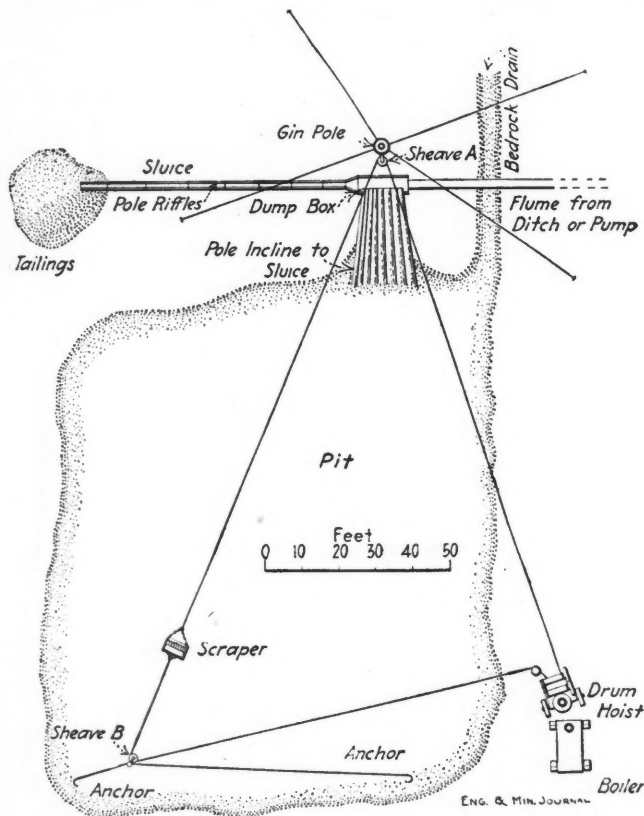


REMOVABLE BULKHEAD TO PROTECT SINKER

ered every time the pump is lowered, they are made of pieces as light as possible, 5x10-in. or 4x10-in. material set on edge serving the purpose excellently ("Bull." A. I. M. E., August, 1913). The pump suction extends through the bulkhead and provision must be made for closing this opening. One way of arranging this is to have the pieces below the pump wedged so that they can be pulled up and out or to leave them loose so that they can be spread. Another method is to use directly under the pumps two 10x10-in. timbers with a 5x10-in. hole in each, thus obtaining a 10x10-in. hole for the suction. This is either covered by a block during blasting, or plugged by the strainer which is pulled just high enough for the purpose. Since the 10x10-in. timbers, however, are extremely heavy when wet, the former method is usually preferred.

Fairbanks Opencut Placer Method

A method employed in working an opencut placer mine, on Pedro Creek, of the Fairbanks district, is illustrated herewith. Operations begin by clearing the ground of brush and then plowing and scraping off the overburden to a waste heap at one side, according to F. J. Katz (U. S. Geol. Surv., Bull. No. 525). Although the ground is frozen, no artificial thawing is required, since the natural thawing keeps pace with the rate of stripping. After about 31½ ft. of waste material has been removed, the extraction of the gravel begins. This is plowed during the night and scraped during the day. Both plow and scraper are actuated by a continuous rope passing over a sheave A on a gin pole and a sheave B be anchored in the cut, as well as over the hoist drum. The plow and scraper can thus be moved in either direction. When



LAYOUT FOR PLACER MINING WITH PLOW AND SCRAPER

the scraper is full the hoist engine pulls it to the pole incline and up the incline to the dump box where its teeth are engaged by a log; this stops its progress so that further pulling overturns it into the dump box.

When the scraper is dumped, the engineer reverses the direction of haulage and brings it back into the pit again. No man is needed at the dump box but two men are required to guide the scraper while filling and two men on the plow. The average depth of the gravel is 8½ feet.

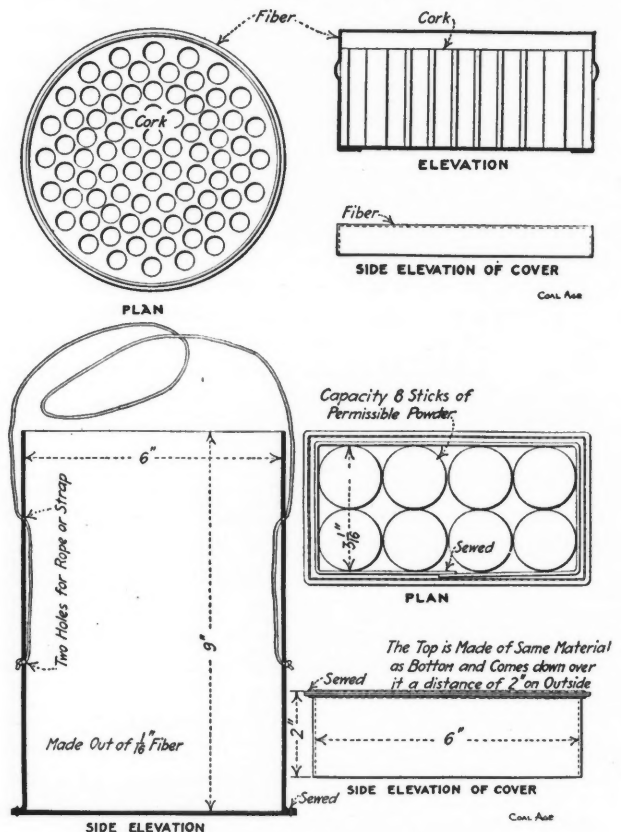
The material from the dump box is sluiced and washed over riffles in the usual way. When one area has been extracted, the plant is moved upstream to the next cut. During a working season of about 120 days, two cuts measuring together 135 ft. by 275 ft. were made. About 5000 cu.yd. of overburden and 11,500 cu.yd. of productive gravel were removed. Water was obtained by

gravity but had to be elevated about 15 ft. with a centrifugal pump. Good wood fuel cost \$8 per cord at the plant. About a cord per day was consumed. The cost of handling the gravel is said to have averaged about 30c. per bedrock sq.ft., the usual unit of the district. The total cost of operating, including cost of installation of plant and amortization charges, would be about 42 to 45c. per bedrock square foot.

Carrying Cases for Explosives

Receptacles for carrying powder and caps are herewith illustrated. The box made of fiber is light to carry and has an air- and moisture-proof cover (Coal Age, Oct. 11, 1913). In use, it is hung from the shoulder by a rope or strap. It is probably too small for use in a metal mine, but the design may carry suggestions.

The cap box consists of a piece of cork with 72 holes



CARRYING CASES FOR POWDER

drilled in it, of a size suitable for holding a cap, the cap being thus protected against jar and check. The cork is encased in fiber. It sometimes becomes necessary for a such case this cork box should prove useful in preventing accidents.

Flat, Tapered, Fiber, Hoisting Ropes are used at the Grand Hornu coal mines in Belgium. The ropes are made of aloe (Agave Americana) fiber, and taper both in width and thickness. They are used in hoisting from a depth of 3280 ft., and at the large end measure 12½ in. wide and are 2 in. thick. At the cage end the ropes are 8½ in. wide and 1¼ in. thick. The weight ranges from 9.8 to 4.75 lb. per ft. The weight of each rope is 10½ tons. Each of the cages has six decks, and weighs 4800 lb., weight of the six cars is 2778 lb., the loads of coal total 6000 lb., making a total weight of 13,570 lb., not including the weight of the rope. The wind is made in 144 sec. actual winding time.

DETAILS OF METALLURGICAL PRACTICE

Pebble Lining for Hardinge Mills

BY DAVID COLE*

In view of the unsatisfactory situation prevailing at present in the silex market, it is interesting to know that the flint pebbles regularly employed as a grinding medium may also be successfully used for lining pebble mills, and are being so used at the No. 6 Concentrator of the Arizona Copper Co., Ltd., at Morenci, Ariz., in 8 ft. by 22 in. Hardinge mills.

In our experience of the past nine months, silex linings have not averaged more than 75 days in use, the longest period being one of 117 days.

One of the pebble-lined mills was started in service June 20, has now been in operation more than 80 consecutive days, and at this writing the lining is in excellent condition.¹ The pebbles are only slightly flattened and apparently not half worn out, thus indicating a life of at least four months, as compared with the above record for 2½-in. Belgian silex blocks.

Lifters are necessary with silex, and are hard to maintain. With the pebble lining, the whole interior of the grinding chamber is rough, thus eliminating the necessity for "lifters." The cascading effect is ideal for the reason that the slip of the charge is absent, or limited. The small pebbles of the charge fit themselves into the spaces between the ends of the large pebbles in the lining, and a large percentage of them remain wedged in these spaces for some time, preventing slippage. The lining in the short cone end of the mill becomes flattened first, for the reason that the charge necessarily slips on the steeply inclined surface of that end.

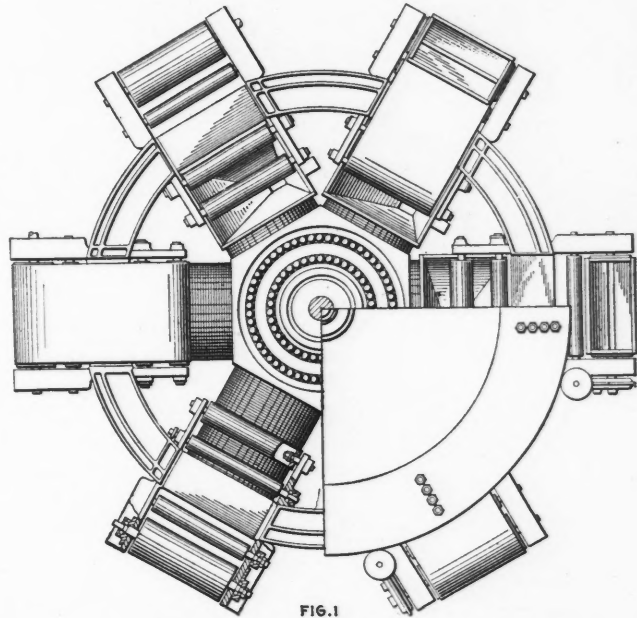
The cost of lining with No. 4 pebbles is about the same as with the regular 2½-in. silex blocks. Mortar made with one part portland cement to 1½ parts clean, sharp sand, is used in the same way as when lining with silex. The larger pebbles are used in the cylindrical part of the shell, in the short cone, and in the larger part of the long cone, and successively smaller ones in the remainder of the long cone. Pebbles are set endwise, tight together. The inlet and discharge throats are lined with small worn pebbles instead of iron lining as formerly. The inlet and discharge funnels are coated with neat cement to a thickness of ¼ in., painted on, in successive layers. Thus, no portion of the shell or the interior of the mill is left unprotected against "copper water." Cement covers the pebbles for two-thirds of their height.

I think no flint need be "scrapped," as the worn pebbles of discarded lining may be used subsequently in the pebble charge. The pebble lining tends to increase capacity through preserving maximum "cascading" effect. No. 5 and No. 6 pebbles will be used in the 8-ft. by 36-in. new Hardinge mills now being installed, and we expect a life of six months with these.

*Engineer-in-charge, No. 6 Concentrator, Morenci, Ariz.
¹We are since advised that the lining is in good condition after 125 days' use.—Editor.

Ullrich Magnetic Separator

The field of magnetic separation of minerals has been a fertile one for metallurgists during the past few years, and a number of devices have been offered to the operator for separating commercially valuable products from complex ores. A new machine has been invented by Georg Ullrich, of Broken Hill, New South Wales, Australia (U. S. pat. No. 1,026,685). This invention is for the magnetic treatment of ore of different degrees of magnetic permeability. Its object is to provide a magnetic separator which will enable ore to be divided into various grades of different degrees of magnetic permeability, in a rapid and inexpensive manner, and, at the same time, permit of such fine adjustment, that ore, or mixtures of



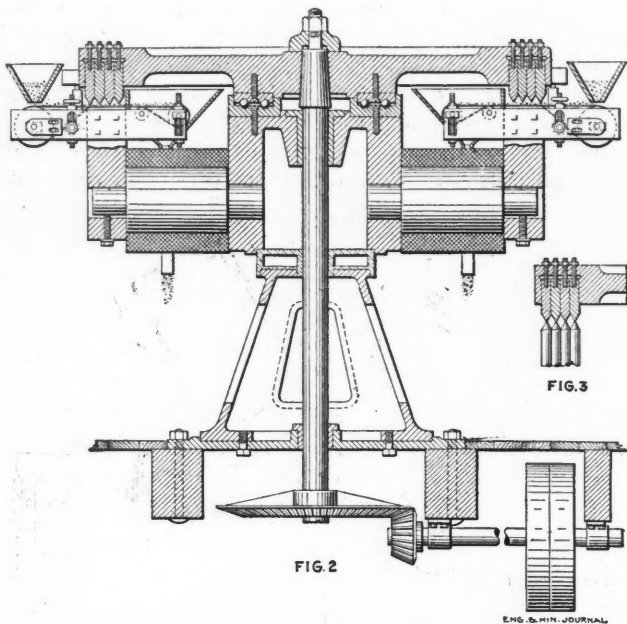
PLAN OF THE ULLRICH MAGNETIC SEPARATOR

ore, in which the various component parts differ from each other but slightly, may be economically treated so as to produce a high degree of concentration at low cost.

The principle of this machine is the passing of the finely divided metal-bearing ore through a magnetic field having zones of different strengths, so that the various constituent parts of the ore which present different degrees of magnetic permeability are separated from each other in the same magnetic field, but by different zones. The ore is passed through the field in one direction by a constantly traveling belt, which is returned in the opposite direction through the same field but on a lower plane. The various strengths of zones in this field are produced by induction rings moving in a horizontal plane and mounted so that they can be adjusted vertically nearer to, or farther from, the pole pieces of the electromagnets. These adjustable separating rings operate so that each raises ore particles of the particular degree of magnetic

permeability for which it is adapted and set, and carries them out of the magnetic field, when a change of polarity of the ring, as it passes from the field of one magnet to the other, will cause the metallic particles to be repelled and discharged from the ring.

The accompanying drawings make clear the working of the machine. Fig. 2 shows a vertical section of the separator as preferably constructed, and Fig. 1 a plan view of the machine having a portion of the rotating ring carrier and other parts removed. A number of polepieces are provided arranged around a common center as shown in the figure. In this example, six of these polepieces are provided, each formed by a horizontally arranged field magnet projecting radially from and supported by a suitable central yoke. The upper surfaces of the pole-



ULLRICH MAGNETIC SEPARATOR

pieces are in the same horizontal plane, and each pole has mounted upon it a frame carrying an endless conveyor belt.

A central vertical shaft is provided carrying a horizontally rotating disk, around the edge of which are arranged any preferred number of adjustable separating rings, so arranged that they travel in a path immediately above the polepieces. These separating rings are supported by setscrews so that they can be adjusted vertically to any desired distance above the pole. As shown in Fig. 3, there will be a series of magnetic zones formed in the magnetic field between each of the rings and the polepieces, and the strength of said zones will vary, as illustrated diagrammatically, according to the distance of the rings from the pole. These adjustments can be produced within wide limits without altering the total strength of the magnetic field. By adjusting the ring so that each successive zone is stronger than the preceding one, the material can be separated into as many grades of product as there are rings, or, if preferred, two or more of the rings can be set to the same distance above the polepieces so as to separate material of the same magnetic permeability. The material to be treated is fed onto the conveyor belt by a hopper and is conveyed to the magnetic field by the belt in a regular stream and at a

regular rate of speed, so that although the entire separation can be conducted rapidly and in a thoroughly efficient manner and with comparatively small expenditure of power.

When the ore is fed by the conveyor belt to the magnetic field between one of the polepieces and the separating rings, the particles having the greatest magnetic permeability are lifted off the belt by the first ring and are carried latterly until they are moved from the influence of the magnetic field, when they drop into a receiving hopper, provided for the purpose, and from thence are conveyed to any suitable bin or receptacle. The change of polarity will cause all of the material to be discharged from the ring as it passes from the field of one magnet into that of another. The proper mechanical appliances and devices are provided for revolving the rings and providing the course for the magnet.

Electric Furnace Lining

Dorsey A. Lyon and Edwin R. Cox, Jr., remark in a recent patent specification that it is well known that no refractory lining has yet been devised for an electric furnace, which does not become a fairly good conductor of electricity at the temperature of the electric crucible, and that the heat-resisting properties of the usual refractory lining, such as firebrick, have about reached their limit in a blast furnace; wherefore, if to the heat which the walls receive by direct radiation and conduction from the melting zone, there be added heat generated by stray electric currents passing through the walls of the crucible, the life of the lining is very short, the refractory material being rapidly melted down and passing away into the slag.

Improvement in Parral Tank

Under No. 1,071,447, Bernard MacDonald, of Guanajuato, Mexico, has received U. S. patent rights covering an improvement upon his familiar Parral tank for agitating slime in the cyanide process. This tank, or the system of operation, differs only slightly from the original patent granted to Mr. MacDonald. In the more recent case the tank is flat-bottomed and can be made in any proportions, not requiring necessarily a tall, narrow tank. The agitation may be performed by one or more air-lift pipes, these being, as formerly, situated around the periphery of the tank. These air-lifts now terminate in bends which deliver the pulp in a manner practically parallel to the side walls of the tanks, thus insuring a rotary or whirling motion to the contents of the tank, very similar to that obtained by agitating with mechanically moved paddles. A new type of ball valve has been designed by Mr. MacDonald for use with this tank, and this, it seems, will give satisfactory results.

The Parral tank has had satisfactory experience in some places, though it has occasionally failed to justify expectations. It is believed by Mr. MacDonald that these improvements will insure a wider popularity to the tank.

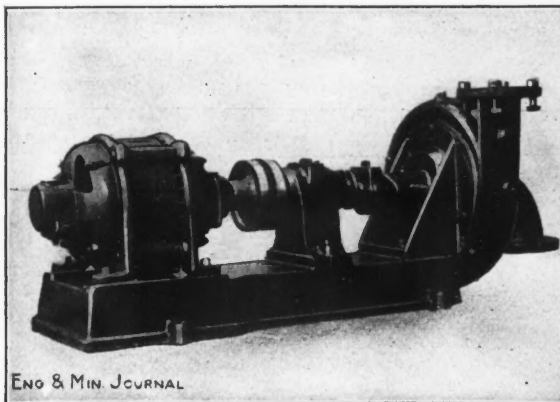
The Murex Magnetic Concentration process has been applied successfully to both sulphide and carbonate ores, says "Metallurgical and Chemical Engineering," November, 1913. The crushed ore is mixed and agitated with an emulsion of oil and magnetic oxide of iron, after which it is passed under an electromagnet which lifts the particles which have been coated with the emulsion. The process has been used at the Cordoba copper mine in Spain, and the Whim Well copper mine in Australia. At the latter place carbonate ore is treated producing a concentrate of 20% to 25% copper from 6% ore, yielding a recovery of about 80 per cent.

MINING & METALLURGICAL MACHINERY

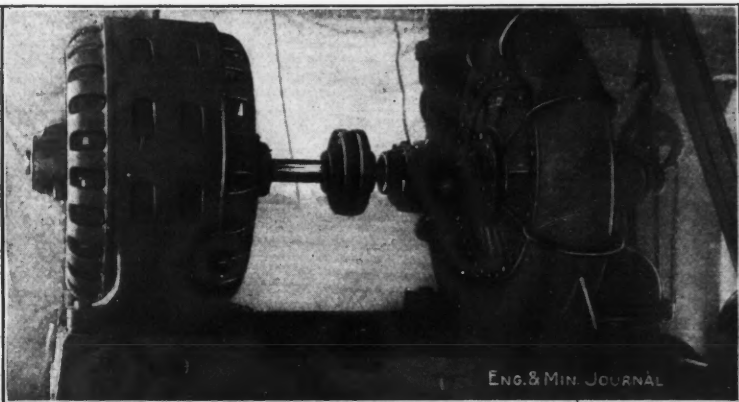
Low Lift Centrifugal Pumps of High Efficiency

Besides its line of dredge pumps, which are used by many of the large dredge operators in California, the Yuba Construction Co. is manufacturing a line of low-lift centrifugal pumps of the types illustrated herewith. The small direct-connected units shown in the upper illustration have been giving most satisfactory results in service and for comparatively inexpensive pumps have

Co. adopted the plan of partly overcoming the thrust of the runner by a simple hydraulic balance and taking care of the remainder by a mechanical thrust bearing. Thus in the latest types, the thrust is partly balanced by the pressure of the water around the outside of the runner, the leakage ring on the suction side of the runner being of smaller diameter than on the side toward the back head of the pump. The thrust being partly taken care of in this way eliminates the necessity of so large and expensive a thrust bearing as is required with pumps



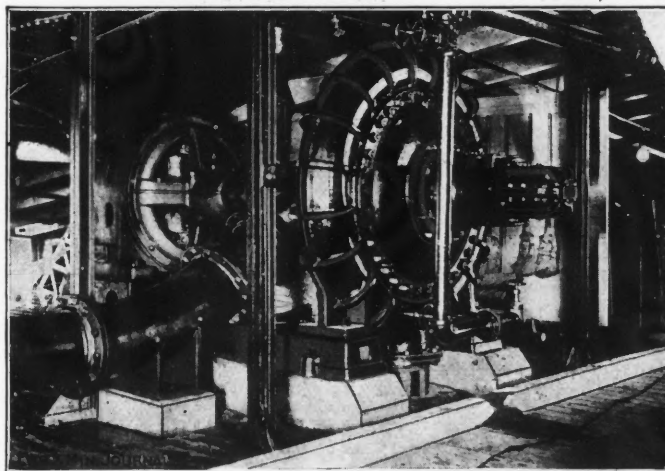
ENG & MIN JOURNAL



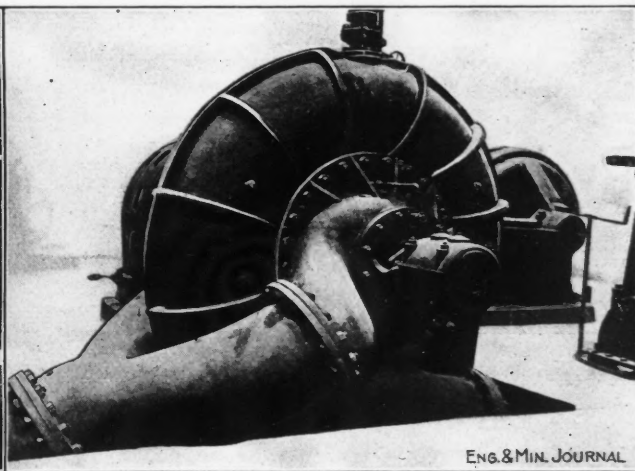
ENG. & MIN. JOURNAL

4-IN. CENTRIFUGAL FOR LOW LIFTS

14-IN. HIGH-PRESSURE CENTRIFUGAL NATOMA No. 8



12-IN. PUMP FOR 200-FT. HEAD, NATOMA DREDGE No. 10



ENG. & MIN. JOURNAL

22-IN. DOUBLE-SUCTION PUMP, ALDER CREEK PUMPING STATION

shown remarkably high efficiency in tests conducted at the company's works at Marysville, Calif., where a complete testing laboratory was equipped for developing the design of this line of pumps. For some of the small pumps, efficiencies running up to 65% and even 70% have been obtained in the company's testing department, where V-notch weirs and carefully calibrated weighing and measuring sets have been installed to test the efficiency of the pumps and of the pump-and-motor unit.

In designing these small pumps, the Yuba Construction

arranged with single suction but with leakage rings of the same size on each side of the runner. The chamber between the runner and the back head of the pump inside the leakage ring is connected with the suction side of the runner by holes around the hub; consequently the water in this chamber is under only a small pressure. In place of the usual water-sealed stuffing box, which is unsuitable to intermittent operation, the company preserves the packing by using an oil seal. An oil reservoir is cast integral with the compression member of the gland; an oil

ring running on the shaft constantly keeps a film of oil on the packing, which is preserved in good condition indefinitely.

In these small pumps, instead of changing the speed to provide for different pumping heads, the company manufactures several runners of correct diameters for various heads, filler rings of corresponding size being sent with the runners to fill the space between the periphery of the runner and the entrance of the collection chamber. The runners are readily changed by opening the casing and inserting the desired runner and filler ring. By this method the water leaving the periphery of the runner with a high velocity passes through a comparatively long channel between the entrance to the collection chamber, thus producing a gradual change of velocity, eliminating serious eddies from abrupt velocity change, and increasing the efficiency of the pump. A feature of the efficiency curves taken on these pumps is the flat top, which carries the favorable operating efficiency of the pump when in actual service over a much wider range than in the case with pumps designed to give a peaked-top efficiency curve.

In addition to this line of small direct-connected units and its regular gold-dredge pumps, the Yuba Construction Co. has built a number of large centrifugal pumps that are of interest. Among these are four 22-in. double-suction pumps in the Alder Creek pumping station of Natomas Consolidated. These are direct connected to 200-hp. General Electric constant-speed motors and operate at 490 r.p.m. against a 50-ft. head and pump 11,250 gal. per min. The company has built a number of 20-in. centrifugal pumps for use on suction dredges in the Sacramento Valley. Illustrations are presented herewith of two gold-dredge pumps, one of which is a high-pressure two-stage monitor pump installed on Natoma No. 10. It is a 12-in. pump driven by a 250-hp. General Electric motor at 580 r.p.m., delivering 3600 gal. of water per minute at 200-ft. head. The other is a typical 14-in. high-duty dredge pump installed on Natoma No. 8 for supplying water to the revolving screen. It is operated by 150-hp. Westinghouse Type CCL motor at 580 r.p.m., and delivers 5500 gal. of water per minute at 60-ft. head.

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Synchronous Motors for Compressors

The use of synchronous motors for driving compressors is comparatively new practice. A typical example of this kind of utilization is furnished by the compressors at the mines of the Wickwire Mining Co., Iron River, Mich. The two compressors on this property are each driven by a Westinghouse self-starting synchronous motor. Both compressors are of Ingersoll-Rand make; one delivers 1352 cu.ft. of free air per minute, at 200 r.p.m., and is driven by a 220-hp. motor; the other delivers 995 cu.ft. of air at 225 r.p.m., and is driven by a 175-hp. motor. These compressors have been in operation over a year and have proved satisfactory.

The synchronous motors used at this mine are characterized by great strength and simplicity of construction. The stator is supported by a heavy cast-iron frame, and the coils are form wound and so arranged that they can be easily removed and replaced if the necessity ever arises. The rotor consists of a cast-iron spider, which carries the field poles. The windings are so arranged that they receive ample ventilation and each field coil can be easily removed. An interesting feature of the rotor is the

squirrel-cage winding that encircles the field poles. This winding makes the motor self-starting and eliminates "hunting," or surging.

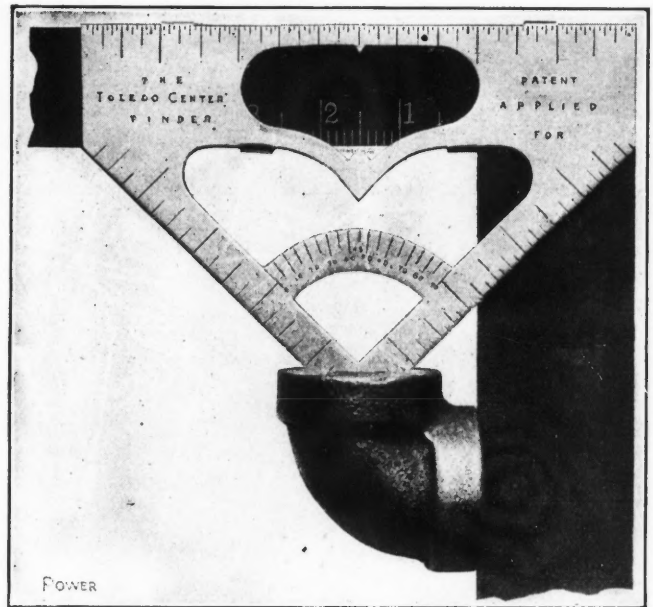
The Wickwire mine is operated from 6600-volt, 60-cycle, three-phase power, supplied by the Peninsular Power Co. This voltage is stepped down to 2200 volts for the synchronous motors, and 220 volts for the motors for driving pumps and other apparatus.

Compared with other forms of drive for large compressors, numerous advantages are claimed for the synchronous motor. This type of motor is especially adapted for direct connection, so that it costs less to install and takes up minimum floor space. The elimination of belts also decreases the maintenance expense. It is able to operate at 100% power factor, which tends to improve the operation of generators and to increase the capacity of transformers and transmission lines. These motors can be arranged to raise the power factor of the entire circuit by being supplied with excess capacity and used as synchronous condensers, thus greatly increasing the operating efficiency of the generating and transmission systems. Another advantage of these motors is their reliability. The modern synchronous motor is self-starting and self-synchronizing, thereby eliminating one of the chief objections to the old type of synchronous motors, which required an auxiliary starting device.

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Toledo Center Finder

This tool is made to use with a carpenter's steel square, as illustrated, when it will readily determine the center measurement of pipe fittings; it covers a



DEVICE FOR DETERMINING CENTER MEASUREMENTS OF PIPE FITTINGS

range of sizes from 1 to 6 in. (*Power*, Sept. 23, 1913). Each straight-edge is graduated, one edge to $\frac{1}{8}$ in., one to $\frac{1}{4}$ in., and one to $\frac{1}{2}$ in. The cross brace forms an arc of a circle and serves as a protractor, being graduated to 5°. The instrument can also be used for striking correct angles and inclinations in laying out piping. The device is made by the Toledo Pipe Threading Machine Co., Toledo, Ohio.

Metal Mine Accidents in British Columbia

BY FREDERICK L. HOFFMAN*

SYNOPSIS—An analysis of metal-mine accidents in British Columbia during the last 10 years. The 1912 mine output was the largest in the province's history; the accident rate the lowest.



In an analysis of the accident statistics of British Columbia for the last 10 years, it is necessary first to refer to the annual report of Thomas Graham, Chief Inspector of Coal and Metalliferous Mines, who is assisted by six district inspectors. Considering the area of British Columbia and the wide distribution of the mining industry, the inspectorial staff would hardly seem sufficient. It requires to be taken into consideration that the scope of inspectorial duties has been materially broadened within recent years and now includes extended consideration of accident prevention, mine-rescue work, instruction of miners in first aid to the injured, public lectures on mine safety and accident prevention, etc. In 1912 there were seven separate fatal accidents in metalliferous mines, causing the loss of eight lives, against 17 deaths in 1911. The fatality rate was, therefore, 2.35 per 1000 as compared with 5.25 for 1911, in spite of the fact that the production of the metalliferous mines in 1912 was the largest recorded in the history of the industry in the province; whereas the fatality rate was the lowest during recent years.

NO FATAL FALLS OF GROUND IN 1912

Another notable feature of the annual record for 1912 is contained in the statement that: "One noticeable feature of this year's accidents is that there were no fatalities from falls of ground; when we consider that many of the largest producing mines are worked on the large open-stope system, with no timbering, it speaks volumes for the supervision and care of the officials and employees, and suggests to us that with a fraction of the amount of care which must have been devoted to this work bestowed on the open chutes, we might eliminate the chute accidents entirely." The table following exhibits the accidents in metal mines of British Columbia for the decade ending with 1912. The record differentiates fatal, serious, and slight accidents, and for each the rates have been worked out on the usual basis of 1000 employees. It is not stated in the reports how the number of employees is precisely arrived at, and it is therefore assumed that the number represents the average for the 12 months of the year. It is possible, however, that for mines working only part of the time the number of employees has been adjusted and reduced to an annual basis of exposure, which, however, would probably not materially affect the returns for most of the districts operated practically throughout the year.

According to this table the average fatality rate for the decade was 4.74 per 1000. The rate was highest in 1903, when it was 7.27, and lowest in 1912, when it was 2.35. Comparing the last five years with the first, it appears that there has been a reduction in the rate from 4.94 to 4.53 per 1000.

*Statistician, Prudential Insurance Co., Newark, N. J.

What reliance can be placed upon the returns of serious nonfatal accidents is rather doubtful. The reported number of such accidents has varied considerably for the different years, and it is practically certain that the actual number of such accidents occurring has been larger than the number reported. The average rate of serious nonfatal accidents as reported for the decade was 3.14 per 1000, the rate having been highest (5.64) in 1906, and lowest (0.97) in 1910. Comparing the first five years with the last, it appears that the rate has decreased from 3.75 to 2.51 per 1000.

The same conclusion and suggestion of caution apply to the returns of slight nonfatal accidents, which reached the maximum in 1907, when the rate was 14.61 per 1000, and the minimum in 1909, when it was only 0.33. The

TABLE 1.
ACCIDENTS IN METAL MINES OF BRITISH COLUMBIA, 1903-1912

Year	Employees	Fatal Accidents		Serious Non-Fatal		Slight Non-Fatal	
		Number	Rate per 1,000 Employed	Number	Rate per 1,000 Employed	Number	Rate per 1,000 Employed
1903	2476	18	7.27	4	1.62	13	5.25
1904	3306	14	4.23	9	2.72	22	6.65
1905	3596	14	3.89	9	2.50	8	2.22
1906	3718	17	4.57	21	5.64	22	5.92
1907	3697	20	5.41	20	5.41	54	14.61
1908	3537	21	5.94	13	3.68	12	3.39
1909	3037	15	4.94	9	2.96	1	0.33
1910	3107	13	4.18	3	0.97	22	7.08
1911	3241	17	5.25	10	3.09	23	7.10
1912	3402	8	2.35	6	1.76	6	1.76
1903-1907	16,793	83	4.94	63	3.75	119	7.09
1908-1912	16,324	74	4.53	41	2.51	64	3.92
1903-1912	33,117	157	4.74	104	3.14	183	5.53

average rate of such accidents for the decade was 5.53 per 1000, the rate having been 7.09 for the first five years, as compared with 3.92 for the last.

For practical purposes the fatality rate is a reasonably trustworthy indication of the hazards of mining in the Province of British Columbia. It should be stated in the report, however, whether the term "fatal accidents" is limited to deaths occurring within a specified period of time, or whether some accidents originally reported as nonfatal may, after some months, have been changed to fatalities, on the basis of supplementary information. Uniformity in the methods of reporting is necessary for purposes of comparison, and an understanding should be arrived at between the several mine inspectors of the United States and the Canadian provinces, for at the present time a reasonable doubt exists as to whether the rates are strictly comparable. For the year 1911 the fatality rate for the metal mines of the United States, according to the Bureau of Mines, was 4.19 per 1000, which compares with a rate of 5.25 for British Columbia. It may also be stated in this connection that the average fatality rate in British Columbia coal mines for the decade ending with 1912 was 4.87 per 1000, against 4.74 for metal mines. As shown by the previous table, there were 157 fatalities during the decade, of which a complete analysis, by occupation and causes, is given in the table on the following page.

Information is not available as regards the number of men employed in the several occupations, so that specific fatality rates cannot be calculated.

Out of the 157 deaths from all causes, 35, or 22.2%, were caused by falls of rock or ore; 25, or 15.9%, were

the result of drilling or picking into missed shots; 18, or 11.5%, were the result of falls down chutes, and 16, or 10.2%, were caused by premature blasts, etc. Mention may also be made of 11 deaths resulting from men being caught in the shaft by the cage or skip; 14 deaths due to asphyxiation by gas or powder smoke; 9 deaths due to falls down shafts; and 8 deaths due to mine cars. The table is of interest, but not conclusive without a further analysis of the deaths in detail, as regards which, however, considerable information can be derived, by means of a special analysis, from the annual reports.

As typical illustrations of fatal accidents in the metaliferous mines of British Columbia in 1912, I quote the following in some detail: A mucker boss was killed on the surface by allowing muck to drag him into a chute; a cage tender was killed in the shaft by a cage; a miner was killed by falling into an ore pocket; another miner was killed by falling from a bench into a chute; a miner picked into a missed hole, which exploded and killed him and another miner; a blaster returned to his place of work too soon and was killed by a delayed blast; another miner was suffocated by powder gas in a raise.

a decrease, while the value of coal, tin and lead ore increased. Dividends paid amounted to £814,256, as compared with £826,976 in 1911.

The gold produced amounted to 1,282,658 fine oz. Other minerals produced, given in order of descending values, were as follows: Coal, 295,079 tons; copper ore, 9556 tons; tin ore and ingot, 575 tons; lead ore, 1868 tons; silver, 138,039 fine oz.; pyritic ore, 7626 tons; copper ingot matte, etc., 8 tons; zinc, spelter, etc., 14 tons. Other miscellaneous mineral products were exported to the amount of £3172.

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“High Grading”

BY G. L. SHELDON*

It is an undoubted fact that the majority of miners the world over will appropriate to their own use rich ore, whenever they find it in the mine. Why, it is hard to explain. I have known many miners that I was perfectly willing to trust in any ordinary business transaction, men who could be relied upon ordinarily, but given

TABLE 2. FATAL ACCIDENTS BY OCCUPATION AND CAUSES

Occupation	Falls of Rock or Ore	Drilled or Picked Missed Shot	Blasts, Pre-mature, etc.	Thawing Dynamite	Falls down Chute	Falls down Shaft	Other Falls	Caught in Shaft by Cage or Skip	Asphyxiation by Gas or Powder Smoke	Caught under Falling Rolling Timbers	Mine Cars	Caught in Machinery	Electricity	Miscellaneous	Total
Miners.....	19	21	10	1	9	1	1	2	12	2	1	..	..	1	80
Shovelers.....	2	1	..	..	3	..	..	..	..	..	..	..	1	1	8
Muckers.....	4	..	..	..	1	..	..	..	..	..	..	..	1	..	6
Laborers.....	2	..	..	..	..	..	..	1	..	1	..	1	..	..	5
Blasters.....	..	..	4	..	..	..	..	..	..	..	..	..	..	..	4
Machine men.....	1	3	..	..	..	..	..	..	..	..	..	..	..	..	4
Carloaders.....	..	..	..	..	1	..	1	..	..	..	1	..	..	..	3
Mucker bosses.....	2	..	..	..	1	..	..	..	..	..	..	..	..	..	3
Timber men.....	1	..	..	..	2	..	..	2	..	..	..	..	..	..	5
Skip tenders.....	..	..	..	..	..	3	..	3	..	..	..	..	..	..	6
Trammers.....	..	..	..	..	1	1	1	..	..	..	1	..	..	1	5
Nippers.....	1	..	..	..	..	..	..	1	..	..	1	..	..	..	3
Brake men.....	..	..	..	..	..	..	..	..	..	..	2	..	..	..	2
Cage tenders.....	..	..	..	..	..	..	..	2	..	..	..	..	..	..	2
Chute men.....	1	..	1	..	..	..	..	..	..	..	..	..	..	..	2
Shift bosses.....	1	..	..	..	..	..	..	..	1	..	..	..	..	..	2
Loco. engineer.....	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Mine foreman.....	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1
Powder tender.....	..	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Top cager.....	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Top carman.....	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Carpenters.....	..	..	..	..	..	..	2	..	..	..	..	..	1	..	3
Manager and superintendts	1	..	..	..	..	..	..	..	1	..	..	..	..	1	3
Crusher.....	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Oiler.....	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Ore sorter.....	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Physician.....	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1
Sawyer.....	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Teamster.....	..	..	..	..	..	..	..	..	..	1	..	..	..	..	1
Totals.....	35	25	16	2	18	9	5	11	14	5	8	2	3	4	157

The reports, unfortunately, are too meager in matters of detail and more information should be given in each case, with special reference to surrounding circumstances, the age of the injured employee, and possibly the length of mine experience. Mention may also be made of some of the more serious accidents briefly referred to in the report, including a foreman who was injured by exploding powder while picking muck and who lost one eye and was otherwise injured. Another serious accident was a case of a chuteman whose foot was crushed on a surface ore dump by a car, necessitating amputation.

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Mineral Output of Western Australia in 1912

The total value of the mineral production, according to the Report of the Department of Mines of Western Australia, was £5,760,207, which was £345,646 less than that of the preceding year. This decrease is more than accounted for by the falling off in gold. Copper also showed

the opportunity, they would invariably take rich ore, if it appeared safe to get away with it. Once, to a partner in some mining claims, I said, “Jim, I have always found you a straight, honorable man in all your dealings; I am willing to and have trusted you; I believe you to be an honest man generally, but you admit that you take rich ore whenever you find it. How can you satisfy your conscience in doing it?” He answered: “Why, God Almighty put that ore there! If I am the first man to find it, why, it is mine.” “Yes, but the ground on which it is found is owned by the other fellow!” “But he might never have found it or known of it, if it had not been for me.”

Probably Cripple Creek has been the greatest camp in the world for the theft of rich ores. The amount stolen has run into the millions, and covered an active period of 10 or 12 years, even yet, today to some extent. Goldfield, in its palmy, leasing days, may have exceeded it for a very short time. The lessee could not afford to say or do a thing. His time was short and he was making so much

*Ely, Nevada.

money no questions were asked. Men were known to have paid a thousand dollars to the foreman for a job, then be ahead of the game within three days.

The ores of Cripple Creek were so much alike in appearance that it was an impossibility for a mine owner to recognize his own. The sylvanite and calaverite specimens were certainly beautiful and immediately lost their identity when roasted. In the boom days nearly every third or fourth man one met on Bennett Avenue had a specimen to sell at from one-tenth to 10 times its value. The greater portion of the stolen ores were purchased by some of the many assay offices in the district.

It was customary to pay for about one-half of its value. There was one fence, an assay office, located in one of the small towns, the owner of which kept cutting down the value of the ores that the boys brought him, until he paid them less than 25% of the value. They cursed and threatened. His location was good, near several rich leases, convenient for the boys to slip in and out unseen. He considered himself safe, as they could not denounce him without involving themselves. One dark night when going home, he was set on by several men, pounded and beaten up thoroughly, and evidently his life was threatened, for as soon as he was able to get out, he closed up his office and left town. It was said he knew his assailants, but he did nothing.

There was another assayer who built up a wholesale business in receiving stolen ores. He had a back room fixed up with crushers and a furnace kept hot, so that at any time, night or day, he could get away with several hundred pounds of rich ore on short notice, and smelt it. Sometimes he would get it in ton lots at night by appointment with the boys, and by morning there would be no evidence left. He was arrested several times, but they were never able to convict him. Later he quit, and bought business property on one of Denver's main streets.

Around a camp fire in Alaska, a miner told me that for 18 months he averaged more than \$50 per day of high grade, which he took from a well known Gold Hill producer. We know that he worked on this mine, during the time specified, and upon his return from Alaska, where he did not make a dollar, he put \$10,000 or \$12,000 into a saloon on Bennett Avenue.

Large amounts of stolen ore were shipped out by express, freight and wagons, the greater portion going to Pueblo and Denver. It was an exceedingly profitable business to everyone connected with it, as much of the ore would run from \$5 to \$50 per pound.

For ingenuity and cunning in stealing rich ores, the Mexican beats them all. I have known of his greasing the hair of his head and his body, rubbing in thoroughly the fine drillings of native silver.

The water boys who carry a five-gallon oil can of water on each end of a bamboo stick, which is light, strong and hollow, except at the joints or knots, which are drilled through, join with the miners in filling the bamboo stick with the native-silver drillings, thus getting away with several ounces at each trip.

In Northern Mexico, in recent years, the theft of rich ore from a well known producer was enormous. From a distance I saw, one morning, 35 mule-loads of ore going to a distant ranch, where it could be ground up in the *tahonas*. For a distance from 10 to 100 miles from the mine, we have seen this ore, which was easily recognized, being ground in a *tahona* run by a burro or mule.

Two miners were caught one day going out on the main trail with over \$2000 worth of ore on their backs. In the company doctor's trunk was found several thousand dollars worth of amalgam.

But the *gambucino* is the shrewdest. He makes a business of robbing mines, especially those not in active operation, to such an extent that it is a notorious fact in Mexico that one rarely finds any rich ore in sight. If a free ore, he grinds it in the *tahona*, and if base he will smelt it in an adobe furnace, using plenty of lead ore and litharge from some other adobe smelter. In either case, its identity is quickly changed.

Some merchant will always buy a product at a fraction of its value. I recall one case where the merchant and the Prefect of the district stood in together, took the *gambucino's* gold, worth \$300, and only gave him \$20 worth of goods. Then when he would not tell where he got the gold, they threw him in jail for 40 days. Later, during the Madero revolution, both the merchant and the Prefect had to make themselves scarce. The latter was caught, his mule taken from him, and he was made to walk a distance of 60 miles to Culiacan, where he was turned over to the rebels in control. I never learned what became of him.

I have known rich gold ores to be pounded up in an old quicksilver flask with a short drill, and then washed and panned down with a horn spoon. But rich silver ores and an adobe furnace seem to have the preference. Often within a radius of 10 miles of a rich mine, there will be several adobe furnaces, the owners of which make a living from stolen ores. They generally have a prospect nearby from which they claim to obtain the ores, but I never could find any rich ore in the prospect.

Often the Mexican mine owner is not very particular, allowing some ore to be stolen, rather than to make trouble. At one rich gold mine belonging to Mexicans, some of the employees are relatives and friends of the owners and it is rare that anything is said or any interference made with their stealing small amounts of ore, though it is a well known fact that there is considerable stolen all the time. This mine has run continuously during all of the revolutions with profit to the owners.

The only successful system of stopping the theft seems to be the one adopted in South Africa at the diamond mines. There the employees are kept in an inclosed compound, never allowed outside or to communicate with outsiders. When one leaves, he is stripped and examined for a stone which might be slipped under the skin. In some cases he is physicked as well, before being allowed to leave, and even with these precautions, a valuable stone is occasionally stolen.

In our country, a self-respecting, honest man objects to being searched, the fellow who wants to get away with the ore objects, and as it is often hard for the management to enforce searching of men as they come off shift, the theft goes on. Many say it makes a better, livelier camp with more money in circulation.

❖

The Neutralization of Mine Water Before Pumping is customary on the Rand, according to the September "Bulletin of the South African Institution of Engineers." The water carries a considerable quantity of free acid and this is neutralized in the sump with carbonate of either soda or lime. The cost of this process has been more than repaid by the reductions in cost of pump and pipe replacements. It is suggested that such neutralized mine water needs only to be freed of its flocculent impurities to make it excellent for milling purposes.

PHOTOGRAPHS FROM THE FIELD



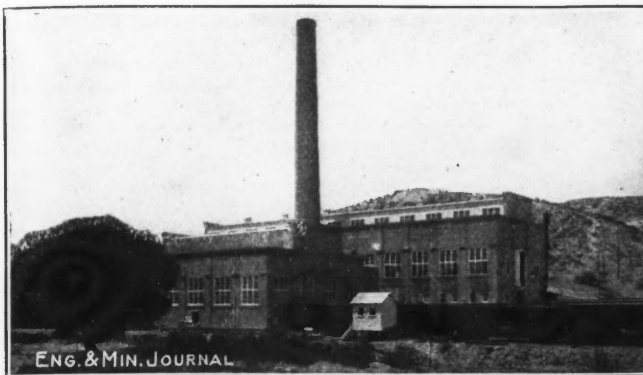
GENERAL VIEW OF THE MILLS AT COBALT, ONTARIO

McKinley-Darragh-Savage mill is in the foreground, across Cobalt Lake is the town of Cobalt. The view shows all the important mills in the camp. The Northern Customs concentrator is at left of center in background.



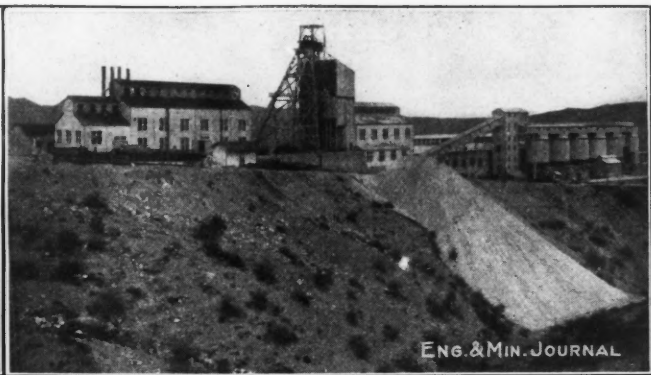
JUNTA CONSOLIDATED CYANIDE PLANT, TELLURIDE, COLO.

The plant, shown under construction, will have a capacity of 300 tons per day.



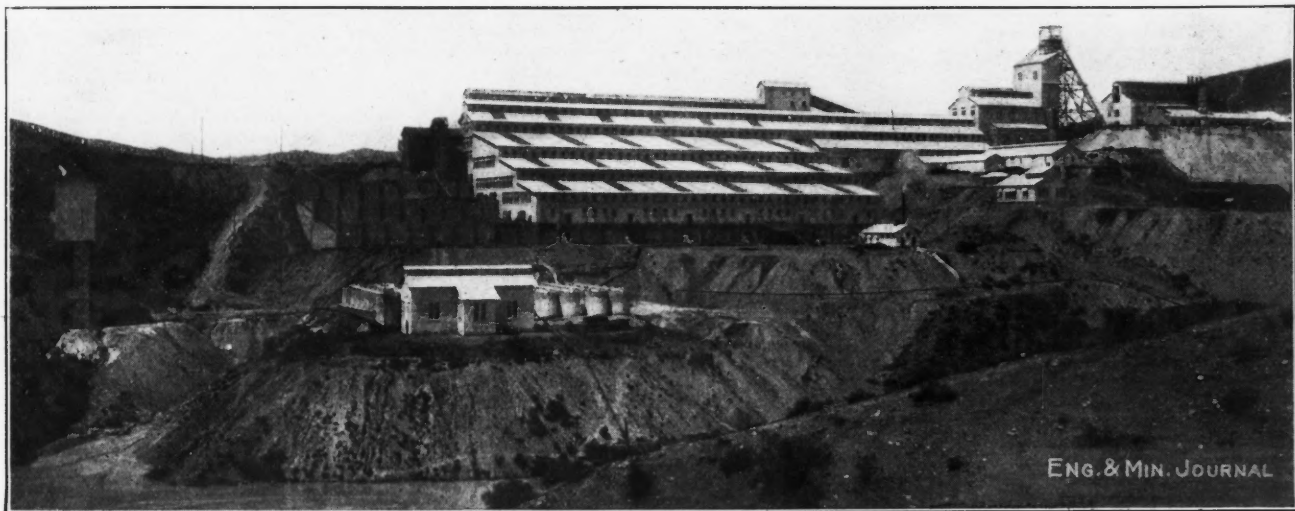
MIAMI POWER HOUSE ON FLAT BELOW MINE

Built of steel and reinforced concrete. Edge Moor boilers. Green economizers and Foster superheaters are used. Petroleum is burned, but coal could be used. Stack is 200 ft. high. Air is compressed to 90 lb. for mine use and 25-cycle electric current at 6600 volts is generated.



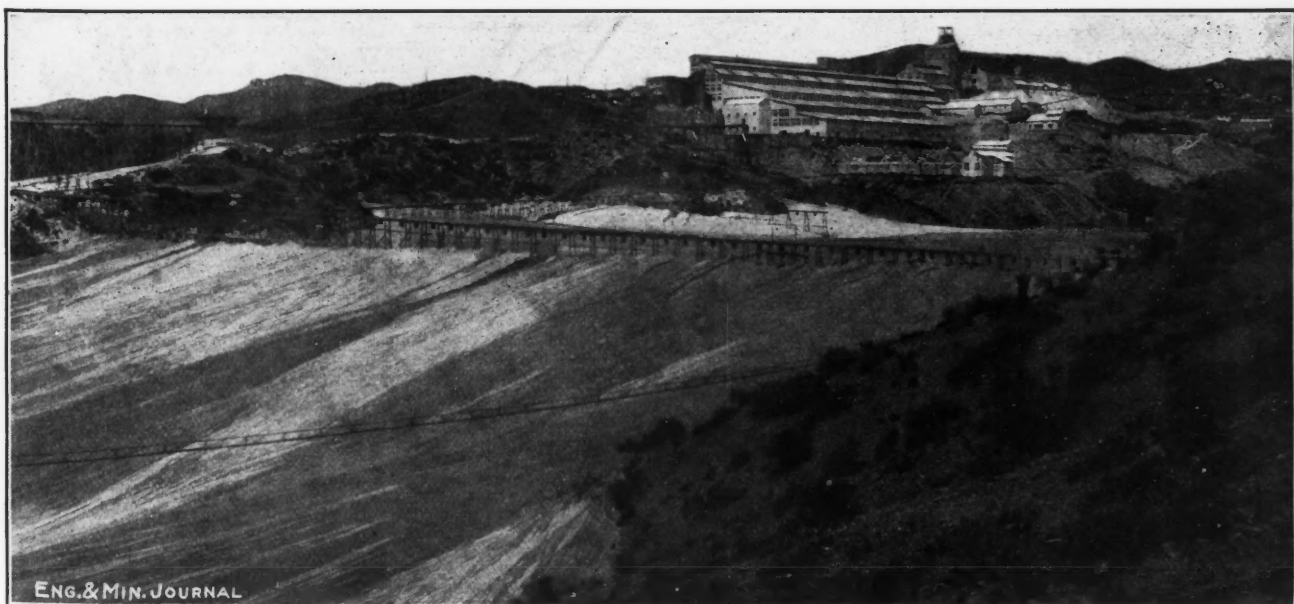
MIAMI No. 4 OR MAIN HOISTING SHAFT

Hoisting capacity 5000 tons per day. Five-compartment shaft 720 ft. deep, 12x16 ft. inside timbers, timbered with creosoted Louisiana long-leaf yellow pine. Each of the circular steel bins at back of the mill to right of shaft holds 1000 tons and serves one unit of the mill.



MIAMI MILL FROM ACROSS TAILINGS POND

No. 4 shaft is seen in the right background. Mill structure is of steel and concrete, only the launders are made of wood. Capacity, 6000 tons concentrating about 20 into 1.



CONCENTRATOR OF THE MIAMI COPPER Co., AT MIAMI, ARIZ.

Tailings Pond in foreground in which water may be clarified for reuse. Gulches to east of mill will afford dumping room for years after this gulch is filled.

NEW PUBLICATIONS

ANNUAL TABLES OF CONSTANTS AND NUMERICAL DATA, CHEMICAL, PHYSICAL AND TECHNOLOGICAL, VOL. II, 1911. 9x11, pp. 759; \$6.80 (paper bound, \$6). University of Chicago Press, Chicago.

HANDBUCH DER MINERALCHEMIE. VOL. II, Part 3. Edited by C. Doelter. 7x10, pp. 160, paper; 6.50 marks. Theodor Steinkopff, Dresden, Germany.

THE GEOGRAPHY AND INDUSTRIES OF WISCONSIN. By Ray Hughes Whitbeck. 6½x10, pp. 94, illus. Bull. 26, Wisconsin Geological and Natural History Survey, Madison, Wis.

OIL AND GAS PROSPECTS OF THE NORTHWEST PROVINCES OF CANADA. By Wyatt Malcolm. 6½x9¾, pp. 109, illus., paper. Memoir 29-E, Canada Dept. of Mines, Geological Survey, Ottawa.

THE GEOLOGY OF KALGOORLIE, WESTERN AUSTRALIA, WITH SPECIAL REFERENCE TO THE ORE DEPOSITS. By C. O. G. Larcombe. 5½x8¾, pp. 315, illus. Australasian Institute of Mining Engineers, Melbourne, Australia.

CONTRIBUTIONS TO THE STUDY OF THE GEOLOGY AND ORE DEPOSITS OF KALGOORLIE. EAST COOLGARDIE GOLDFIELD, Part I. By E. S. Simpson and C. G. Gibson. Pp. 198, illus. Bull. 42, Western Australia Geological Survey, Perth.

STATISTICS OF THE CLAY-WORKING INDUSTRIES IN THE UNITED STATES IN 1912. By Jefferson Middleton. With Notes on the Occurrence of the Different Varieties of Clay, by J. H. Hance. Advance Chapter from Mineral Resources of the U. S., 1912. Pp. 100. U. S. Geological Survey, Washington, D. C.

MERCURY, OR "QUICKSILVER," IN NEW SOUTH WALES WITH NOTES ON ITS OCCURRENCE IN OTHER COLONIES AND COUNTRIES. By J. E. Carne. Second Edition. 6x9¾, pp. 53, illus. board covers; 2s. 6d. Mineral Resources No. 7, Geological Survey Branch, New South Wales Dept. of Mines, Sydney.

THE MINERAL INDUSTRY DURING 1912. Vol. XXI, Edited by Charles O. F. 6¼x9¾, pp. 1090, illus.; \$10. McGraw-Hill Book Co., New York.

This is the 21st volume of the well known annual started by R. P. Rothwell, and published for many years by the "Engineering & Mining Journal." The present volume follows the main lines established by its previous editors. These are so well known that it is unnecessary for us to describe them anew. Each volume brings up to date the statistics and the commercial and technical history of the mining and metallurgical industry in the several parts of the world. This is done through the studies of the editor and his assistants and through contributions by experts in the respective subjects. The list of contributors to "The Mineral Industry" is always impressive, in the last volume no less than its predecessors.

A noteworthy improvement of the volume is the introduction of even more extensive bibliographies of the periodical literature than in previous years. A single volume, not even such a one as "The Mineral Industry," cannot be expected to include in abstract an account of everything that everybody may want to know. With its comprehensive reviews, however, supplemented by copious references the chances are that anybody will at least be put on the track of what he is looking for. Whenever information be needed the investigator may well begin his search by reference to "The Mineral Industry." It is a great labor savor, and consequently a necessity in every technical library.

APPLICATION OF ELECTRIC POWER TO MINES AND HEAVY INDUSTRIES. By W. H. Patchell. 5¾x9, pp. 333, illus.; \$4. D. Van Nostrand Co., New York.

The subject matter of this book was originally presented as a course of lectures, whence it is natural that the work shows a certain lack of finish in some details, and somewhat of discursiveness in others. Thus, in the opening chapters, the statistics of coal production, of labor employed, and of fatal accidents in the United Kingdom, are only casually connected with the subject; likewise with the discussion of the strength of wire ropes in the chapters on hoisting and hauling. The treatment is based almost exclusively on practical examples; theoretical discussions occur, but they are not usually analytical in character.

The chapter on the methods of laying, supporting, and connecting cables for underground work contains many valuable points of information. That on coal cutters presents a comparison of efficiency between air and electrically operated machines, greatly to the advantage of the latter. The two chapters on haulage contain much information on the subject in general, in addition to the electrical aspect of the problem. The chapter on hoisting first presents an analysis of the whole problem, and then describes the several methods of applying electric power to this operation; this is the most valuable section of the book. In connection with fan ventilation, a series of tests on modern installations is tabu-

lated. The section on air compression relates mainly to turbo-machines, while the chapter on pumping goes with considerable detail into a comparison between plunger and turbo types. In the chapter on rolling mills, after a discussion of the advantages of electric motors for this service, details are given of a number of recent installations throughout Europe. The chapter on cranes presents a number of striking examples of the use of electricity for this purpose, concluding with data on magnetic cranes. The final chapters on electric welding and electric furnaces presents the latest advances in these arts, describing the typical designs of apparatus and the methods of using them. A number of electric iron furnaces are illustrated.

IGNEOUS ROCKS: COMPOSITION, TEXTURE AND CLASSIFICATION, DESCRIPTION AND OCCURRENCE, VOL. II. By Joseph P. Iddings. 6¼x9¾, pp. 685, illus.; \$6. John Wiley & Sons, New York.

Vol. I of this book covered the composition, texture and classification of igneous rocks; the present volume describes the rocks in detail, and reviews their occurrence throughout the world. While the chemical composition of rocks is taken as the basis for their grouping into families, and the results of 2000 rock analyses are tabulated, still the chemical composition, in the description of a given group of rocks, is made subordinate to both mineralogy and texture, a condensation for which the old-school petrologists should be duly appreciative, coming from the one who has been most active in bringing forward the new quantitative scheme of classification. The new names appear, it is true, but generally in italics, and inconspicuously. The author, however, does not fail to present his reasons for the faith that is in him regarding the inconsistencies and confusion inherent in the old qualitative schemes, and the merits of the new system.

The volume is divided into two parts. The first describes the rocks, in groups and individually. All rocks are classed into six divisions, characterized as follows, the coarsely crystallized rocks being distinguished by their mineral components, and the finely crystallized or glassy rocks by their chemical composition: (1) By quartz; (2) by quartz and feldspar; (3) by feldspar; (4) by feldspar and feldspathoids; (5) by feldspathoids; (6) by mafic minerals (pyroxenes, hornblende, olivine, mica, garnets, etc.). In each division the rocks are first defined in general terms. The phanerites (coarsely crystallized) are described first, and in divisions 1 to 5 are divided into groups according to the preponderating feldspars or feldspathoids, and in division 6 according to mafic minerals. The descriptions are first mineralogical, then textural, and lastly chemical. Aphanitic (finely crystallized or glassy) equivalents of the phanerites in each division are then described, and, so far as possible, are considered in groups corresponding to those established for the phanerites.

To illustrate the method employed, the following synopsis of division 2 may be given: General definition and method of subdivision. Mineral composition of the phanerites. Specific characters of the constituent minerals. Textures. Group A—Granites. B—Quartz-monzonites and granodiorites. C—Quartz diorites and quartz-gabbros. (Under each group, all the related types are fully discussed.) Chemical composition of the phanerites (grouped as above). Aphanites of division 2 in general. Composition of the constituent minerals. Group A—Rhyolites (with its related types). B—Dellinites. C—Dacites. Finally, in tabulated form, come about 270 analyses of rocks belonging to this division, the footnotes under each table stating the name and locality of the rock, and the chemist who made the analysis. Under each analysis, also, is given the recalculated criteria by which the rock is assigned to its place in the quantitative scheme. This same method is followed in each of the six divisions. The striking characteristic of this part of the volume is the widely separated habitat of the rocks discussed, ranging from Greenland to the Antarctic and from Asia Minor to Java.

In the second part of the volume, the occurrence of igneous rocks all over the known world is described. The descriptions are necessarily brief, and in some cases are little more than indicative, but they serve as a basis for the discussion of petrographic provinces. The world's area is divided as follows: North America and contiguous islands; South America; Europe and western Asia; Africa; islands of the southern Indian Ocean and Antarctica. Asia and Japan; Philippine islands and the East Indies; Australia and New Zealand; islands of the Pacific Ocean. The different districts of the United States are naturally treated in more detail than other parts of the world. In the preparation of part II, geological literature has been drawn upon to the widest extent; no fewer than 977 references are cited, all being classified and tabulated in a separate section at the back of the book. Finally, an index covering 11 closely printed pages renders quickly available the mass of data in the book.

CORRESPONDENCE AND DISCUSSION

Calculation of Extraction in Cyanidation

The accompanying extracts from recent Bulletins of the Institution of Mining and Metallurgy have some bearing on the discussion of methods of estimating extraction in gold mills and cyanide plants, which has been inaugurated by Mr. Megraw's articles¹ and the comments by Messrs. Cadogan², Simpson³, Additon⁴ and Welton⁵. In the paper by Allan J. Clark and W. J. Sharwood, on the "Metallurgy of the Homestake Ore," the authors describe the control of operations, in part, as follows:

"Mill feed is not directly sampled, but in metallurgical summaries is calculated from tailings assays and bullion actually recovered. The feed to the sand plants has been sampled by means of a horizontal slotted pipe, pivoted at one end, which was swung at intervals by hand across the stream of pulp. An improved sampler has lately been installed, in which the slotted pipe is suspended from a small car running on rails, and is moved through the stream parallel to itself and at a uniform rate, by a sprocket chain driven by a winch. Three portions of 1.5 a.t. each are assayed from each vat charged, and the gold buttons are weighed progressively.

"Sand residues are sampled after the final draining by making a number of vertical holes with a pipe having a slot with one lip projecting to form a cutting edge, and a conical solid point. The sampler is then laid over a trough divided into three equal sections, giving a 'top,' 'middle' and 'bottom' section. Two portions of 2 a.t. are assayed from each sample, and the two buttons are weighed together. The assays of the three layers, and their average, are reported, and the average is used with the corresponding 'charge' assay in computing extraction.

"Sand is estimated from the depth of each charge, after leveling the top, and is based on the area of the vat and the average weight of a cubic foot of sand, after drying.

"Slime heads or charge samples are drawn from the main feed pipe, one being taken when each press commences filling, and a general sample being cut from the accumulation of each 24 hr. Four melts are made of 2 a.t. each. The result is checked by daily samples taken hourly with a cup from the 'No. 1 sludge' and 'No. 2 sludge' streams.

"The slime plant is divided into three sections of nine or ten presses each. In each section there are placed three residue-sample buckets, A, B and C, corresponding to the 'fast,' 'average,' and 'slow' leaching rates of the charges. During the sluicing of each charge a cup sample is caught at the outlet cocks and put into the sample bucket corresponding to its leaching rate. Three fusions of 2 a.t. each are made on each of the three samples caught daily.

"Slime tonnage is assumed at 25 tons of dry solid per press charged, and is based on a number of determinations of the net contents of equidistant frames.

"All slime samples are dewatered on a horizontal laboratory filter press, having a working surface 18 in. square. Compressed air is used, as no vacuum is available. The thin, tough cake obtained is rolled into a cylinder on the cloth and cut into sections with a knife or spatula. Sand samples, after draining if necessary, are cut down with a trowel while moist. Dried samples, either of sand, slime or crushed ore, are cut down with the Jones riffle.

"Stamp-mill tonnage is usually averaged at 4.2 tons per stamp per 24 hr. The numbers of cars hoisted and delivered to the mills are also recorded. When the performance of particular batteries is to be accurately determined it is done by timing with a stop-watch the filling of a measure holding 2 cu.ft., and then weighing the amount collected.

"The daily performance of tube-mill and pans is determined by timing the filling of a 5-gal. bucket ($\frac{2}{3}$ cu.ft.), and weighing the catch. Wherever possible the tipple is used for diverting the flow to the sampler. Suitable tables have been drawn up so that the rate in tons per day, and the water ratio can be read at a glance from these data. The readings are made twice a shift, six times daily, and averaged.

"Assay samples of the feed to pans and tube mill are taken with slotted-top hand samplers, and are used for assay and sizing tests. Similar samples of the tails or ground product are taken. Three samples of 1.5 a.t. each are taken for assay.

"The specific gravity of various samples is determined by the hydrometer in the case of slime pulp, or by the weighing of a tared liter flask full of coarser material. From the gravity of such pulp the water ratio is at once calculable, as for nearly all purposes the density of all products can be assumed as constant at 3. The chlorite and hornblende have a specific gravity somewhat over 3, quartz 2.6, and the iron sulphides about 5. When concentrating by cones the coarse quartz of low gravity and the sulphides of high gravity tend to go together, so that the average is not much changed.

"At the sand plants it is the practice to fill a vat with pregnant solution to a fixed point, and then precipitate it, so that the tonnage of each precipitation is known. The pregnant sample is taken by a drip system, a small iron pipe, tapped into the main and controlled by an iron screw, dripping into an enameled iron bucket, from which a sample is dipped into a bottle after the vat is full. This is occasionally checked by taking a 'dipper' sample from the full vat.

"At the slime plant continuous pumping is practiced, and a similar sample is taken for each eight-hour shift, the tonnage being computed from the speed of the electric pump.

"The 'barren' solution samples, corresponding in periods to the various 'pregnants,' are taken by a similar drip system from the launders leading from the precipitation presses. A special barren sample is usually taken to cover the first half hour of a tank precipitation, and occasionally hand samples are taken half hourly from

¹Engineering and Mining Journal, March 8 and Sept. 6, 1913.
²Engineering and Mining Journal, May 31 and Sept. 6, 1913.
³Engineering and Mining Journal, June 21 and Sept. 6, 1913.
⁴Engineering and Mining Journal, July 5 and Sept. 6, 1913.
⁵Engineering and Mining Journal, July 12 and Sept. 6, 1913.

suspected sections of presses, if precipitation is not entirely satisfactory. As a further check on the barren solutions, daily samples are taken from the storage vats in which they are collected.

"Common quart glass bottles are used to convey solution samples to the assay office. By holding these lightly on an emery wheel a label is ground on them, so that they can be legibly marked with a lead pencil.

"Solution samples are assayed by precipitation with zinc dust in presence of acetate, followed by heating and addition of hydrochloric acid. The lead sponge obtained is filtered off and scorified with the addition of metallic silver, and then cupeled and parted. This is a modification of the Chiddey method, and has been in use since 1904. In the case of rich solutions 250 c.c. are taken, and from 'barrens' 500 c.c.; a special table is used to convert the milligrams of gold obtained to the basis of dollars per ton.

"During a clean-up the wet precipitate from the press is mixed well in the shallow collecting tray, and is then shoveled into boxes. Usually every fifth shovel is thrown upon an iron plate, where it is systematically quartered down at once to a sample of 2 lb. to 4 lb.

"An alternative method is to take a tryer sample (four or five cores) from each of the filled boxes, which is further reduced by the tryer.

"The boxes are weighed on a platform scale as soon as filled, and again when delivered for acid treatment.

"The final sample is put in an iron jar with air-tight cover, and is taken to the assay office. Here it is weighed in a shallow pan, dried at 100° C., and moisture is calculated to 0.1%. The dried precipitate is then roughly crushed and quartered down on a Jones riffle sampler to about 100 grams or 150 grams. This sample is ground fine in a Wedgewood mortar, without sifting, and samples of 0.1 a.t. (usually triplicates) are weighed out for assay as quickly as possible, weighing to the nearest milligram or half milligram. Better results are obtained by grinding without sifting, as dusting, oxidation and absorption of moisture are thus avoided, and there are no actual metallics as in zinc-box product.

"For the assay of precipitates a fusion method is used, one-third of the flux being retained for use as a cover, with a further addition of a little borax glass. The slag and cupel of each sample are fused together with a special flux, and the resulting lead cupeled; the correction button thus obtained is weighed with the main button. These are inquarted and cupeled with proof, etc., and parted in a standard platinum apparatus. When fusions are performed in a muffle this method gives results which agree closely among themselves, and also with parallel determinations made by the best 'combination' acid-scorification methods.

"Samples of bullion bars are taken from two opposite corners with a pneumatic drill in the case of mill bullion, and by chipping with a chisel in the case of bars from the cyanide plants. After sampling, the bars are weighed to the nearest hundredth of an ounce. One assay (0.5 gram) is run on each sample for gold; silver is determined by cupellation of only one sample from each bar. The fineness is reported to the nearest quarter-millième for gold and half-millième for silver, which conforms to the practice of the United States mint, to which the bullion is sold.

"The total weight of quicksilver fed to the batteries is reported daily to the main office by the mill foreman, together with the weight of each individual lot of amalgam; the amalgam weights are checked later when delivered at the assay office, and the corresponding weight of bullion and 'retort percentage' are reported for each mill. The daily weighings of mercury and amalgam indicate closely the amount recovered, and the probable value of the clean-up.

"The standard sizing test is made by passing the dry material over sieves of 100 and 200 meshes to the linear inch, the percentage of the three products being respectively reported as coarse, middle and fine. Others of 50- and 80-mesh are used where necessary. The apertures are given in Table I:

TABLE I. SCREEN APERTURES

Nominal mesh per lineal inch	Aperture calculated from nominal mesh and wire diameter, in.	Average measured aperture in.	Nearest Mesh in.	Equivalent Standard Aperture in.	I.M.M.
50	0.011	0.0115	50	0.010	
80	0.0071	0.007	70	0.0071	
100	0.0051	0.0057	100	0.005	
200	0.0029	0.0027	200	0.0025	

The fines are still further separated by a centrifuge into two grades, which are styled "granular" and "floculent."

"A comparison of the actual production of a cyanide plant with the estimates based upon daily samples and tonnage is always of interest; we have prepared such a record to cover the first 10 years' operation of the No. 1 sand plant, which is the oldest of the three, and to include also the entire product of No. 2 sand plant (eight years) and the slime plant (four years) up to the close of 1910. The figures include gold only, and the total value of product is between \$8,000,000 and \$9,000,000, from over 9,000,000 tons treated.

COMPARISON OF GOLD VALUE

Gold value of bullion actually sold.....	100.00%
Called for by assays of precipitate.....	100.10%
Called for by assays of charges and residues.....	100.67%
Called for by assays of solutions before and after precipitation.....	99.55%

"The excess in the case of the charge-residue estimate is partly due to the imperfect charge sampler used during this period at No. 1 plant, which has invariably given somewhat higher gold values than check core samples taken from top to bottom of the charge, in the same manner as the residue samples are obtained. The use of the core or tryer method, however, is not advisable in the case of the charge, as it offers too many chances for channeling and 'short-circuiting' of air and solution during subsequent treatment.

"The main assay office at Lead includes the laboratory, refinery and electro-plating equipment, and serves the mine and cyanide plant No. 1, and here all assays of bullion and precipitate are made. A small assay office is operated by one man at cyanide plant No. 2, and another at the slime plant.

"At the slime plant no grinding is necessary; at the other offices disk grinders are in use, and ore samples have a preliminary crushing with a small Gates crusher and bell grinder."

In discussing the paper quoted, W. H. Shockley said: With regard to the question of the extraction at the Homestake, it seemed to him they did not know. They did not know how much ore they milled, and they did not know the value of it and, without knowing those factors, they could not tell what percentage they extracted. That was plain enough. They did not sample the ore, they did

not sample the mill feed, and they also said they did not weigh it. They kept an account of the number of cars hoisted and delivered to the mill, and estimated the tonnage at 4.2 tons per stamp. It was only by those indirect methods that they got at the amount of the ore. It seemed to him that a company like that ought to have one mill where they knew what they were doing.

In reply to the above the authors wrote:

"The tone of finality in Mr. Shockley's comments makes it somewhat difficult to formulate a reply; apparently, however, his objection to our methods of computing the percentage extraction, etc., is simply the fact that they are not the methods most commonly followed. Others have also questioned their accuracy from time to time, because, like the concentration formulas described by Gahl, Hoover and others, they are less obvious in principle than methods involving the direct weighing of every pound of ore, together with sampling and assaying it before milling. But must a surveyor drag a chain to a remote object to determine its distance, when he has the means of measuring a base line and a couple of angles? Does not Mr. Shockley overlook the fact that the sampling and weighing of large tonnages of coarse, low-grade, and more or less spotty gold ore, with the accompanying moisture determinations and assays, can rarely be carried out without larger aggregate errors than our system involves? True, we do not weigh the ore directly, nor before milling, nor do we sample or assay it directly. We do, however, determine, by methods which are mathematically correct in principle, and probably within 1% of actual physical accuracy, the weights of all the separate products collected in the three cyanide plants. The weight of escaping slime is similarly determined, but, as the amount is relatively small, the percentage error may be greater, though the absolute error is trifling. The sum of the dry weights of sand treated at No. 1 and No. 2 plants, of the slime treated, and of the small proportion of slime going to waste, necessarily equals the total weight of ore crushed. The value of the bullion extracted at the mills and plants is accurately known, as our assays agree closely with those of the U. S. Treasury Department, which purchases it. The residue of every charge at the various plants is very carefully sampled and assayed, and the wasted slime is also periodically sampled and assayed.

"In the matter of assays the customary close agreement over long periods between the charge-residue figure ('theoretical extraction'), the solution values, the precipitate, and the resulting bullion, has given us a reasonable degree of confidence in this branch of the work.

"To show that we have not neglected the question of measurement, we refer to a description of some of these methods published in the *Mining Magazine*.⁶ By checking them in various ways we have convinced ourselves that 2% represents the maximum error in our weights, and nearly all our tests have indicated that we are well within 1% of the truth.

"But, adopting the methods of computation which we use, namely, taking the total content of the residues, etc., escaping (determined by weight and assay), and the total bullion content, as together equaling the original ore content, the percentage error in the 'extraction' thus computed may be demonstrated to be very much smaller

than the percentage error in the weight of ore. This is always the case when the actual extraction is reasonably high.

"While we must apologize for devoting so much space to this portion of our reply, the matter is so vital that we feel obliged to attempt to make our point clear, and we invite Mr. Shockley's attention to the following analysis of what we may call the Homestake method of computation (though it is not entirely original with us) as contrasted with the orthodox procedure.

"When the percentage recovery is based simply on assays of the original mill feed, and of the final tailing or residue discharged, the calculation is entirely independent of the tonnage. Thus, if p is the original assay, and r that of the residue, the percentage recovery is:

$$\frac{100(p-r)}{p}$$

For any variations dp and dr in the values obtained for p and r , the corresponding variation in the final percentage is:

$$d\left(\frac{100(p-r)}{p}\right) = 100\left(\frac{r}{p^2}dp - \frac{1}{p}dr\right)$$

If we take $p = \$4$ and $r = \$0.24$, we have:

Percentage variation in extraction = $1.5 dp - 25.0 dr$.

"The reasoning adopted covers the simplest case, where only one kind of residue is considered, and that is equal in weight to the original ore. The latter condition applies to ores of the precious metals where roasting and concentration are not practiced. For instance, at the Homestake the monthly 125,000 tons of ore yield only about one ton of gold bullion. When there are several residues, or products of considerable weight, to be taken into consideration, the expressions become somewhat more complicated, but the final results are similar.

"In calculating the percentage extraction by this orthodox method (by assays alone) an error of one cent (\$0.01) value in the heads assay (p) has therefore less than one-sixteenth the influence of an equal error in the assay of tails or residue (r). If the error is 10% of the value in each we have $dp = \pm 0.40$, $dr = \pm 0.024$, whence the maximum error in the final percentage becomes approximately:

$$\pm 0.6 \pm 0.6 = \pm 1.2\% \quad (\text{Case I})$$

"If, on the other hand, no precautions are taken to sample the heads or feed, but only the residue or tails, while the tonnage (t) is approximately determined, the original content can be computed by adding to the residue assay (r) the quotient obtained by dividing the total recovery (V) by the tons (t).

The percentage recovery is then:

$$\frac{100 \frac{V}{t}}{\frac{V}{t} + r} = \frac{100V}{V + rt}$$

"The error introduced in the percentage recovery thus calculated, by variations dr and dt in the values of residue and tonnage (V , the total recovery, being known and constant), is:

$$(d)\left(\frac{100V}{V+rt}\right) = \left(\frac{-100V}{(V+rt)^2}\right)(t dr + r dt)$$

"If, in a particular case, $V = \$37,600$, $t = 10,000$ tons, and as before, $r = \$0.24$, we have:

⁶W. J. Sharwood: "The Measurement of Pulp and Tailing," *Ming. Mag.*, I (1909), pp. 226 and 297; II, p. 45.

“Variation in calculated percentage recovery
 $= -23.5 dr - 0.000564 dt$.

“And if $dr = 10\%$ of $r = \$0.024$, and $dt = 10\%$ of $t = 1000$ tons, we should have, as the approximate maximum error in the percentage recovery,

$$\pm 0.564 \pm 0.564 = \pm 1.128\% \quad (\text{Case II})$$

“If, again, the error in t is only 2% , or $dt = 200$ tons, the maximum error in the percentage recovery calculated would approximate:

$$\pm 0.564 \pm 0.1128 = \pm 0.67\% \quad (\text{Case III})$$

“As a concrete example is usually more convincing than mere mathematical demonstration, we have worked out a case in detail, to show how small is the effect on the calculated percentage extraction, of excessive percentage errors in the assumptions made regarding the heads, tails and tonnage.

“Assume that 10,000 tons of ore are treated, which actually contain \$4 gold per ton; that gold to the value of \$37,600 is actually obtained therefrom; and that the tailing or residue contains \$0.24 gold per ton.

“By whatever method we calculate, we have:

Heads.....	\$4.00 per ton
Tails.....	0.24 per ton
Extraction.....	3.76 per ton
Extraction.....	94%

“Now assume an error of 10% in the assays, and in opposite directions, giving the most unfavorable conditions. We have two cases: (a) Heads high and tails low, and (b) *vice versa*. Consider the extraction based on assays alone:

	a	b
Heads.....	\$4.40	\$3.60
Tails.....	0.216	0.264
Extraction.....	4.184	3.336
Percentage extraction.....	95.091	92.666
Maximum error in percentage.....	1.091	1.333

“If the error were in the heads assay alone, the percentages would be 94.545 and 93.333; if in the tails alone, 94.60 and 93.40.

“Again, assume that the extraction is to be calculated by the method adopted at the Homestake; namely, by dividing the actual value of the bullion sold by the estimated tonnage, and adding the residue assay to this figure to obtain the original value of the ore. In this case we may also assume the error in estimating tonnage at the absurdly high figure of 10% , and consider also the worst conditions, when the residue assay varies 10% in the direction which increases the error.

	a	b
Bullion value.....	\$37,600	\$37,600
Tons.....	9,000	11,000
Extraction calculated from bullion and tonnage.....	\$4.178	\$3.418
Tails by assay.....	0.216	0.264
Heads (sum of above).....	4.394	3.682
Percentage extraction.....	95.084	92.830
Maximum error in percentage.....	1.084	1.170

“Here, again, if the error in tailing assay is zero, the percentages become 94.567 and 93.441.

“As in fact we have evidence of the highest class that the error in estimating tonnage is less than 2% , and probably within 1% , we will recalculate the percentage extraction, as before, on a hypothetical \$4 ore yielding a 24c. tailing, but assuming an error of 2% in the tonnage estimate; at the same time considering the possibility of a 10% error in the tailing assay. Here there are several variations depending on the coincidence of errors:

Tonnage estimate.....	High	High	Low	Low	High	Low
Tailing assay.....	Low	High	Low	High	High	Low
Tons assumed.....	10,200	10,200	9,800	9,800	10,200	9,800
Extraction calculated from bullion and tonnage.....	\$3.686	\$3.686	\$3.837	\$3.837	\$3.686	\$3.837
Tails by assay.....	0.216	0.264	0.216	0.264	0.240	0.240
Heads (sum of above).....	3.902	3.950	4.053	4.101	3.926	4.077
Percentage extraction.....	94.464	93.316	94.670	93.562	93.887	94.113
Error in percentage.....	0.464	0.694	0.670	0.438	0.113	0.113

“From a consideration of this specific example, as well as from the general analysis preceding, it is evident that the error in the calculated percentage extraction depends much more upon errors in the tailing assay than in that of the heads or in the tonnage.

“Experience has shown that the true tonnage per stamp per 24 hours so nearly averages 4.2, that it is safe to accept this figure for all ordinary approximations.

“We may add that mechanical samplers have for years been attached to certain batteries of stamps for experimental purposes, so that parallel tests can be made for comparison of various adjustments, screens, etc. The tonnage performance of any 5-stamp battery can at any time be determined by a time-gravity measurement.

“As examples of actual measurements we may cite some made on a fairly large scale within the last few months, which have closely verified previous results. For instance, the 54-ft. sand vats at No. 2 plant have been deepened during 1912 by adding a further extension of sheet-iron to the staves, thus making the depth of sand about 13 ft. 6 in., with a tonnage of about 1350 per charge. The tonnage of the special charge measured, by the standard everyday system of computation, based on the depth and weight of sand from a number of cubic-foot boxes, is given as (a) below.

“Another system was used to check this in two ways. At the start the sand vat was completely filled with water. A large tank (1246 cu.ft.) was arranged so that the entire overflow (equaling in volume the entering pulp) could be switched into it, and the time of filling the 1246 cu.ft. noted. This tank was filled 53 times at equal intervals during the 48 hr. required to fill the sand vat, the total volume of pulp being thence calculated as 92,711 cu.ft. Meanwhile the pulp was systematically sampled by a mechanical cutter, a standardized bucket of $\frac{2}{3}$ cu.ft. capacity (5 U. S. gallons) being filled and weighed 116 times at equal intervals. The samples were all thrown upon a filter, to be dried and weighed later. The specific gravity of the dry solid was accurately determined. From these data the following computations (b) and (c), were made:

- (a) Tonnage for a depth of 160 in., based on former accepted weight of cu.ft. boxes... 1344.0 tons.
- (b) Sp. gr. of ore 2.985. Average weight of 116 buckets of $\frac{2}{3}$ cu.ft. = 54.575 lb., or 81.862 lb. per cu.ft. pulp. Average sp. gr. of pulp = 1.31, whence 1 cu.ft. contains 29.062 lb. dry sand $29.062 \text{ dry lb. sand per cu.ft.} \times 92,711 \text{ cu.ft.} \div 2000 = 1347.2 \text{ tons.}$
- (c) Total dried sand from 116 buckets totaling 77.333 cu.ft. pulp weighed 2261 lb., or 29.24 lb. per cu.ft. pulp. $29.24 \text{ dry lb. per cu.ft.} \times 92,711 \text{ cu.ft.} \div 2000 = 1355.4 \text{ tons.}$ Maximum variation = 11.4 tons = 0.85%.

“By similar methods the tonnage of a charge at No. 1 plant was found to be: a, 569; b, 566.0; c, 564.4; variation, 0.81%.

“In reply to the question as to the method of computing the 94% extraction, this figure is based on the total gold content of the ore mined and milled. As stated, 72% of this is obtained as amalgam, 22% by cyanidation. The average extraction from sand and slime together, is therefore approximately 22/28, or about 78.5%, including the loss in slime wasted. We omitted to mention that the actual average extraction from the sand cyanided is $\frac{3}{4}$, or 75%, and from the slime treated is $\frac{8}{9}$, or 88.9%.”

W. J. SHARWOOD.

Lead, S. D., Sept. 10, 1913.

EDITORIALS

The Downfall in Copper

The report of the Copper Producers' Association for October shows that in spite of the restriction of output in Michigan and Mexico, the production by the refiners continues to run rather high. This may imply simply drafts on the stock of unrefined copper, of which a surplus was carried over from 1912, and which increased further during the period of the strike at the Nichols refinery last summer; or the appearance of copper refined from crude imported from Europe, and temporarily converted into invisible supply, the quantities of copper afloat between Europe and America not being reported in any of the statistics; or both these conditions may be playing a part.

The maintenance of deliveries, both domestic and foreign, is discouraging rather than encouraging. In view of the fact, now well established, that American brass-makers are operating at reduced capacity, while things are not just right in other branches of the copper-manufacturing industry, all of this reflecting the general recession in trade, the maintenance of large deliveries to the manufacturers indicates their overbought situation, and their ability to remain out of the market for some time yet to come. As we have previously pointed out, it is not the spot and near-by position that is worrying the producers, but rather the state of their order books for December and later deliveries.

We have witnessed during the last week something akin to demoralization in the copper market, the metal having been steadily offered down and the market being apparently headed for 15c., plus or minus. The old asked price of 16 $\frac{7}{8}$ c., which is still nominally maintained, and is talked about in the newspapers, is as meaningless now as would be an asked price of 25c. Even the producers which maintain that price intimate, prayerfully, that any substantial bid will receive careful consideration. Indeed, certain of these producers as long back as a fortnight ago began surreptitiously to do rather more than intimate willingness. In the meanwhile, the other important agencies have been openly and severely cutting prices in their efforts to sell.

We have been during the last week favored with the usual newspaper pabulum for public consumption, denying that the price of copper is anything but the top price, dwelling upon the strong statistical position, which "an important producer says is superior to anything that ever occurred within his memory," etc. If people like to talk such half truths or nonsense, and other people like to be deceived by it, they may, of course, suit themselves.

The statistical position is apparently strong on the face of things, and it is true that the Rio Tinto and Michigan strikes and the Mexican troubles have materially restricted the output of crude copper. The output of refined copper has not yet been restricted in just the same proportion, on account of the working off of old accumulations of crude copper, some operations of 1912 here coming home to roost. We do not think that the pes-

simistic notions respecting the effect of full resumption of the Michigan output in the near future are sound. The strike there has become a stalemate, out of which the companies will gradually extricate themselves, but their production is going to be restricted for a long time because of scarcity of labor. As to the Mexican troubles, he would be an optimist indeed who can see any near outcome from them.

The thing that has caused the temporary downfall of copper is not increasing production or the prospect of it, but rather diminished consumption, reflecting the general recession in business. Whenever such a condition develops, the feelings of producers become of the gloomiest. They persuade themselves almost that the consumption of copper is going to cease altogether, that nobody is ever going to buy any more. In fact, the difference between the normal rate of consumption and the rate in the nadir of depression is perhaps not more than 10%, and consumers will continue to have to buy a great deal of copper, and, moreover, to buy it right along. At present, the market is simply going through one of its recurrent agonies of trying to establish the price at which buyers will be generally interested.

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The Situation in Mexico

We should like to find a cheerful optimist who can see any improvement in the state of affairs in Mexico. To us they seem to be steadily going downhill. If we may judge from the newspaper dispatches, this also is the view in Washington. The administration seems still to be without a definite policy.

There is talk of aiding the constitutionalists, of declaring Mexico an outlaw among nations, cutting off its supplies of arms, ammunition and money, and finally of intervention, with or without appropriation of Mexican territory.

As against recognition of the constitutionalists, it is argued that their success would simply substitute a different kind of disorder in Mexico, that the United States would have to intervene eventually, and that in such event the arms supplied by us would be turned against us. Moreover, it is argued, recognition of the constitutionalists would jeopardize subsequent claims for loss of life and property, the bill for which is increasing steadily.

In favor of the outlawry of Mexico it is argued that if intervention should finally become necessary, the Mexicans would have scarcely anything better than bows and arrows to fight with. On the other hand, such isolation of Mexico would paralyze industry for many years to come.

As to intervention, everybody recognizes the serious consequences to come from it, and hesitates to advocate it. Yet, it is being admitted more and more that the logic of events is pointing that way.

There is one very important thing that is being quite

lost sight of. It is assumed that when order is finally restored in Mexico and a strong, legitimate government has been established there, all that foreign corporations which have lost their property will have to do will be to file their bills and collect their damages. Let us assume that after prolonged diplomatic negotiations such a result is attained, who, then, will pay the money and how will it be obtained? Of course, the money will have to be raised by taxation and the taxation will fall heaviest upon the industrial companies. In other words, they will collect their indemnities but they will, themselves, pay it, so they will be no better off. The experience of the gold-mining companies of the Transvaal, after the war there, will illustrate this. It is a sad economic truth that there is no recouping of the capital that is destroyed by war, fire, pestilence and acts of God. The longer such destruction goes on the worse is it for everybody.

✽

Reducing Losses

The managers of our mining and metallurgical companies have never given so much attention to the reduction of losses in ore treatment as they are now. The discharge of tailings carrying nearly one-third of the original copper content of an ore, even if it be only a low-grade ore that 10 years ago was unworkable at all, is more of an offense in their own estimation than it is in the eyes of the most voluble conservationist. "I don't believe we'll have any trouble from the farmers on account of these tailings," said a mill superintendent to his general manager. "It's not the farmers that I'm thinking about," replied his superior. "It's the 10 lb. of copper per ton that we're letting go. I don't know now how to get that copper, but I don't want to let the tailings go to places where I can't get it some day when I know how."

We think it not premature to say that a great deal of the "knowing how" has been learned during the last two or three years, and a great deal more will be learned in the next year or two.

The problem, briefly stated, is to recover the copper which can be released only by fine grinding, and which in ordinary mechanical concentration disappears in the slime, the *bete noir* of the millman. In the solution of this problem experimentation is proceeding along the following lines:

- (1) The improvement of existing methods of mechanical concentration.
- (2) The introduction of new methods of mechanical concentration.
- (3) The development of hydrometallurgical methods.

None of the companies that have engaged themselves in this matter has tied itself to any one of these lines. Rather is it the idea to try everything and adopt the best. The work of the Anaconda company, which is perhaps further ahead than any other, has been of this nature.

The Anaconda company has a large accumulation of slime and is adding to it every day. This accumulation is comparable, both in assay and tonnage, to the orebody of a first-class porphyry mine, with the differences that on the one hand the copper is more difficult of extraction and on the other hand the ore is already mined and is lying on the surface. Plants to treat this deposit have been erected by the Bradley process company, a hydro-

metallurgical project, and by the Peck concentrator interests. The Bradley process proved a failure, but the Peck concentrator has been a success. This employs a new principle in mechanical concentration, viz., centrifugal force. For a year or more it has been in regular operation, delivering a considerable tonnage of commercial product.

At the same time the Anaconda company itself has been experimenting with the time-honored round table and finally has constructed a 20-decker. The multiplicity of decks, which results in a tower-like structure, does not introduce any new physical principle, but reduces cost of construction, floor space, etc., and permits the use of a great deal more table area than is commonly the practice. These features, together with the cement surface of the tables and other details of construction are considered to have gone far in solving the slime problem at Anaconda. The Peck centrifugal concentrator and the 20-deck buddle give results of a similar character, but the 20-deck buddle is thought to be the superior. It is announced that a large plant of this type will be built.

The Anaconda company has also experimented with the Laist process, a hydrometallurgical method, and has erected a plant of 80 tons daily capacity. Hydrometallurgical methods of copper extraction are no new thing, but away from the peculiar conditions of Spain and Portugal they have never been employed on a very large scale, at least, not in this country; and certainly they have not received the high degree of mechanical development that the cyanide process of gold and silver extraction has experienced. The Laist process does not appear to embody any new chemical reactions, but appears to depend chiefly upon conducting the roasting in just the right way. The copper having been obtained in solution, several methods of precipitation—electrolysis, hydrogen sulphide, or iron—are open. As to this part of the process, no decision has yet been reached. An idea of reducing iron ore to spongy iron and using that as precipitant is regarded favorably. Anyway, the Anaconda metallurgists consider that their hydrometallurgical work is well advanced and will probably result in the profitable extraction of a great deal of copper that now escapes.

So far as we are aware the Anaconda metallurgists have done no extensive experimentation with the flotation process, a relatively new method of mechanical concentration. This, however, has been exhaustively studied by the Utah Copper Co., Nevada Consolidated, and Inspiration. The Inspiration will probably make a large installation using this process, and it is not unlikely that the Utah and Nevada companies will introduce it as an accessory to their present methods.

The flotation process offers the advantage of being able to treat excessively fine material—200-mesh stuff and such sort. It is the one method of mechanical concentration in which the formation of slime or dust is not to be feared. Consequently, ore containing finely disseminated mineral may be reduced almost to impalpable powder in tube mills, and nearly all the mineral being thus released separation may be made.

The flotation process is commonly used in connection with ordinary concentration by jigging and tabling. As much of the valuable mineral is taken out by the jigs and tables as can be, and the middlings or tailings are passed on to the grinders and thence to the flotation vats.

In the case of some of the porphyry ore deposits, as in the Miami district, there are, associated with the sulphides, oxidized copper minerals, which neither settle well nor float well. It has been contemplated in the Miami district to pass on the flotation tailings to a hydrometallurgical process, but such a chain of treatments suggests the idea "Instead of making three bites at the cherry, why not try only one?" In other words, why not put the ore right away into the chemical treatment? In some cases that may, indeed, be the proper thing to do; in other cases it may be better to do things step by step. This is something that must be decided for each ore.

We are practically taking it for granted that there is going to be a new hydrometallurgy of copper. The character of the experimental work that is going on and the kind of metallurgists who are conducting it practically assure this. Probably there are not going to be any new reactions discovered, but the old well known principles are going to be employed in large, modern mills along with modern machinery and methods. In other words, the hydrometallurgy of copper is going to be raised to the same standard that now obtains in the hydrometallurgy of gold and silver.

BY THE WAY

Copper statistics favor an advance in the price of the metal more than at any time before, remarks the *Evening Post*, but copper statistics cannot be counted on too much, for, as pointed out by one who is bearish on copper, there are three kinds of lies: plain lies, horrible lies and statistics.

In the White Island sulphur article in the *JOURNAL* of Nov. 1, 1913, it is stated that the water of the White Island lake has been freely taken away for its medicinal value. A correspondent says that he "doesn't see why." It strikes him as a long haul to take dilute sulphuric and hydrochloric acids over.

Sometimes the daily press is not so speedy as it looks. Recently we saw, in a Western daily, what looked to be an interesting construction note concerning a new quartz mill and wrote for further particulars. The reply was: "This notice was given out more than 30 years ago. Mr. _____" (the promoter) "died in 1904."

A Washington press dispatch of date Nov. 5, said that of the 50,000 or more Americans who were in Mexico prior to the beginning of the present diplomatic difficulties between the United States and that country, only about 5000 still remain. According to information reaching the State Department, about 1200 to 1500 Americans remain in the City of Mexico, the remainder of the 5000 being distributed among the towns of Torreon, Monterey, Guaymas and Mazatlan.

A startling headline in the *Duluth News Tribune* reads, "Copper Mine Discovered by a Goat." Further perusal discloses the fact that the mine in question is the Fahlun in Sweden, and that it was discovered thus capriciously, so to speak, in the twelfth century. The world moves; we know of no modern records of copper mines, nor gold nor silver nor any other mines being discovered by goats.

But many are the goats that have awakened and discovered the absence of a mine when their money was gone. There is one born every minute.

According to newspaper reports, the U. S. Bureau of Standards is looking forward to the receipt of a \$1500 consignment of radium reported on its way from Austria. The bureau now has only five milligrams, which is valued at \$600. The only other radium known to be in the possession of the Federal Government is in the keeping of the Bureau of Mines, and is necessary to the operation of a delicate instrument. The piece is so small, however, that it can be seen only with the aid of a microscope. We wish we knew what the delicate instrument is, but we suppose the above is official.

Mrs. Sarah H. Sorin, of Arizona, appeared, on Nov. 5, in the Supreme Court of the United States as sole counsel of a mining corporation. Only on a few occasions have women addressed the court and then, in nearly every instance, only as associate counsel. Mrs. Sorin was defending the claim of the United Globe Mines, a corporation of which she is general counsel, to two mining claims in Gila County, Arizona. James H. Works also claims the mines. When the case was brought to the Supreme Court, Mrs. Sorin was associated with her father, William Herring, as counsel. Since then Mr. Herring has died and Mrs. Sorin has fought the case to the end. The decision in the Supreme Court of Arizona was in her favor.

The *Boston News Bureau* tells this story, which is not lacking in point: At a meeting of the directors of a copper company, some months ago, there was under discussion the advisability of calling an assessment. Considerable difference of opinion was expressed as to whether stockholders would respond. Finally a director who favored the assessment clinched the argument by the following story: "In the early days of Union Pacific, a traveler alighted from a train at a depot lunch room, purchased a ham sandwich, took a bite and turned to the clerk, saying: 'How much for this sandwich?' 'Five dollars,' answered the clerk. 'That's robbery,' replied the exasperated traveler. 'I know it,' retorted the clerk, 'but you see you're into it now, and besides I need the money.'"

Setting back the hands of a clock in order to permit legislation to be enacted for other purposes, is a not infrequently noted device. We have never seen mention, however, of setting back the hand of a pressure gage; yet it is stated that this has been found necessary, in cases, when sinking rather deep shafts by the caisson method. The allowable limit of pressure under which men may safely work in caissons is, we believe, usually put at 48 lb. In order to reach depths corresponding to higher pressures without openly violating laws or alarming the men, gages have been manipulated to read from 5 to 10 lb. lower than the actual existing pressure. It is understandable that with only a few feet to go in order to land an expensive shaft which would otherwise be lost, the temptation to take chances and exceed safety limits is enormous. Nevertheless it is a thing not to be countenanced by anybody with the least humanitarian feeling. The occupation of the "sand hog" is sufficiently hazardous without his being made the victim of a crooked deal.

Alaska Gold and the Porphyries

A visit made by Charles Hayden, of Hayden, Stone & Co., to various of the porphyry-copper propositions and to the Alaska Gold Mines, enable him to voice his opinions of these properties, for each of which his firm has acted as promoter. The *Boston News Bureau*, Nov. 12, 1913, publishes Mr. Hayden's résumé as follows:

At Utah, one is immediately impressed with the fact that had we not built our own railroad it would have been impossible to secure transportation facilities from any one else sufficient to handle the enormous tonnage that is now being treated. On certain days during the past month as high as 26,000 tons per day were moved from the mine to the mills. There will be no startling developments at Utah, unless in a year or two copper metal conditions are such as to warrant an increase in mill capacity from 20,000 tons to 30,000 tons per day. Such an increase would, of course, also be contingent upon our making big strides in advance stripping operations.

At Nevada Consolidated there is little new that can be said. The property is being excellently managed, but, as has been said many times, it is a relatively short-lived mine—its present life being from 12 to 13 years at current rate of production.

At Ray everything is working to complete satisfaction, and it really is a remarkable achievement that this, the only underground mine of the four, has been able in such a short period of time to open up the property underground so that it can extract from two shafts 6500 to 7500 tons of ore per day. The full normal capacity of the mill—8000 tons—should be reached by next February, and from now on there should be a steady decrease in the cost per pound, due to the treating of the full tonnage for which the equipment was built.

At Chino there are likely to be for some time variations in monthly production, such as have occurred the last few months, as nearer the surface there are certain bunches of high-grade ore, certain bunches of ore running high in iron, and others with more or less carbonated material. Until the lower levels are reached, there will not be the same uniformity of production that there is at the other properties, but the general average should be a monthly output of around 5,000,000 lb. The percentage of high-iron ores and carbonated ores is very small as compared with the total orebody.

I hardly think that people realize that Butte & Superior is now producing 11,000,000 lb. of zinc concentrates per month, this being only a trifle less than one-half the total amount of copper now coming from the entire Butte district. After the many vicissitudes of a year or so ago, this property has been brought up to a satisfactory condition both as to mine and mill. It is inconceivable to the company's management or any of its legal advisors that the present flotation process, which has been developed and perfected by our Mr. Janney, is in any respect an infringement upon either the Minerals Separation Co. process, or the Hyde process. The primary and broad principle of the flotation process has been in use for years, and the main claim of the Minerals Separation Co. and the decision of the lower court were based upon the use of less than 1% of oil. We have demonstrated at Butte & Superior that we get very satisfactory results with a flotation process using not only 1% of oil, but 2%, 5%, 10% or 20%. The use of varying amounts of oil is largely a question of internal economy, and if an excessive amount of oil is used there is little difficulty in recovering it, and no great expense in so doing. It was estimated that the cost of producing spelter would be in the neighborhood of 4½c. per lb., so that the profits of Butte & Superior will be dependent entirely upon the market price of spelter.

At the property of the Alaska Gold Mines I was particularly gratified to find each of the three divisions not only up to schedule as respects construction and equipment, but that the lay-out was most comprehensive and complete. Our general manager, Mr. Thane, we believe is fully competent to carry out the entire proposition to completion by January, 1915, as originally planned. At the mine the various levels are being opened up in readiness to ship to the full capacity of the mill as soon as the plant is entirely completed. At Sheep Creek the grading for the mill is completed, the structural steel is all ordered and erection will be started in the early spring. The record of driving the Sheep Creek tunnel is nothing short of phenomenal, an 8x10 opening having been advanced 600 feet a month. It will be only a month or two before all supplies for the mine will be transported from the steamers at the wharf direct through the

Sheep Creek tunnel to all parts of the mine, and they will no longer have to use the road four miles up the cañon.

The big concrete dam for the reservoir at the Salmon Creek power plant is about half completed, and while no pouring of concrete will be done during the winter weather, everything will be ready to start again in the spring, and the entire dam will be completed as originally planned.

All the experimental work which has been done by various metallurgists in respect to extraction of the values from the ore demonstrates that it will be more than satisfactory and that a very high recovery will be obtained, and a remarkably high ratio of concentration secured.

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Nevada Consolidated Copper Co.

Report of the Nevada Consolidated Copper Co. for the quarter ended Sept. 30, 1913, shows a total copper production of 15,835,563 lb., divided into 5,403,919 lb. in July, 5,989,973 lb. in August and 4,441,671 lb. in September. In the first quarter of the year, 14,523,565 lb. were produced and 17,928,746 lb. in the second.

During the quarter 813,153 tons of ore were milled, 93% of which came from the pits and 7% from the underground workings of the Veteran mine. Ore treated averaged 1.53% copper, the cost of which was 10.09c. per lb. Net charge to undivided profits for the quarter was \$95,157 after paying the sixteenth quarterly dividend, the further payment of \$136,990 to the Steptoe company for depreciation, and charging off \$135,082 for ore extinguishment.

Copper on hand and in transit, sold and unsold, was 21,958,859 lb., inventoried at 13.615c. per lb. Earnings for the quarter are based on 15.081c. per lb. for copper.

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Beaver Consolidated

The report of the Beaver Consolidated Mines, Cobalt, Canada, for the quarter ended Aug. 31, 1913, shows the company's cash balance was \$26,098; there were \$13,235 due from smelters and estimated value of ore ready for shipment was \$106,039; total amount available, \$145,371. Accounts payable amounted to \$17,461, leaving \$127,910 as a net balance available. It is stated that the payments on its interest in the Beaver Auxiliary property have been kept up, but three payments of \$5000 each must be made to complete the purchase price. The main shaft was down 230 ft. on this property and a station was cut at the 200-ft. level. On the Beaver Consolidated property the main shaft is down 800 ft. On the 530-ft. level in "A" stope the ore chute is reported to be 150 ft. long, and in "B" stope 125 ft. long, with good ore in a stope between which was just being opened up. It is stated that the company is convinced that it should carry its shaft down to 1500 ft., to do this it will be necessary to install a new hoist as the one now in use is taxed to its capacity. A 6-ft. ball mill was being installed at the milling plant to increase its capacity. The profit from the mill was reported to be \$40,000 for the quarter.

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Pennsylvania Smelting Co.

It appears that certain persons have believed that the statement on p. 759 of the *JOURNAL* of Oct. 18, 1913, implied that the Pennsylvania Smelting Co. was controlled by the American Smelting & Refining Co. Such is not the case, nor does the statement, on careful reading, imply it. The statement that the Pennsylvania Smelting works was closed down is an unfortunate error of our correspondent as it has been operating continuously.

PERSONALS

Robert Linton, of Los Angeles, Calif., is visiting New York.

Phil. J. Hickey, of Seattle, Wash., recently went to Seward, Alaska.

Frank H. Probert, of Los Angeles, is in Plumas County, Calif., on professional business.

Charles A. Banks, manager of the Jewel Denoro mine, Greenwood, B. C., is in New York.

B. B. Gottsberger, general manager of the Miami Copper Co., is expected in New York next week.

C. W. Merrill, of San Francisco, is visiting in New York and expects to remain here for several weeks.

Chester F. Lee, of Seattle, Wash., is examining placer-gold ground on Similkameen river, in British Columbia.

J. O. Baylor has succeeded A. L. Gastman as superintendent of the Horse Mountain mine, Eureka, California.

C. H. Poirier, of Poillon & Poirier, New York, is at the Golden Zone property, near Hedley, B. C., on business.

Pope Yeatman is in Chile visiting the property of the Chile Copper Co. He will probably return next February.

F. Lynwood Garrison, of Philadelphia, has gone West on business and may not return until near the end of December.

Royal Pullen has been appointed assistant superintendent of the operations of the Canadian-Klondike Mining Company.

Oscar Lachmund is back at Greenwood, B. C., from a visit to the British Columbia Copper Co.'s headquarters in New York.

Willard P. Ward has resigned his position as vice-president and director, of the Kerr Lake Mining Co., of Cobalt, Ontario.

M. J. Falkenburg, of Falkenburg & Laucks, Seattle, Wash., has been in San Francisco and Los Angeles, on professional business.

Dr. Baxeres de Alzugaray, consulting chemist and metallurgist, announces the removal of his office to 324 West 83d St., New York.

John Gross, of Denver, has just completed the construction of the mill for the London Mines Co., at Twelve Mile, Gilpin Co., Colorado.

T. Walter Beam has returned to Denver, Colo., from Camp Hedley, B. C., after having spent several months there for a New York syndicate.

L. O. Kellogg, of the editorial staff of the "Journal" is visiting mines in Minnesota, after which he will proceed to Wisconsin and Michigan.

Sir Richard McBride, premier and minister of mines for British Columbia, is again in Canada after having spent several weeks in England.

John Hays Hammond has sold his residence in Washington, one of the handsomest in that city, to the Russian Government for its embassy.

Earl A. Henry is now chief of the West Virginia Department of Mines, succeeding John Laing. Mr. Henry was formerly district mine inspector of the state.

H. S. Robinson, engineer of the Trethewey Mining Co., Cobalt, Ont., is now at the West Beaver mine, in the Port Arthur district, which is under option to the Trethewey.

W. D. Greenough, manager of the Atlas Mining Co.'s mines in Whitehorse copper camp, Southern Yukon, left that camp last month for a trip to see his principals in the United States.

J. W. Gates, an engineer well known among Utah miners, has taken charge of the new office which the Stephens-Adamson Manufacturing Co., of Aurora, Ill., has just opened at Salt Lake City, Utah.

Julius M. Cohen has resigned his position with Graphite Ltd., St. Remi d' Amherst, Quebec, to accept the position of assistant manager with the Porcupine Crown Mines, Ltd., Porcupine, Ontario.

Frank S. Baillie, general manager of the Columbia Gold Mining Co., who resides at the mine near Sumpter, Baker County, Ore., is back to work after a vacation spent at the coast, near Newport, Oregon.

H. N. Thompson, for the past four years superintendent at the International Smelting & Refining Co.'s Tooele plant, resigned Oct. 15. Mr. Thompson was presented with a watch and fob by the employees.

Leo G. Smith, who has been Superintendent of the open-hearth works of the Prime Steel Co., Milwaukee, Wis., since March, 1912, was on Oct. 1 made works manager of that plant and also of the crucible plant.

Cunningham Craig, a British government geologist, after examining the oil fields near Calgary, Alberta, expresses the opinion that oil occurs in commercial quantities and advises a thorough exploration of the district.

Heinrich J. Freyn, formerly consulting engineer of the Gas Engine Department of the Allis-Chalmers Manufacturing Co. of Milwaukee, has recently joined the H. Koppers Co., of Chicago in the capacity of third vice-president.

Geo. Watkin Evans, consulting coal mining engineer of Seattle, Wash., has completed the examination of the Matanuska coal field of Alaska for the United States Navy. Mr. Evans will soon resume his private practice in Seattle.

Henry Kehoe, of Spokane, Washington, who spent several months of last year in Ontario, has been appointed engineer in charge of mining operations of the recently organized London-Arizona Consolidated Copper Co., in Pinal County, Arizona.

Horace Dunbar, who has been mining editor of the "Salt Lake Tribune" has resigned to accept a position with the United States Phosphate Co., as field manager for California. The company has phosphate properties in Utah, Idaho and Wyoming.

F. T. Hamshaw, of New York, formerly managing a placer-gold mine on McKee creek, Atlin, B. C., after having obtained an option on several of the working claims in Shushanna gold field, Alaska, left that field last month for the outside, to make arrangements for operating them next mining season.

Dr. Alfred G. Wilson, of the Mines Branch, Canada Department of Mines, Ottawa, has been making inquiries in British Columbia in connection with a request that the Dominion Government appoint a commission to investigate and report on the requirements of the lead and zinc mining industries of that province.

Miss Daisy Adams Walker, assistant statistician for the past 11 years in the San Francisco office of the U. S. Geological Survey, of which Charles G. Yale is statistician in charge, resigned her position on Nov. 1 to be married on Nov. 11 to Frank Pierce Otis, an attorney at law of Sonora, Tuolumne County, California. Miss Walker, from her long connection with the survey, is known throughout the Pacific Coast by mining people, and has perhaps a larger acquaintance with mining men and affairs than any other woman on the Pacific Coast.

OBITUARY

Marion Jasper McDonald died at San Francisco, Oct. 29, aged 82 years. He was one of the early settlers in California and was for a number of years interested largely in mining in Amador County, Calif., and was also concerned with several companies on the Comstock Lode. He was prominent in local politics.

Ernest G. Peterson died at Butte, Mont., Oct. 31, aged 43 years. He was connected with several mines in the Butte district, but some years ago went to Salt Lake, when he was concerned in several Utah mines. About a year ago he returned to Butte as superintendent of construction for the Butte & Superior Mining Co. He leaves a widow and three children.

Richard R. Lee died at Silver City, N. M., Oct. 25, aged 53 years. His death was the result of an automobile accident in the Burro Mountains. He was born in Cornwall, England, and came to this country about 25 years ago. After three years in the Michigan copper country he went to New Mexico and settled at Pinos Altos, removing a few years ago to Leopold. He had some important mining interests in the Mogollon district. He leaves a widow and five children.

A dispatch from Eagle Pass, Tex., Nov. 6, says: "R. Weinger, assistant superintendent of the Penoles Mining Co., at Mapimi, Durango, Mexico, was robbed and then killed at the direction of a Constitutionalist leader, and after the murder his fingers were cut off so that the rebel commander might

obtain valuable rings the American wore. This information was brought to Eagle Pass tonight by Ernest Muller, an official of the mining company, who, with other refugees, reached the border after an overland journey of 18 days."

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.

PHOSPHORIC ACID—Art of Converting Phosphorites. Henry Vail Dunham, Bainbridge, N. Y., assignor to Nacirema Chemical Co. (U. S. No. 1,074,779; Oct. 7, 1913; and 1,076,200; Oct. 21, 1913.)

PHOSPHORIC ACID—Process of Making Fertilizer. Spencer B. Newberry and Harvey N. Barrett, Baybridge, Ohio. (U. S. No. 1,074,808; Oct. 7, 1913.)

AMPHIDIZING—Apparatus for Amphidizing. Charles S. Bradley, New York, N. Y., assignor to Bradley Copper Process Co., Jersey City, N. J. (U. S. No. 1,077,036; Oct. 28, 1913.)

CHEMICAL FILTER. Charles S. Bradley, New York, N. Y. (U. S. No. 1,077,037; Oct. 28, 1913.)

GOLD-EXTRACTING MACHINE. Charles R. Dennison, Youngstown, Ohio. (U. S. No. 1,077,261; Nov. 4, 1913.)

ALUMINUM SULPHATE—Method of Preparing Aluminum Sulphate. Heinrich F. D. Schwahn, Belleville, Ill. (U. S. No. 1,077,309; Nov. 4, 1913.)

DRILL—Pneumatic Feed and Return Rock Drill. Ebenezer R. Ray, Placerville, Calif. (U. S. No. 1,077,856; Nov. 4, 1913.)

DRILLS—Valve-Motion for Rock Drills. Lewis C. Bayles, Johannesburg, Transvaal, assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,077,584; Nov. 4, 1913.)

DRILL STEEL—Oil Forge for Drill Steel. Willis W. Case, Jr., Denver, Colo. (U. S. No. 1,077,803; Nov. 4, 1913.)

MINE CARS—Running Gear and Draw Bar Attachment for Mine Cars. John F. Fox, Birmingham, Ala. (U. S. No. 1,077,601; Nov. 4, 1913.)

STEAM SHOVELS—Turning Device for Steam Shovels. William L. Strahlem, Middle Point, Ohio. (U. S. No. 1,077,174; Oct. 28, 1913.)

ORE CONCENTRATOR. Frank Picone, Tombstone, Ariz. (U. S. No. 1,076,700; Oct. 28, 1913.)

ELECTRIC FURNACES—Improvements in Crucibles for Electric Furnaces. Morgan Crucible Co. Ltd., London, Eng. (Brit. No. 24,626 of 1912.)

ELECTRIC MELTING FURNACE. Leslie E. Howard, La Grange, Ill., assignor to Simonds Manufacturing Co., Fitchburg, Mass. (U. S. No. 1,076,887; Oct. 28, 1913.)

LEAD-COPPER-TIN COMPOSITIONS, Process of Making. Edward D. Gleason, New York, N. Y., assignor to Plastic Metal Co., New York, N. Y. (U. S. No. 1,077,701; Nov. 4, 1913.)

OIL-FUEL BURNER—Adjustable Impact Atomizer. Robert Schorr, San Francisco, Calif. (U. S. No. 1,076,705; Oct. 28, 1913.)

ROASTING—Improvements in Furnaces for Roasting Ore. E. Dohet, St. Sarvais, Namur, Belgium. (Brit. No. 7892 of 1913.)

CYANIDING—Apparatus for Thickening and Agitating Pulp. John V. N. Dorr, Denver, Colo. (U. S. No. 1,076,666; Oct. 28, 1913.)

HARDENING—Method of Making Case-Hardening Material. Hugh Rodman, Edgewood, Penn., assignor to Rodman Chemical Co. (U. S. No. 1,076,453; Oct. 21, 1913.)

METHOD OF NODULIZING MATERIALS. Lewis P. Ross, Standish, N. Y., assignor of one-half to Northern Iron Co. (U. S. No. 1,076,705; Oct. 28, 1913.)

ALKALI METAL—Method for Extracting Alkali Metals in the Form of Nitrates from Minerals. Anton Messerschmitt, Stolberg, Germany. (U. S. No. 1,076,508; Oct. 21, 1913.)

EXCAVATING AND DREDGING MACHINE. William R. Litzenberg, Portland, Ore. (U. S. No. 1,075,923; Oct. 14, 1913.)

LAMP—Electric Safety Lamp. Emil Gottschalk, Trep-tow, near Berlin, Lothar Werner, Berlin, and August Gast, Steglitz, Germany, assignors to the firm of Chemische Fabrik Griesheim-Elktron, Frankfurt-on-the-Main, Germany. (U. S. No. 1,076,495; Oct. 21, 1913.)

ROCK DRILL. Grant W. Smith, Chattanooga, Tenn. (U. S. No. 1,076,246; Oct. 21, 1913.)

STEAM SHOVELS—Dipper for Steam Shovels and Dredges. Cooley Butler, New York, N. Y. (U. S. No. 1,076,548; Oct. 21, 1913.)

CRUSHING—Projectile for Rock Breakers. Mitts Quenner, Nogales, Ariz., assignor to Quenner Dry Crusher Co., Douglas, Ariz. (U. S. No. 1,076,148; Oct. 21, 1913.)

ELECTROMAGNETIC SEPARATOR. Erich Langguth, Neerpelt, Belgium. (U. S. No. 1,076,213; Oct. 21, 1913.)

LEACHING—Process of Extracting Copper from Ore. Frederick Laist, Anaconda, Mont. (U. S. No. 1,076,833; Oct. 28, 1913.)

ORE DRESSING—An Improved Apparatus for Dressing Ores. E. Pooley, Carn Brea, Cornwall, Eng. (Brit. No. 21,054 of 1912.)

ALLOY of Iron, Nickel, Manganese and Aluminum. Walter Rubel, Berlin, Germany, assignor to Rubel Bronze, Ltd., London, Eng. (U. S. No. 1,076,455; Oct. 21, 1913.)

ORE TREATMENT—Process of Treating Ores and Smelting Products Containing Cobalt, Nickel and Silver. G. Borchers, Goslar, Germany. (Brit. No. 18,276 of 1912.)

ORE TREATMENT—Treatment of Ores. Nicolas Henri Marie Derker, Paris, France. (U. S. No. 1,075,409; Oct. 14, 1913.)

PYRITES—Furnace for Decomposing Pyrites or Metallic Sulphides. William Augustus Hall, New York, N. Y. (U. S. No. 1,076,763; Oct. 28, 1913.)

ROASTING—Mechanical System for Roasting Sulphurous Ores by a Continuous Process. Xavier de Spirlet, Brussels, Belgium. (U. S. No. 1,077,010; Oct. 28, 1913.)

PHOSPHORIC ACID—Process for Separating Phosphoric Acid from Natural Phosphates. Maximilian Mattheus Hall, Ottawa, Ont., assignor to Thomas Leopold Willson, Ottawa, Ont. (U. S. No. 1,076,497 and 1,076,499; Oct. 21, 1913.)

INDUSTRIAL NEWS

Hardinge Conical Mill Co., 50 Church St., New York, N. Y., reports the order of two Hardinge Ball mills from the Federal Mining & Smelting Co., of Wallace, Idaho. This company is already operating eight other Hardinge mills.

The royalty agreement under which the Cresson-Morris Co. (formerly the Geo. V. Cresson Co., of Philadelphia, Penn.), manufactured and sold the Buchanan crushing and concentrating machinery to the trade, has expired by limitation, and the C. G. Buchanan Co., of 90 West St., New York, N. Y., has made arrangements with the Birdsboro Steel Foundry & Machine Co., of Birdsboro, Penn., under which all of the Buchanan machinery, as well as new and repair parts, etc., will be manufactured by the Birdsboro company.

The Denver Engineering Works Co., Denver, Colo., reports the following orders recently received: The Furukawa Kune Mine of Japan for a double-drum electric hoist of 5000 lb. capacity. The San Juan Mines of Buenos Aires, Argentine, South America, a 5000-lb. capacity double-drum electric hoist complete with electrical equipment. Takata & Co., New York and Tokio, Japan, a 2500-lb. capacity single-drum electric hoist for shipment to one of its customers at Moji, Japan. The Zaalplaats Mine in South Africa has ordered a Richards Pulsator Classifier. Cia. Minera La Lucha y Anexas, El Oro, Mexico, has ordered from Victor M. Braschi Machinery Co., Inc., a Denver Engineering Works, 10-stamp mill equipment, 1250-lb. stamps, which includes a 4½-ft. diameter by 18-ft. long tire and trunnion-type tube mill.

TRADE CATALOGS

Pacific Metal Products Co., San Diego, Calif. Catalog Moore Motor Trucks. 40 pp. Illus. 8x11 inches.

National Tube Co., Frick Building, Pittsburgh, Penn. N. T. C. Bulletin No. 17. 40 pp. Illus. 11x8½ inches.

The Diester Concentrator Co., Fort Wayne, Ind. Loose Leaf Catalog. Ore Concentrators. Illus. 6x9 inches.

G. L. Simonds & Co., 115 South La Salle St., Chicago, Ill. Booklet Vulcan Soot Cleaner. 48 pp. Illus. 9x6 inches.

This book on the subject of soot in relation to boiler efficiency contains valuable engineering data. It is sent free to those who request it.

Goldschmidt Thermit Co., 90 West St., New York, N. Y. Booklet. Thermit Railing Welding. 24 pp. Illus. 9½x6 inches.

The Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog E. Brownhoist buckets and tube. 64 pp. Illus. 6x9 inches.

H. W. Johns-Manville Co., New York, N. Y. Booklet. J-M Asbestos Roofing and Waterproofing Specifications. 56 pp. Illus. 6x9 inches.

Chicago Pneumatic Tool Co., Chicago, Ill., Bulletin No. 34-T Class "M" Chicago Pneumatic Corliss Type Steam-Driven Compressors. 12 pp. Illus. 9x6 inches.

Denver Engineering Works Co., Denver, Colo., Bulletin No. 1061. Open Front Stamp Mortar Improved Ore Feeder, 4pp. Illus. 8½x10½ inches. Bulletin No. 1062. Ovoca classifier, 8 pp. Illus. 8½x10½ inches.

Stephens-Adamson Mfg. Co., Aurora, Ill. The Labor Saver No. 62. 16 pp. Illus. 6x9 inches. Booklet Power Transmission Machinery. Section 2 "S-A" General Catalogue No. 19. 110 pp. Illus. 6x9 inches.

This booklet contains a very complete list of gears of every sort.

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Nov. 5

Kennedy Extension-Argonaut Suit on trial before Judge F. V. Wood in the Superior Court of Amador County, closed for the defense, Oct. 22, and a recess was taken until Oct. 27, when the plaintiff began the introduction of evidence in rebuttal. The chief witnesses in behalf of the defendant, following Mr. Rainsford, were Professors Wylie and Lawson and Fred Scarles, all of whom testified as to the geological and physical conditions of the Argonaut and the Kennedy Extension in support of the contention of the defendant company that the Argonaut workings are all on the Argonaut (Pioneer) vein and that the vein is continuous from the apex within Argonaut ground to the lowest level, though following its dip under the surface of the Kennedy Extension ground. The defense also placed in evidence records and verbal testimony as to the early operation of the Pioneer mine and its acquisition by the Argonaut Mining Co. The chief witnesses introduced by the plaintiff in rebuttal were Doctor Finch and Professor George. Doctor Finch occupied two and a half days in direct and cross-examination, Professor George following on the afternoon of Oct. 29. Three other witnesses were to follow, and it was expected that the further testimony would not be concluded until the first week in November. By the direct evidence the plaintiff sought to show that the Kennedy Extension mine, which embraces the Muldoon and the Jackson claims, contains within its boundaries the apex of the vein which has been mined by the Argonaut. The defendant sought to maintain that the Argonaut workings are clearly within its extralateral rights, and that there is no other continuous vein within the contested ground. In rebuttal the plaintiff sought chiefly to show that there is no continuous vein apexing in the ground claimed and owned by the Argonaut Mining Co. Some new maps and a plaster of paris model of underground workings of the two properties were introduced in rebuttal; and though adding largely to the volume of documentary evidence, enhanced the interesting features in the case. Whatever may be the judicial outcome of the suit, there has been a large amount of valuable contributions to the literature of the Mother Lode, not alone by Doctor Finch, but by the several other expert witnesses on both sides.

DENVER—Nov. 8

The Strike Situation in the southern coal fields drags along, the agitators so far having achieved little besides an enormous money loss to their organization, to the operators, and the people and business of the state. During the presence of the state troops, of course, matters are comparatively quiet, and the strikers are being disarmed as fast as possible, though comparatively few firearms have been turned in so far, most of them having been hidden. It is said now that Governor Ammons is preparing to withdraw all state troops except the cavalry from the strike zone within 10 days. The coal operators have made a proposal to Governor Ammons offering to re-employ all old miners who have not been guilty of violence but they will not recognize the union. Meanwhile there is no coal in storage in Denver except what is in dealers' hands. The gas and electric company has ceased to make coke and part of the gas for the city is now being made from oil. The following is an excellent summary of the history of the strike up to Nov. 6 as published in "The Independent" of that date: "Since the beginning of the coal miners' strike in southern Colorado 37 days ago, there have been 19 battles between strikers and mine guards, 28 men have been killed, 41 have been wounded, and 11 buildings have been wrecked or destroyed. The majority of the strikers are Greeks who recently fought in the Balkans. They are well armed and they have been drilling every day. State troops have been sent to the scene of disturbance, and martial law has been proclaimed there. There was a series of battles last week, beginning with one in which a striker was killed and a guard wounded. On Oct. 26 there was continuous fighting for 12 hours in Berwind cañon, at Hastings, and near the railroad station at Ludlow. One guard was killed. In the vicinity of Ludlow there were 700 armed strikers. They attacked a railroad train, believing that it was carrying mine guards. Two days later there were three battles, at Berwind, Tabasco and Hastings. One guard was killed; four strikers and two children were

wounded. At Hastings the strikers surrounded a camp of guards. At Tabasco the strikers used a machine gun and were aided by a searchlight. The governor of Colorado sent all of the state's militia to the district, with orders to disarm both the strikers and the guards. After the arrival of 600 militiamen, the strikers became violent at a place some distance from their camp, capturing the building of the Southwestern Fuel Co. and burning it. In this building there was a post office. The strikers rifled the mails before setting fire to the structure. By order of the governor both sides were given 24 hours in which to surrender arms and ammunition. It was the avowed purpose of the strikers to establish camps in the hills and to defend them against the militia."

BUTTE—Nov. 5

The Butte & Superior Suit brought by the Minerals Separation Co., of London, to prevent the defendant company from using an oil flotation process for the concentration of zinc ores, a patent upon which process is alleged to be owned by the complainants, was commenced, Nov. 4, in the United States district court under Judge Bourquin. The contention of the defendants is that the process being used by them is not an infringement of the London company's patent, in that considerably more than 1% of oil is being used, whereas the patented process specifies that 1% or less of oil shall be used in concentration. The oil clause of the patent is one of four alleged infringements named in the complaint, and the first day was taken up by chemists and metallurgists in the employ of the defendant company in making a series of practical experiments in the court room, showing different percentages of oil used.

SALT LAKE CITY—Nov. 6

At The Utah Apex Mine at Bingham new machinery is being installed and a number of improvements made. Plans for enlarging the concentrator from 150 tons to 350 tons daily have been approved. This will require all of the winter to complete, and the same general flowsheet as that used at present will be followed. Though the rated capacity of the mill is but 150 tons at present, about 200 tons per day are being treated. A new electrically driven compressor with a capacity of 1300 cu.ft. is being installed, and is nearly ready for operation. A 200-hp. motor and transformer are to be added to the equipment. The Utah Apex in the last few months has opened a large tonnage of lead ore of both shipping and milling grades. This property is one of the largest producers of lead in the Bingham district. About 200 tons of sulphide ore and concentrates daily are being shipped, the output being limited by the ability of the smelting companies to handle the product. Monthly earnings have been between \$30,000 and \$40,000, and the company is rapidly wiping out its bonded indebtedness, which has been much reduced. This should be out of the way early in the coming year, enabling the company to go on a dividend-paying basis. Plans are being considered for operating the underground hoist by electric power.

CALUMET—Nov. 8

No New Developments in the strike situation have transpired during the last week. The strikers have continued their early morning parades through the district, but without disturbances. The Federation insists that the strikers make these morning demonstrations and anyone not appearing loses his \$1 per day. The Federation is establishing a series of so called "cost stores" where they expect to sell to the strikers, clothing and provisions at cost. This particular move is not finding much favor among storekeepers of the district who have been soliciting the Federation orders and returning a 5% discount on these orders back to the Federation, and henceforth it is not likely that this set of business men will continue enthusiastic in their support of the Federation. The Calumet & Hecla has secured practically as many men for underground work as were in its employ before the strike and production is being increased, so that in all probability the November output will be about normal. The Superior company is shipping between 600 and 700 tons of rock daily, which is an increase in production over that for a period some time before the strike. The Copper Range companies secured outside men during the week, most of them coming from Chicago, formerly employed in the steel

mills, also a number of men are applying for positions, coming from the iron ranges of Michigan, where curtailment is being made. The Ahmeek, which is in the center of the union stronghold, is making preparations to receive imported men and it is expected that the arrival of these men will precipitate renewed outbreaks of lawlessness and disorder. During the period of forced suspension at the Calumet & Hecla mills, the men were put on construction work, and as a result, a large amount of this work was accomplished. At the electric-power plant all the work has been completed and the 900-kv.a. mixed-pressure turbine is being finally adjusted, and will be ready to go into regular commission within a few days. The buildings comprising the No. 2 regrinding plant are all completed and the machinery is being rapidly assembled. At the electrolytic plant, the building is completed and the tanks and electrical equipment are being installed. The White Pines company in Ontonogon County, a subsidiary of the Calumet & Hecla, has been operating two shafts full force throughout the strike without interference. The Phoenix company has about 25 men at work sinking an exploratory shaft on the Ashbed lode. Diamond-drill cores taken from this formation have been encouraging and further developments are being awaited with interest. The hull of the hydraulic dredge built for the Calumet & Hecla has been received. This dredge will handle the sands from the stockpile to the pool, from which it will be delivered to the classifying house and then to the mills.

MARQUETTE—Nov. 7

The **Breitung Corporation** was recently forbidden to sell its stock in Michigan. Following a hearing at Lansing, the securities commission later reversed this order. E. N. Breitung, of Marquette, one of the principal stockholders and one of the state's wealthiest men, appeared before the commission personally. Officers of the corporation, particularly Breitung, were indignant at the first ruling, and especially at some unofficial comment in connection with the decision. They at once took steps to have the hearing reopened. Their indignation arose largely from the fact that the commission had taken the serious step of forbidding the sale of the stock without calling on any of its officials for a personal statement. It now appears that the original action was based on incomplete data relating to the company furnished from the New York offices. In response to a request for information, papers were forwarded that did not give adequate information as to the plans or scope of the corporation. The commission acted on these papers. Because of Breitung's prominence in the business world, the action of the commission received wide publicity.

ISHPEMING—Nov. 7

The **Movement of Ore** from the Lake Superior region is on the wane. Many mines have, in fact, completed their shipments for the season. Very little ore is going forward from the Crystal Falls district of the Menominee range.

Failure to Find New Deposits after several years of persistent exploration through extensions of underground openings and by the use of the diamond drill has caused the Oliver Iron Mining Co. to surrender its lease of the Atlantic mine at Iron Belt, in the Wisconsin division of the Gogebic range. A force of 130 men was employed. Following the surrender of the Plummer exploration by the same company several weeks ago, the abandonment of the Atlantic comes as a hard blow to Iron Belt and the western end of the Gogebic country. The Atlantic has yielded a considerable tonnage in the aggregate, but as the ore was found in the black slates of the hanging wall, a fact regarded at the time of the original discovery as peculiar, the measures did not prove persistent and suspension had long been apprehended.

DEADWOOD—Nov. 8

U. S. Assay Office at Deadwood is purchasing bullion under the new order recently issued by the director of the mint, the only change being that the depositors are required to pay the transportation charges on their product to the mint at Denver. This amounts to 80c. per \$1000 of bullion value. The exhaustion of the fund for transportation of bullion between assay offices and mints, and the failure of Congress to provide additional funds in the last deficiency bill, has made this action necessary. It is believed that it will be only temporary, and that at the regular session Congress will supply funds to enable work to be continued as in the past.

SILVER CITY, N. M.—Nov. 6

Three New Mills are under construction at Pinos Altos and the Mountain Key mill is being repaired and will resume operations within a short time. Grading for the C. & O. plant is under way and efforts are being made for completion before winter sets in. All machinery for the J. A. Peterson & Co. mill is on the ground and it is thought operations

will commence by Dec. 1. It has been some time since much work has been done in the Pinos Altos district but the present outlook is brighter than it has been in years. The ores of this district are complex but doubtless modern methods will solve the problems that have retarded progress.

Phelps-Dodge Operations in the Burro Mountain mining district will soon be under way. It is understood that the visit here last week of Dr. James Douglas and Walter Douglas brought about letting the contract for the grading of the mill and townsite at Tyrone. Chadwick & Deyo, the contractors building the branch railroad from Whitewater to the Phelps-Dodge property, have practically completed their work and it was thought the first train would be run into the camp about Nov. 15. The new townsite will extend from the Pines ranch up the cañon for nearly one mile and the company offices will be moved from Tyrone to the Parker place. The company as yet has not developed a large water supply and it is generally known that extensive experimenting has been done with the oil-flotation process of concentration and from this fact it is generally believed that this method will be used.

JOPLIN—Nov. 8

Rapid Falling Off in Drilling operations and decreasing developments marked October work in the Joplin district. From a field with many drills at work and much new shaft sinking in progress, it changed to one shipping its drills to the oil fields and new development was halted until it could be seen what was going to happen in the spelter and ore markets. During the last 60 days 38 drill rigs have been shipped from the Joplin district into the oil fields of Kansas and Oklahoma and it is believed that the next 30 days will see half that many more shipped out unless there is a rallying of ore prices sufficiently to bring back confidence in the zinc mining business. The passage of the tariff act reducing the duties on spelter and ore discouraged many producers and the drop in prices coming simultaneously so disorganized the prospecting and development part of the industry that many hitherto optimistic operators have either slowed down their activities or are getting into other lines of industry. The fact that petroleum prices have been advancing and that many of the Joplin mining men are also interested in that industry has contributed something to the activity of the prospect-drill men in shipping their machines to the oil fields. Joplin companies are entering the shallow oil regions around Paola, Osawatomie, Rantoul and Moran, in Kansas, while others are going into the old Chanute field. Some are going into Chautauqua County, Kansas, while a large number are becoming interested in wildcatting south of Tulsa and in the new Ardmore field in Oklahoma. One group is also developing in the new territory on the Red River on the Oklahoma side just across from the Electra and Petrolia field in Texas. With oil selling above \$1 per barrel the incentive to drill is great to the ordinary man but when such an incentive is placed before a Joplin mine operator who has seen his industry's tariff protection wiped out, and this followed immediately by a price reduction on zinc ores that is a close approach to the worst days of 1907 and 1908, he does not hesitate about taking it up. Hence it is no wonder that Joplin zinc men are turning to the oil fields since they are almost at his doors on the west and southwest. The effect of all this exodus, while not apparent in the production right now, will begin to be felt in the mining field before another summer season comes on. When the drills stop operating in the Joplin field, it is not long until the number of mines cutting out overtakes those that are coming in. The short life of the average Joplin mine makes the absence of the drills felt all too quickly and unless there is a readjustment soon in the prospecting and development the tonnage of high-grade ore coming from the Joplin field will suffer considerable reduction. Nothing but a season of high-priced zinc ores will be able to bring that confidence back sufficiently to induce a return of the drills and with present tariffs and present range of prices for spelter in Europe the problem faced by the high-grade zinc ore producer and the smelter of this class of ores is not any too pleasant. The ore producer is trying to forget mining for awhile and is going into the oil business where he can do so.

TORONTO—Nov. 8

The Calgary Oil Boom, despite the warning issued by the Calgary board of trade against too hasty speculation before the occurrence of oil in commercial quantities was assured, has resulted in the formation of numerous companies with the object of placing stock on the market. Up to the end of October 10 companies, with a combined capital of nearly \$3,000,000 had been registered in Calgary. At least 10 drilling outfits will commence operations within a few months.

THE MINING NEWS

ALASKA

COAL-LAND HEARINGS on the three important tracts involving 5872 acres in Katalla field will be heard Oct. 2, 1914. Cases are against McKenzie Anthracite Coal Co., Carbon Mountain Anthracite Coal Co. and Alaska Smokeless Anthracite Coal Co. Lands were located by C. W. Doughton. Government charges fraud in making location and failure to develop. Depositions will be taken in New York, Chicago, Los Angeles, San Francisco, Sacramento, Portland, Spokane and Seattle.

EBNER GROUP is now controlled by U. S. Smelting, Refining & Mining Co., which, it is understood, is under contract to spend up to \$200,000 in exploration work. Receivers of Alaska Ebner Gold Mines Co. some months ago entered into contract with H. W. Martin for development work, it being understood that Martin represented United States company. This agreement stipulates that Martin is to provide funds up to \$200,000 for extension of a tunnel, work upon which had begun when receivers were appointed for company. At time of receivership tunnel had been extended about 1100 of proposed 4000 ft. Present plans call for tunnel's completion by new year. This tunnel was undertaken for purpose of striking general gold-bearing vein of that region. Property in question is owned by Ebner Gold Mines Co., and is capitalized for 100,000 \$5 shares. Entire capital stock was placed in treasury of Alaska Ebner Gold Mines Co., now in receivers' hands. Stock of subsidiary formed part of collateral back of an issue of bonds of parent corporation, of which \$600,000 were sold. Arrangement entered into between Martin and Alaska Ebner receivers called for working option; in no way can it be considered an option for control. Foreclosure proceedings against all assets of Alaska Ebner Gold Mines Co. will shortly be instituted which will then make it necessary for United States company to make a bid for Ebner property should developments there warrant its acquisition. Receivers' certificates, to which United States company will be entitled for money advanced, understood to exceed to date \$100,000, while a first lien, do not constitute a guarantee that its bid, should one be made, would be successful over all competitors.

ALASKA MEXICAN (Douglas)—In September 17,364 tons of ore yielded \$35,709, \$2.07 per ton; profit \$7625.

ALASKA TREADWELL (Douglas)—In September 78,113 tons of ore yielded \$225,908, \$2.92 per ton; profit \$123,310.

GOLDEN HILL (Willow Creek District)—Ten-stamp mill has been purchased, and will be in operation in early spring.

ALASKA MEXICAN (Douglas)—In August 19,740 tons of ore yielded \$1.94 per ton, or a total of \$38,060. Net profit estimated at \$9094.

GRANITE (Port Wells)—Foos gasoline engine of 25 hp. and Ingersoll-Rand air compressor, have just been purchased and will be installed at once, increasing capacity of plant.

ALASKA UNITED (Douglas)—In August 19,866 tons of ore crushed in the Ready Bullion mill yielded \$2.54 per ton; 18,795 tons crushed in the 700 Claim mill yielded \$2.18 per ton. Total yield was \$90,415; estimated profit \$29,342.

KEYS & RETTIG (Chatanika)—These lessees on the Doctor bench claim at the mouth of Cleary Creek have stopped work in the lower shaft on account of the low grade of the ground. Except for the robbing of a few pillars, operations in the upper shaft were finished Sept. 25.

SOO MINING CO. (Dome City, via Fairbanks)—A crosscut into the hanging wall from the end of the east drift on the 100-ft. level recently disclosed considerable high-grade ore, \$2 being recovered from panning a single handful. The last 200 ft. of the drift was driven by contract, and following the line of least resistance, the contractors wandered away from the vein. No work is at present being done on the west drift of the 100-ft. level which is in ground belonging to the Wild Rose claim, owing to the inability of the lessees to come to an agreement with the owners in the matter of royalty.

ARIZONA

Cochise County

CALUMET & ARIZONA (Warren)—Utley Wedge is reported to have been working on treatment of Cornelia ore. Process is said to consist of mixing pyrites with ore and roasting in Wedge furnace. Roasted ore is leached with dilute sulphuric acid, copper solution being electrolyzed. Expected recovery of copper 92%, costing 7 to 8c. per pound. Plant of 250 tons daily capacity is contemplated at first, cost estimated at \$100,000.

Gila County

MIAMI INDUSTRIAL COUNCIL recently issued a strike notice, but carpenters union refused to be governed by action of council and withdrew from that body, advising its members to return to work at Inspiration mill, giving as their reason that steel work there had not been union work from beginning and that there were virtually no union men to aid by striking.

IRON CAP (Globe)—Aspect of mine as a whole is better than at any time during its development. About 50 ft. remains to be driven before connection is made with Eureka shaft of Arizona Commercial.

SUPERIOR & BOSTON (Globe)—October was most prosperous month in history of mine, shipments exceeded 4000 tons. Diamond drilling to explore country east of present workings was begun Nov. 1, and is making headway of 12 ft. daily.

CASTLE DOME (Miami)—A second tunnel has been started 100 ft. lower than tunnel in which such rich ore was recently encountered. As in tunnel above, a stringer of rich ore was found near beginning of new adit and at present entire face of tunnel is mineralized with chalcocite, chalcopyrite and galena, carrying gold and silver, and occurring in small, rich stringers.

RAY CONSOLIDATED (Hayden)—Mill has been completed and eighth and last section was started about end of October. With all sections operating 8000 tons of ore are treated daily. From now on it is planned to keep concentrator fed at as near capacity as conditions will permit, and at times as much as 10,000 tons per day will be treated, as each section has shown ability to handle as much as 1250 tons daily. This can be done without crowding mill.

ARIZONA COMMERCIAL (Globe)—Work on 1200 level has been temporarily suspended because of water. Present flow can be handled easily enough with pumping equipment now in use but it is feared that further opening of ground now would result in flow too great for pumps. No statement has been made as to when pumping machinery will be augmented. Fourth crosscut had only penetrated vein the distance broken by one round of shots when work was discontinued on the level, but ore was of same character as that exposed in third crosscut and gave evidence of increasing richness as vein was entered. Vein where encountered on 1000 level was 27 ft. wide, 2 ft. excellent ore, rest carrying stringers of good ore that would have to be sorted from gangue. Vein is being drifted on at this level. On 700 level, also on 500 level drifting is proceeding on vein.

INSPIRATION CONSOLIDATED (Miami)—Excavation is now well under way for power house in Webster gulch, and carpenters will soon be making forms for concrete. American Bridge Co. finished structural work on machine shop and warehouse at the millsite Nov. 4, then started riveting on ore bins in Webster gulch. All steel is now in place for about two-thirds length of bins. Work has been started on steel foundation for conveyor belt between coarse-crushing plant and ore bins, and already one tower is in place. Steel for crushing plant will soon arrive and work will be started on this next, in conjunction with headframes for main shafts. Within a few weeks new test mill will be ready for operation, as practically all machinery is now in place and crushing plant at Scorpion shaft is all but completed, conveyor belt being in place and crushing machinery housed with corrugated iron.

MIAMI COPPER CO. (Miami)—It is reported that the determination has been made to alter first five sections of concentrator to conform with sixth unit which now secures two pounds per ton better extraction than rest of plant. Each section will be enlarged sufficiently to permit of total treatment of 4000 tons of ore daily against 3000 tons, existing capacity. Such an enlargement would increase monthly production from 3,000,000 lb. to 4,200,000 lb. If plans materialize this work will be carried out next year. Under direction of J. Parke Channing, there have been carried on for some time a series of experiments which if adopted will be utilized both by Miami and New Keystone. Treatment of mixed sulphide and oxide ores has been most puzzling, not only to Miami but to other companies having similar mixtures. A 20-ton experimental plant will soon be started by Miami upon a new process, details of which follow, in brief: Coarse crushing and removal of fine dust; rough water concentration to take out coarse sulphides; roasting of tailings from preceding operation; leaching with sulphuric-acid solution; precipitation of copper by electrolysis and regeneration of solution with sulphurous-acid gas, solution then being used again for leaching.

Mohave County

WALDRON (Deluge Wash)—A road is being built to connect with Cedar road and equipment for new mill will be hauled in; Arizona Venture Corporation owner.

TENNESSEE—It is stated that the orebodies on the 900 level are wider and the ore is of better grade as drifting progresses; 150 tons of ore are shipped to the smelters daily.

WALKOVER (Hackberry)—The new owners have nearly completed preparations for the resumption of work on the property and it is expected that a small force will be started at once.

GEORGE WASHINGTON (Mineral Park)—Trustees' sale of interests has been postponed till Nov. 25. It is understood that settlement will probably be made before that date and work will be resumed.

BI-METAL—A shaft is being sunk on this property north of the old workings and some high-grade milling ore has been found. It is understood that a churn drill will be used to prospect a large part of the ground.

BOUNDARY CONE (Oatman)—The main shaft has reached a depth of 520 ft. and drifting is in progress along the vein. Several stockholders have visited the property and are considering the advisability of erecting a mill.

ORO PLATA—This property has just been sold at mortgage sale for approximately \$35,000. Gaddis & Perry Co., of Kingman, were the bidders. It is stated that the property is credited with having made a production worth more than \$500,000. The deepest workings are less than 300 ft. below the surface.

CALIFORNIA**Amador County**

KENNEDY EXTENSION VS. ARGONAUT—It is expected that at close of taking evidence further hearing will be postponed for one month to give attorneys time to prepare for oral argument.

PLYMOUTH DISTRICT is attracting attention through bonding of Rhetta and other properties by representatives of large operators. It is reported that U. S. Smelting & Refining Co. has had an engineer examining these mines, but report is not corroborated. Examinations have been made covering large territory in district, and improvements are being made by realty owners in town of Plymouth, encouraged by continued development of Plymouth Consolidated. London Exploration Co. has also recently taken over mining property on east belt of Mother Lode, near Plymouth Consolidated.

Butte County

MAMMOTH CHANNEL (Magalia)—Proposition recently made to lease this gravel property for 20-year term which calls for investment of \$100,000 in a drain tunnel and other development, was to be considered by Mammoth Channel Gold Mining Co. at a meeting of stockholders, Nov. 10.

GOLD BANK-GOLDEN QUEEN (Forbestown)—Further examination, it is reported, is being made by prospective purchasers. The 20-stamp mill was closed during summer months because of lack of water for power, but preparations are being made to resume milling. Should properties be taken over by company with large capital, installation of electric power would follow. Shortage of water during summer was due to fact that power water was taken from local ditch that must supply irrigation water to farmers.

Calaveras County

MOKELUMNE HILL DISTRICT mining is progressing. The Megaw-Magee tunnel has reached a good prospect of gravel at 1900-ft. point. Large amount of water has come in, which will be handled with water jet. Carpenter shaft is in pay gravel. Five stamps of 8-stamp mill are dropping. Electric power is used. One of the Nuner shafts at base of Stockton hill will be unwatered. Electric power will be used.

LAND CONTEST between F. M. Raymond, mineral contestant and Frank Reister, homestead entryman, has been decided by U. S. registrar and receiver at Sacramento in favor of mineral claim. Ground is at Smith Flat near Angels. Homestead claimant is permitted to proceed to patent the land that does not conflict with mineral claims.

Eldorado County

HEWITT EXTENSION (Slug Gulch)—Property, including Rody Bar mine and Cosumnes Crystal cave on Cosumnes River has been leased to J. B. White, of Fort Wayne, Ind., who, it is said, will develop mines and explore cave with view of making latter a show place of interest to tourists.

Fresno County

PACIFIC QUICKSILVER CO. (Dos Palos)—Six new Knox & Osborne condensers went into commission in September.

Inyo County

BLUE BELL (Bishop)—It is expected that milling will begin soon.

GEM GROUP—A large amount of ore has been milled from this mine in Jail Cañon this summer. A cyanide plant is being built.

MONTRÖSE MINING CO.—It is reported that road leading to old Panamint mine will be rebuilt and stamp mill will be erected. Pay ore is reported in new territory outside of patented ground.

Kern County

GOOD HOPE (Randsburg)—Mill has resumed running, treating 70 tons of ore daily. Large shoot of good ore, recently exposed, assures long mill run.

Lake County

UTOPIA QUICKSILVER MINING CO. (Lakeport)—Assessment of 1½c. per share has been levied on stock for purpose of reopening and developing the mine near Bartlett Landing. About 300 ft. of sinking and drifting had been done and indications of good ore found. H. C. Davy, manager of Guadalupe quicksilver mines in Santa Clara County is one of the largest stockholders and will have supervision of development.

Madera County

CALIFORNIA-NEVADA—Further litigation is expected regarding title to this property formerly known as Dalton copper mine. It was purchased at sheriff's sale in 1910 by J. R. Barnett, and was sold for delinquent taxes on Oct. 18, 1913, by L. M. Bradford, of Madera. Barnett will try to recover title.

Nevada County

GOLDEN CENTER (Grass Valley)—Ten-stamp mill is being built. It is expected stamps will be dropping in December.

GASTON (Gaston)—Ten stamps from upper mill have been removed to point below, where vein has been disclosed at greater depth.

NORTH STAR (Grass Valley)—Third dividend for 1913, 20c. per share, and amounting to \$50,000, has been declared. Total of \$150,000 has been disbursed in nine months. Total dividends of North Star now amount to \$8,936,898 on capitalization of \$2,500,000, in addition to large sums set aside for purchase and development of Champion mines at Nevada City.

Placer County

PIONEER GOLD MINES CO. (Auburn)—Articles of incorporation have been filed; capital \$1,000,000. Company has purchased Pioneer mine near junction of Humbug Cañon and north fork of American River.

COLORADO**Custer County**

SPRINGFIELD (Salida)—Mine in Pass Creek which has been lying idle since the '30s has been reopened by Salida men, who in driving crosscut tunnel, opened shoot of ore assaying \$80 to \$100 per ton in gold and 5% copper. Old stopes are also said to be full of \$15 ore.

Lake County

DISCOVERY (Leadville)—First ore has been shipped and as oreshoot is now well proved shipments will continue regularly from both zinc and iron shoots. Former carries 30% zinc and latter 10 to 15 oz. silver per ton with 5% lead and 40% excess silica.

MOUNT CHAMPION (Leadville)—In Dick Turpin claim in Lackawanna Gulch, largest shoot of ore yet found in that mine has been opened. It is mostly smelting ore rich in gold as is the milling ore. Mill is running day and night treating 100 tons daily.

San Juan Region

CONCENTRATE SHIPMENTS from Teliuride during October totaled 83 carloads. Cash in mine in Paradox Valley is shipping high-grade copper ore which nets owners good profit over marketing costs of \$32 per ton. The 50-stamp mill of the Junta Consolidated is to be ready to operate some time in November. There is plenty of ore blocked out to keep it running continuously.

Summit County

COLORADO GOLD DREDGING CO. (Breckenridge)—Recent semi-monthly cleanup resulted in two gold bars valued at \$14,000 being sent to Denver mint. This represented about 13 days actual dredging. Company has leased Farncomb Hill Gold Dredging Co.'s property known as Snyder placer which has big record for nugget and coarse gold from its bedrock drifting.

Teller County

MARY McKINNEY (Anaconda)—Sinking has been resumed in main shaft for another lift of 100 feet.

OPHIR (Cripple Creek)—Mine has been bought in at sheriff's sale by James F. Burns under judgment of \$1368 and costs in his favor.

GOLCONDA (Victor)—After 10 years idleness mine has been leased to T. Fitzmorris and associates for 5 years on graded royalties from 15 to 25% on net returns.

IDAHO**Cœur d'Alene District**

AMADOR (Iron Mountain)—First car of copper ore has been shipped since work was resumed after settlement of litigation several months ago. Raise from 400-ft. level has opened up good ore. Narrow-gauge railroad from Iron Mountain to mine has been repaired and is in operation. It is equipped with gasoline locomotive and 7-ton cars.

GREEN-HILL CLEVELAND (Mace)—New Nordberg hoist is now installed and in operation and mine will be in operation by Nov. 15. New hoist replaces old one, which was demolished recently when loaded skip dropped 2000 ft. It is of type used in Butte and will raise nine tons 3000 ft. Hoist is designed to compress air when lowering.

INTERSTATE (Wallace)—Mine in Nine-Mile cañon is being equipped with electric haulage for 4000 ft. Milling plant is now running with three shifts to its full capacity of 300 tons per day. Five four-horse teams are hauling crude ore and concentrates to Bunn station. Five more teams are at work hauling from sawmill near mine for construction of 12 new bungalows and 75-room hotel for employees. All buildings will be equipped with steam heat, baths and modern improvements.

TYLER (Wardner)—A caterpillar engine has replaced the motor truck which was used to haul ore during summer. The motor truck could not be operated satisfactorily on hill in deep mud. New engine, which is built by Holt Mfg. Co., of Stockton, Calif., travels through 4 in. of mud without difficulty. It is driven by 65-hp. gasoline engine and travels two miles per hour. Some difficulty was experienced at first in having too light trailers which engine pulled to pieces in mud. Engine now pulls two 7-ton bottom-dump wagons and makes regular trips. In some places grade is from 12 to 15%. It is planned to run caterpillar throughout winter, makers claiming that it will run as good through snow as it does through mud.

IDORA HILL (Wallace)—Tuscumbia property has been bonded and leased at a price of \$225,000. Not all Tuscumbia stock was turned in on the option, but enough to give Idora working control of property. Term of bond is for two years, with royalties on all ore extracted from Tuscumbia ground. Consolidation of the properties is of great advantage to stockholders financially, and promises greater convenience in working. Idora is equipped with mill, which is running steadily on Idora ore but with addition of Tuscumbia, which is in shape for immediate production, mill can be run at full capacity and shipments of ore be correspondingly increased. Ore is hauled from Idora mill to Bunn station on the Northern Pacific Ry.

MICHIGAN**Iron**

IN IRON RIVER DISTRICT mining business does not look any too bright at present, as there is not a single property working in Spring Valley, the seven mines being closed. Youngs, Zimmerman and Berkshire have been shut down for some time, and Baltic, Bengal, Fogarty and Caspian were closed week before last. Last four mines belong to Pickands, Mather & Co., and shut-down is only supposed to be temporary. When orders were received to cease shipments, mines were not in shape for stocking ore and so it was necessary to stop mining until stocking room could be made. Just when operations will be resumed is not known; probably soon. There is little ore in stock at any of the mines in the valley, shipments from that region having been heavy this year.

ATLANTIC (Iron Belt)—Oliver Iron Mining Co. has surrendered its lease, several years of persistent exploratory work having failed to disclose new bodies of ore of importance. Shut-down is serious blow to Iron Belt as only a few days before Plummer lease was given up.

PURCELL (Iron River)—McGreevy Steel Co. has ceased all work with exception of pumping. Considerable new machinery arrived at property a few weeks ago, but it will not be installed now. All ore shipments stopped with shut-down. It is believed that mining operations will be resumed next spring.

HOMER (Iron River)—New mine buildings are hearing completion, transformer house and boiler house being about finished. Two 250-hp. boilers have been installed and are in use. Walls of engine house are up and floor will soon be laid. Change house is now receiving most attention, as company desires to have this structure ready for occupancy at an early date. All new buildings are built of brick, with steel girders, and iron roofs.

CLEVELAND-CLIFFS IRON CO. (Negaunee)—Company closed its crushing plant at South Jackson location, where most of ore shipped from Chase, North Lake and Moro mines this season was crushed. Plant had a busy season and operated with day and night forces all summer. Ore that has been in stock at Moro for several years has been shipped, a little remains which will be sent out next year. Property was abandoned a year ago, having been worked out.

AUSTIN (Gwinn)—Property was shut down lately because there is considerable ore in stock and management deemed it unwise to mine more until improvement in iron market. Men have been given work at other mines of Cleveland-Cliffs Iron Co. in Gwinn district. Stephenson is only large property in district now being operated, although work is being done at Gwinn, Mackinaw and Gardner shafts. Princeton was closed three weeks ago. No mining has been done at Gwinn, Mackinaw and Gardner properties, but shafts have been sunk to ore and sinking is again in progress. Gwinn will probably be a producer in 1914.

MINNESOTA

CUYUNA-DULUTH IRON CO. (Ironton)—No further shipments will be made this season, but stockpiling will continue throughout the winter.

DULUTH-BRAINERD MINING CO. (Manganese)—New three-compartment shaft is now down 35 ft. Product, manganese iron ore. Northern Pacific Ry. is arranging to lay track to property.

BARROWS (Barrows)—Five or six thousand tons will be loaded from stockpile at once, as mine is not hoisting enough to fill the 10,000-ton order before close of navigation. About 200 tons per day are being hoisted.

JAMISON & PEACOCK (Crosby)—The Drilling on Sec. 1, 46-29, continues to show sensational results. Hole No. 514 averaged over 69% iron for a distance of 20 ft., with one sample 69.52% and 0.011 phosphorus. Drilling has shown up highest grade of bessemer hematite ever encountered anywhere in Lake Superior region.

Mesabi Range

THE TOWN OF FAYTON has been platted on the Western Mesabi between Grand Rapids and Coleraine, near operations just started by Interstate Iron Co.

ORE SHIPMENTS are again being made to Lake Superior docks, after suspension of several days. It is learned that stoppages of shipments was result of congestion at Duluth.

U. S. STEEL CORPORATION—On Oct. 31, the last legal date, the corporation paid its real estate taxes for last half of 1912. These amounted to \$1,520,616, made up as follows: Operating mines, \$966,266; timberlands and inactive mines, \$549,198; Minnesota Steel Co. new plant at Duluth, \$5152. The yearly taxes of the Steel Corporation for 1912 in St. Louis County were \$3,040,119.

CASHMAN TARIFF LAW, a recent Minnesota enactment, goes into effect Jan. 1, 1914. Sense of the law is to put all freight rates on a "per mile" basis throughout state. It has been ruled that iron-ore shipments to Duluth docks, being destined for Lake Erie ports, are inter-state shipments, and do not, therefore, come under new law. New steel plant at Duluth will be only consuming interest to be affected. No schedule of rates on iron ore has been announced as yet.

LA RUE (Nashwauk)—A concentrator plant is contemplated.

JOHN, JR.—Mine has closed down for winter, after completing its shipping contract.

PEARSON—This underground mine will operate throughout winter, for first time, stockpiling product.

QUINN—Stripping will be continued all winter by Butler Bros., stripping contractors. Pit will produce in 1914.

HAWKINS (Nashwauk)—Stripping operations will continue through winter. Two shovels are at work, with five locomotives.

CROSBY (Nashwauk)—Plans are being prepared for concentrator. This is an underground mine, but will not operate in winter.

COLUMBIA (Virginia)—Preparations are being made to remove houses over orebody, and all will be moved to new location. It is planned to complete the work as soon as possible, so that stripping can be gotten under way.

COLERAINE EXPLORATION CO. (Coleraine)—This company of Duluth mining men was recently organized to explore 16 "forties" east of Trout Lake, near Coleraine. Several drills were started this week. Surface indications of ore were discovered there little less than a year ago, and all the territory will be thoroughly explored.

INTERSTATE IRON CO. (Grand Rapids)—The dredge "John Beckfelt," with which company hopes to remove overburden from its new property, was towed to its moorings several days ago and stripping has been started. Total of 3000 ft. of pipe was laid through which waste material will be carried to dumping ground by aid of suction pump. Machine has not been in operation long enough to make any predictions as to outcome.

MISSOURI-KANSAS-OKLAHOMA

Joplin District

STRIKE OF ZINC ORE was made on farming land near Afton, Okla., last week at depth of 10 ft. by men drilling for water. No mines are situated near tract and scene of strike has been visited by many operators.

MEXICO-JOPLIN (Joplin, Mo.)—Three drifts at 180-ft. level are showing ore.

BRAY MINING CO. (Springfield)—Average of 35 tons of blende is being produced weekly. Operations for several months have been successful.

QUEEN CITY LEAD & ZINC CO. (Aurora, Mo.)—Tract of 30 acres has been sold to Investors' Realty Co., comprising local operators. Development work is to be done.

GRANBY MINING & SMELTING CO. (Joplin, Mo.)—New mine in Chitwood camp is proving profitable, 7% ore being found; development campaign extended over a year.

RAGLAND (Joplin, Mo.)—J. M. Short has leased property and placed four drill rigs at work. Disseminated ore has been encountered at 240 ft.; the tract consists of 80 acres.

BARNES & MCCONNELL (Baxter Springs, Kan.)—Concentrator has been completed and will be placed in operation soon. A tram has been built to connect 150-ft. shaft with mill.

LEE HALL (Joplin, Mo.)—Mill has suspended operations pending prospecting work. Mine has been one of the best producers of West Joplin field for last six or seven years.

GENERAL LEAD & ZINC CO. (Carthage, Mo.)—Edward Lanyon and associates are developing a good mine on this tract. An old shaft was sunk deeper and a vein of high-grade ore was encountered.

YELLOW PUP (Galena, Kan.)—O. W. Sparks has made an unusual strike at a deep level near this property. Ore is richer than that of Yellow Pup and Yellow Jacket. Ore from new shaft will be treated at Yellow Jacket mill.

BERTHA A (Webb City, Mo.)—Concentrator is to be enlarged to 500 tons capacity. Operations will be continued while work is in progress. Two new roughers, larger power plant, larger crusher, and elevators will be installed. Three shifts are producing ore.

POCAHONTAS (Thoms Station, Mo.)—Unless prices of ore increase soon, company will withhold its ore, it has been announced. Other companies will do likewise. Powhattan is owned by Pocahontas operators, and rule may apply there also. The two produce on average of 300 tons of ore weekly.

MONTANA

Butte District

W. A. CLARK'S GOLDEN ANNIVERSARY of his arrival in Montana will be celebrated by citizens of Butte. Mr. Clark's long activity in development of Butte mines is recognized by Butte's citizens as deserving celebration which they have planned and which promises to mark a red-letter day in history of Butte.

BUTTE & SUPERIOR (Butte)—Reports are current that company has purchased Deadwood and Deamert claims adjoining Black Rock mine in which latter claim all of present work is carried on. Mill is treating now on an average 1000 tons of ore per day, making recovery of 87 per cent.

NORTH BUTTE (Butte)—Development on Snowball vein is progressing with increasing success. Lode was encountered in crosscut on 1800 level toward close of 1910, and since that time it has been opened on successive levels in depth to 2800 level and also on levels above eighteenth. Of total 10 veins nearly one-third of ore reserves, according to latest estimate, was contained in Snowball vein. Ore in this vein averages 6 to 7% copper and 8 oz. silver per ton.

BOSTON-BUTTE COPPER & ZINC CO (Butte)—Company has been incorporated by Butte men under the laws of Arizona with a capital of \$1,000,000. Company owns 750 acres of ground in northwest part of district, which it proposes to develop by sinking central shaft to depth of 1500 ft., and crosscutting north and south to boundaries. It is understood that no stock will be sold at this time as arrangements have been made with Boston men for sufficient money to equip and develop property.

BUTTE CENTRAL (Butte)—F. O. Curry, Nova Scotia holder of 1000 shares, after more than a week's stay, has gone to Vancouver to look after interests there. Mr. Curry after his investigation, was quite satisfied that money would be forthcoming to pay off indebtedness of company and enable it to resume operations. He believed that with careful and prudent management mill could be operated with profit, and that there was sufficient ore blocked out to run concentrator for many months. He is of opinion that shaft should be sunk at least 500 ft. and a thorough examination be made of ground at depth.

BUTTE-BALLAKLAVA (Butte)—There is every reason to believe that mining operations will be resumed within a short time now that litigation with Anaconda company has been settled. All the time mine was closed down a crew has been maintained keeping shaft clear of water so that work can be started up without any delay. When injunction was secured Butte-Ballaklava company was shipping some high-grade ore, and it was over ownership of ground from which this ore was being extracted that dispute arose. Company was making a good profit and paid one dividend of 50c. per share. It is surrounded by some of best producing properties of Anaconda company.

BUTTE-DULUTH (Butte)—New leaching machines which were installed and put in operation last week near Columbia Gardens are doing highly satisfactory work. Machines have increased capacity of original plant to fully 240 tons per day. According to Capt. A. B. Wolvin's statement, average extraction, using ¼-in. perforated screen, has been 83½%. By using finer mesh, tests already made show possible recovery of 90%, which is accomplished in 20 min. Crushing plant for treating 1000 tons per day has been ordered and is expected to be available for operation by Feb. 1, 1914. Claims of Butte-Duluth company are being prospected by churn drills

and exploration work has so far revealed existence of extensive orebodies, far richer in copper than had been anticipated. All Butte is watching with intense interest further developments.

ANACONDA (Butte)—The Nettle mine, one of the oldest in Butte district, and 1½ miles from city proper, has passed into possession of Anaconda company, and in course of a few months will again be in operation. Workmen are engaged in erecting several buildings for mechanical shops and bunk houses and electrical equipment has been ordered. Mine has three shafts, one 300-ft. deep, another 400, and third is 500 ft. deep. Large amount of development work has been done, and there are several miles of workings. It was a silver producer in old days, and for many years furnished manganese flux for Colorado smelter. It was last operated in 1901. Having been closed down for 13 years shafts are undoubtedly in bad condition and will no doubt require extensive repairs. Shafts are full of water and several weeks will be required for unwatering. It is thought that by first of next year property will be ready for operation.

Deer Lodge County

GLADSTONE (Anaconda)—Preparations to begin operations are being made, it is reported.

BALTIC COMBINATION (Georgetown)—Owing to heavy snows it has been decided to close property until next spring. Low-grade ore has been opened, but none of shipping grade.

BLUE EYED NELLIE (Anaconda)—Owners of this former producer of silver-lead ore are preparing to operate it again. Shaft has been retimbered, a gasoline hoist has been installed, and old workings cleaned out.

WASHOE WORKS (Anaconda)—Experiments by Anaconda company in leaching of copper tailings is meeting with continued favorable results, and everything points to successful application of this method as a finishing process after water concentration, indicating that large additional profits should result. Method consists of preliminary roast, leaching with sulphuric acid and precipitation, either electrolytically or by scrap iron, or hydrogen-sulphide. It is estimated that cost will not exceed 70c. per ton. Method, though evolved primarily for treatment of mill tailings, will also be applied to enormous accumulation of tailings from previous operations which is estimated to amount to from 20,000,000 to 30,000,000 tons. Recovery of 10 lb. of copper per ton on this material would result in total profit to the Anaconda company of from \$14,000,000 to \$20,000,000.

Granite County

BOULDER (Phillipsburg)—Arrangements have been made for erection of buildings and at once to begin driving tunnel to vein at depth of 600 ft.

PURITAN—Unwatering of this mine, which has been in progress about a month, is nearly completed, the 400-ft. level having been drained several weeks ago.

NEVADA

Churchill County

NEVADA WONDER (Wonder)—Dividend, 10c. per share, has been declared, payable Nov. 21.

GEORGE A. BETHUNE vs. JOHN T. HODSON—A new trial will be asked for. Plaintiff alleges that he is entitled to share in proceeds of mining deal involving sale of property now constituting Nevada Hills Co. at Fairview.

O'CONNELL (White Rock Cañon)—This group of 24 claims, it is stated, has been sold to San Francisco men for \$125,000. Property has been partially developed and vein of good-grade copper ore carrying some gold and silver has been discovered.

Clark County

ST. ANTHONY (Goodsprings)—Joseph Dederich, manager of this property, announces that he will erect an aerial tramway from the upper workings at once. Copper ore is being shipped to smelters at the rate of six cars per month, and a large tonnage is blocked in the mine.

HICKORY DICK—Vanadium-bearing ore has been discovered on the Westminster claim of this group, belonging to Harvey Hardy & Son, of Goodsprings. The mineral in which the vanadium occurs is cupro-desclowitzite, which also carries small percentages of lead, copper and zinc with a few ounces of silver, the whole occurring in calcite gangue. The vein, as opened, averages over 10 ft. in width and can be traced on the surface for a distance of 200 ft. Assays across the vein have indicated from 3 to 4% vanadium oxide. Preliminary tests have shown that the mineral can be readily concentrated by ordinary methods, and the owners are considering the installation of a small test-plant to treat the ore. On the Bill Nye group adjoining the Hickory Dick, the same mineral has been encountered, and the owners, Allen & Fredrickson, have men at work on development.

Humboldt County

NATIONAL MINES CO. (National)—The 30-ton milling plant has resumed operations.

CHARLESTON NATIONAL MINING CO. (National)—Shaft is being sunk at rate of 6 ft. per day.

MONTEZUMA—Property near center of Humboldt County has been taken under bond and lease. Ore is lead-silver and occurs at contact of lime and quartzite.

Lyon County

MONTANA-YERINGTON (Yerington)—Wingfield option on this property has expired and work is now being done by company.

NEVADA COPPER BELT R.R. (Mason)—Auto stage route has been established between Hudson and Aurora, thus making daylight trip between Reno and Aurora.

MASON VALLEY MINES CO. (Thompson)—Ore receipts at smelting plant for week ended Oct. 30, 1913, were as follows: From Mason Valley mine, 2155 tons; from Nevada-Douglas, 1167 tons; from other mines, 724 tons; total, 4047 or daily average of 578 tons. During same week five cars of matte were shipped.

NEVADA-DOUGLAS (Ludwig)—Second sublevel, 90 ft. below Douglas Hill tunnel has struck continuation of Maby stope. Development on this oreshoot, which assays 5% copper, is now in progress. An oreshoot has been cut by Ogden crosscut from No. 2 tunnel, 150 ft. below Douglas Hill level, and is continuation of oreshoot above. A raise will be lifted in ore to connect, and crosscutting will be done to determine width of shoot. Development is being done on second and third levels, and 75 tons per day is being shipped from this section of mine. The 800-ft. level in Ludwig is now advanced 370 ft. from shaft.

Mineral County

NATIONAL (Rawhide)—The 20-stamp mill has resumed operations.

LUCKY BOY (Hawthorne)—Large flow of water has been struck in tunnel and property is temporarily closed down.

ANDERSON (Luning)—Prospecting shaft has been sunk to the 120-ft. level and 5-hp. hoist installed. Fifty tons per day are now being shipped, ore being hauled to Luning by teams as auto-truck service has been discontinued.

Nye County

HALIFAX TONOPAH (Tonopah)—At a meeting directors discussed advisability of installation of a crushing plant and ore washer similar to plant now in operation at West End mine, but did not decide finally to build it. Crosscutting is under way on 1100 level to locate oreshoot, which was discovered on 1000 level, which should be done in near future; and, provided vein is cut and it looks as well as it does on 1000-ft. level, it will not be long before such a plant will be built. Company is also undertaking to cut this vein on 1400-ft. level with another crosscut, and work is in right formation on this level. Expected that it will not be long before vein will be found on this 1400-ft. level.

Washoe County

COPPER QUEEN (Reno)—Roads are being repaired preparatory to shipping.

TWIN METALS (Reno)—Hoist will be installed and stoping will commence at once.

STOKE-POGIS (Reno)—A 60-ft. shaft has been sunk in ore. Roads are being repaired preparatory to shipping.

RENO-PEAVINE (Reno)—Gasoline hoist has been installed at 250-ft. shaft, new engine room and bunk house will be built and shaft will be equipped with new guides. Development in mine will commence as soon as new construction is completed.

White Pine County

ARGUS MINES CO. (Taylor)—Extensive churn-drill work in blocking out ore is now under way, and it is likely that most of next year will be devoted to this method of blocking out ore in Taylor deposit. Company owns 240 acres of virgin ground of old Taylor deposit, including patented claims of old Argus Mining Co., from which was produced some 30 years ago, over \$1,000,000 gross. Vein is a blanket from 40 to 50 ft. in thickness and lies close to surface. Ore channels exist in this vein, similar to vertical veins, and there are two stratas of ore channels, each from 12 to 18 ft. thick. The ore in lower strata assays \$16 per ton, mostly silver, 60c. to \$1.20 gold. Ore is ideal for cyaniding. It is perhaps the first instance where a large deposit of silver-gold ore is being blocked out similar to porphyry coppers. Although the limestone is hard the work is proceeding nicely.

NEW JERSEY

Sussex County

ANDOVER IRON MINE—This old mine has been sold by the Trenton Iron Co. to the American Steel & Wire Co., and it is reported that operations will be resumed shortly. The mine was first opened about 1780 and has been operated at intervals since then. It has been shut down since 1880. For a long time it supplied ore to Andover Forge, and later to Andover Furnace, both now dismantled.

NEW MEXICO

Bernalillo County

GOLD RANGE MINING CO. (Albuquerque)—William Jenks, agent, filed incorporation papers Oct. 31. Capital stock is \$10,000, and company starts business with \$2000 subscribed.

Grant County

MEERSCHAUM MINES on the Sapello River are closed down for an indefinite period.

PLACER MINING ON BEAR CREEK, 18 miles north of Silver City, is soon to begin. A. H. Jacobs, of Salt Lake City, is at the head of the project. Several weeks ago the dam that had been built across Bear Creek was washed out, but work upon reconstruction was commenced at once.

A PARTY OF ZINC MEN was in Silver City a short time ago inspecting property of Empire Zinc Co. at Hanover and looking over Utter zinc property at Pinos Altos, but nothing definite was given out regarding transaction with Utter for Cleveland group. In party were: J. A. Van Mater, of New York, head of mining department of New Jersey Zinc Co.; Arthur Thacher, of St. Louis; E. A. Hoskins, of Mineral Point, Wisconsin, zinc works; J. H. Troutman, Denver, manager of Empire Zinc Co.; J. E. Dwell, mining engineer, and C. T. Brown, New Mexico representative of Empire company.

HARDSCRABBLE (Pinos Altos)—J. T. Janes has secured lease and will begin extensive work. Property has been profitable in the past.

BELL & WRIGHT (Pinos Altos)—Lessees have a new hoisting plant on their workings, and will put it into operation in a short time. They are now shipping two cars of high-grade ore to El Paso weekly.

Socorro County

PACIFIC MINES CO. (Mogollon)—Electrical equipment purchased several months ago is now being installed.

ERNESTINE (Mogollon)—Auxiliary water supply has been established by sinking well in cañon about ½ mile from mill and installing electric pump.

THE MARKET REPORT

METAL MARKETS

METAL MARKETS

The metal markets have not been active. Copper has been slow and prices have been weaker. In fact, nearly all the metals reported have been easier.

Copper, Tin, Lead and Zinc

Copper—Immediately following the date of our last report the copper market became very weak, the efforts to sell on the part of agencies previously indifferent, to which we referred in our last report, having become more generally known. Since then there has been active competition from all quarters except one, although there has been a lot of moonshine for popular consumption about maintaining prices, etc.; in fact nearly all of the agencies have been desirous of placing copper and have been cutting each other's prices from day to day. By Nov. 12 all disguise was discarded and no secret was any longer made about the real situation, which in fact dated back at least 10 days. On Nov. 7, 16c., delivered, usual terms, was offered about all around, but failed to command business, which was taken by cheaper sellers. On Nov. 8, there were sellers at 15½c., delivered anywhere, and sales were made. On Nov. 10, 15¾c., delivered, was commonly offered and there were shadings of that price. On Nov. 11 copper was offered at 15¼@15½c. in the early part of the day and at 15% @15½c. in the latter part. Some fair lots were sold, including deliveries so far inland as Detroit. On Nov. 12, copper was freely offered at 15½@15¾c., delivered, and sales were made. Right through the week the market was unsettled and prices changed not only from day to day but also from sale to sale in the same day. Up to Nov. 11 no large volume of business was done, but on Nov. 11 and 12 buyers became more interested and took some fairish quantities. The larger part of the sales of the week were for delivery in Europe. However, the place of delivery cut no great figure in the minds of sellers.

We have not heard of any sales at all of Lake copper. The leading Lake company, which is the only one having any supply of consequence to offer, was understood to be naming no price, but will probably name a new price presently inasmuch as some of its regular customers will shortly be needing further supplies. What the new price will be does not yet appear to have been settled. We quote Lake copper nominally at 16@17c., which is named in the absence of any business and is a mere guess rather than anything else.

Casting copper has again been offered liberally at concessions without attracting buyers. The accumulation of this kind of metal has lately increased rather materially.

Electrolytic copper in cakes, wirebars or ingots at the close is quoted at 15.25@15.30c. We quote casting copper nominally at 15.20@15.30c. as an average for the week.

Base price of copper sheets is now 22c. for hot rolled and 23c. for cold rolled. Full extras are charged and higher prices for small quantities. Copper wire is 17¼@17½c., car-load lots at mill.

Exports of copper from New York for the week were 10,547 long tons. Our special correspondent gives the exports from Baltimore for the week at 2865 tons.

The London market for standard copper was weak. On Monday, Nov. 10, it had a perpendicular drop of £2, spot going to £67 2s. 6d. and three months to £66 15s. There was a reaction of £1 on Tuesday, spot going to £68 7s. 6d. and three months to £68. On Wednesday, Nov. 12, it closed at £68 for spot and £67 10s. for three months. There has been considerable bear selling.

Tin—The London market was adversely affected by the serious decline in standard copper. While quotations in London gave way easily, considerable transactions took place in the Far East, where purchases, presumably for American interests, were made direct from the producers, at prices which were a good deal higher than the London parity. There was quite an active business in this market, especially in the retail trade. The market closes firm at £179 15s. for spot and £181 10s. for three months, and about 39½c. for November tin here.

Lead—Some carload business has been done right along through the week at 4.35c., New York, and 4.20c., St. Louis, but offers to sell moderate tonnages at those prices have failed to result in business, while a large tonnage of the metal is reported to have been offered still lower. We quote New York at 4.30@4.35c., and St. Louis 4.15@4.20c.

The London market is lower, Spanish lead being quoted £19 6s. 3d., English 2s. 6d. higher.

Spelter—The galvanizing and brass business being quiet, the demand for spelter is small, even though buyers are believed to be poorly covered, and the market has been weaker. Some producers have steadily been offering the market down and capturing such business as consumers have offered. At the close St. Louis is quoted at 5.05@5.10c.; New York, 5.30@5.35c.

The London market is also somewhat lower, good ordinaries being quoted £20 12s. 6d., specials £1 higher.

DAILY PRICES OF METALS

NEW YORK

Nov.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	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.
6	4.8490	59½	*16 @17	15.75 @16.00	40	4.30 @4.35	4.15 @4.20	5.25 @5.30	5.10 @5.15
7	4.8485	59½	*16 @17	15.65 @15.75	40	4.30 @4.35	4.15 @4.20	5.20 @5.30	5.05 @5.15
8	4.8480	59½	*16 @17	15.55 @15.60	40	4.30 @4.35	4.15 @4.20	5.20 @5.25	5.05 @5.10
10	4.8485	59½	*16 @17	15.50 @15.60	39½	4.30 @4.35	4.15 @4.20	5.20 @5.25	5.05 @5.10
11	4.8490	59½	*16 @17	15.35 @15.50	39½	4.30 @4.35	4.15 @4.20	5.20 @5.25	5.05 @5.10
12	4.8510	59½	*16 @17	15.25 @15.30	39½	4.30 @4.35	4.15 @4.20	5.20 @5.25	5.05 @5.10

*Nominal.

The quotations herein given are our appraisal of the market for copper, lead, spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

Nov.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'd	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
6	27 1/4	69 1/2	15.15	69 1/2	76	182 1/2	183 1/2	20 1/2	4.40	20 1/2	4.48
7	27 1/4	69 1/2	15.13	68 1/2	75 1/2	182	183 1/2	20	4.35	20 1/2	4.48
8	27 1/4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	27 1/4	67 1/2	14.58	66 1/2	73	179 1/2	181	19 1/2	4.29	20 1/2	4.48
11	27 1/4	68 1/2	14.86	68	74 1/2	179	180 1/2	19 1/2	4.21	20 1/2	4.45
12	27 1/4	68	14.77	67 1/2	74	179 1/2	181 1/2	19 1/2	4.17	20 1/2	4.48

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 = 0.21¼c.

Other Metals

Aluminum—Current business is dull, with mainly small transactions and little demand. Prices are about the same, 19½ @ 19¾ c. for No. 1 ingots, New York. The foreign market is reported easier.

Antimony—The market is little changed with a good jobbing trade. Cookson's is in rather short supply, and is a shade firmer at 7.60 @ 7.75 c. per lb. Hallett's is quoted at 7½ @ 7¾ c., and 6½ @ 6¾ c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—Business has been rather quiet, but the market is steady, and there is no material change in prices. The New York quotation is \$38.50 per flask of 75 lb. with 56 @ 57 c. per lb. for retail lots. San Francisco price is \$38.50 per flask, with special terms for export business. The London price is £7 5s. per flask, with £7 quoted from second hands.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London was unchanged, at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Some gold was taken for India. There is talk of more gold being taken for New York, but so far only the shipment of \$2,000,000, reported two weeks ago, has been made.

Sales of gold bars from the New York Assay Office in October were \$3,477,880. For the 10 months ended Oct. 31 the total sales were \$25,574,684 in 1912, and \$28,666,374 in 1913; an increase of \$3,091,690 this year.

Gold in the United States Nov. 1 is estimated by the Treasury Department as follows: Held in treasury against gold certificates outstanding, \$1,098,995,169; in Treasury current balances, \$192,428,146; in banks and circulation, \$614,478,201; total, \$1,905,901,516, an increase of \$10,463,271 during October.

Iridium—The market is a little easier and sales are reported at \$80 @ 81 per oz., New York. The foreign market is easier.

Platinum—The market is more active but inclined to be easy. Quotations are again rather lower, \$43 @ 44 per oz. for refined platinum and \$49 @ 52 per oz. for hard metal.

Our Russian correspondent writes under date of Oct. 23 that dealers look forward to higher prices, as the season of active work in the Urals is nearly over, and production will be restricted by winter. So far, however, there has been no actual advance. Prices at Ekaterinberg are 9.50 rubles per zolotnik—\$35.72 per oz.—for crude metal, 83% platinum; in St. Petersburg, 36,400 @ 36,500 rubles per pood—equal to \$35.72 per oz.—for the same grade.

Silver—The market has ruled quiet and steady between 27½ d. and 27¾ d. in London, and is without special feature.

Shipments of silver from London to the East, Jan 1 to Oct. 30, as reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India.....	£8,950,500	£8,561,500	D. £389,000
China.....	1,081,000	702,000	D. 37,000
Total.....	3£10,01,500	£9,263,500	D. £768,000

Imports of silver at New York for the week ended Nov. 8 were \$344,102, chiefly from Mexico and Central America. Exports were \$796,451, principally to London and Paris.

Coined silver in the United States Nov. 1, is estimated by the Treasury Department: Standard dollars, \$565,683,263; subsidiary coins, \$176,239,292; total, \$741,922,555. Of the dollars, \$491,637,000 are held against silver certificates outstanding.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Nov. 8

The base price paid this week for 60% zinc ore was unchanged at \$42 @ 43 per ton. The base price paid for 80% lead ore was \$53 per ton.

SHIPMENTS WEEK ENDED NOV. 8

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	2,865,030	.....	1,278,900
Year to date	126,616,710	5,855,550	50,058,900
Total shipped during week to separating plants, 2,151,970 lb. zinc.			

MONTANA ZINC ORE

The production of blende concentrates in the Butte district, Montana, in October was about 12,000 tons.

JOPLIN, MO.—Nov. 9

The high price of zinc blende is \$46, the base per ton of 60% zinc ranging from \$41.50 to \$43.50 for choice grades. Heavy buying constitutes the feature, despite the declining spelter market and the shipment is one of the largest of the year. Calamine remains on a base of \$21 @ 23 per ton of 40% zinc with a shipment of upward of 2000 tons of stock the past three weeks. The average price of all grades of zinc is \$40.18. Lead is in strong demand and buyers are watchful of every small production. The high price is \$56, the base \$52 per ton of 80% lead, and the average price of all grades is \$50.26 per ton.

SHIPMENTS ENDED NOV. 8

	Blende	Calamine	Lead	Value
Totals this week ..	13,074,670	1,483,020	2,518,590	\$355,725
Totals 45 weeks ..	493,793,560	37,424,380	82,015,320	\$12,451,234

Blende value, the week; \$272,940; 45 weeks, \$11,416,286.
Calamine value, the week, \$19,505; 45 weeks, \$481,499
Lead value, the week, \$63,280; 45 weeks, \$2,180,519.

IRON TRADE REVIEW

NEW YORK—Nov. 12

The iron and steel markets show no material change. New orders come in slowly and there is an evident hesitation to buy, which promises to keep matters quiet at least until the new year opens. The railroads are making inquiries for equipment, but not many purchases as yet.

Pig iron remains quiet, though a little more inquiry has developed for foundry iron. No large contracts are reported, but consumers are evidently short of supplies.

It is understood that some German and Belgian interests are making a push for business on the Pacific Coast. Quotations have been made at Los Angeles and San Francisco for German steel at 1.81c. for plates, 1.76c. for shapes and girders and 1.61c. for bars. As the freight rates from Pittsburgh are 66c. rail and water and 50c. all rail, these quotations are much below Pittsburgh parity. The Steel Corporation's current rate for bars is 1.75c. San Francisco.

Frank W. Blair, Detroit, Mich., has been appointed receiver of the Lake Superior Iron & Chemical Co., by the Federal Court at Grand Rapids, Mich. This action is understood to be in pursuance of a plan of reorganization. The company is a consolidation which owns several charcoal furnaces, with by-product charcoal plants in Michigan. The stock is largely owned in Canada and England.

The United States Steel Corporation reports a total of unfinished orders on its books Nov. 1 of 4,513,767 tons of material. This is a decrease of 490,018 tons from Oct. 1, and is the smallest total reported since Nov. 1, 1911.

Pig-Iron Production—The statements of the blast furnaces, as collected and published by the "Iron Age," show that on Nov. 1 there were 244 coke and anthracite stacks in blast, having a total daily capacity of 78,550 tons; a decrease of 4825 tons, as compared with Oct. 1. Making allowance for the charcoal furnaces, the estimated production of pig iron in the United States in October was 2,571,200 tons; for the 10 months it was 26,791,900 tons. Of this total 18,817,800 tons, or 70.2%, were made by the furnaces owned or operated by steel companies.

PITTSBURGH—Nov. 11

This district has been visited by a severe snowstorm, quite unexpectedly and unusually early in the season. No one was prepared for it, so there has been a good deal of trouble, much more than if it had come later in the season. Railroad communication was cut off for two days and mill operations badly delayed.

Under these circumstances there was little business and it cannot be said that there have been any changes of importance. New orders have been small and prices weak, though little change is noted in the last 10 days, except that some contracts for sheets have been placed at lower figures.

Pig Iron—The market is quiet. The production is being curtailed, especially by the merchant furnaces. Quotations are weaker, if anything. Bessemer pig is \$15.25 per ton; basic, \$13.50; No. 2 foundry, \$13.50, all f.o.b. Valley furnace 90c. higher delivered Pittsburgh.

Ferromanganese—Prices are unchanged at \$50, Baltimore, for English and \$49.50 for German.

Steel—The billet and sheet-iron market is still irregular. We continue to quote prices at \$20.50 for billets and \$21.50 for sheet bars, Pittsburgh or Youngstown. Rods are uncertain at \$25 @ 26, Pittsburgh.

IRON ORE

Shipments of iron ore from the Lake Superior region in October were 6,521,884 tons. For the season to Nov. 1 the shipments were as follows, in long tons:

Port	1912	1913	Changes
Escanaba.....	4,663,879	4,914,342	I. 250,463
Marquette.....	3,082,331	2,942,897	D. 139,434
Ashland.....	4,382,877	4,056,754	D. 326,123
Superior.....	13,100,043	12,846,823	D. 253,220
Duluth.....	9,415,511	11,520,153	I. 2,104,642
Two Harbors.....	8,703,960	9,506,399	I. 802,439
Totals.....	43,348,601	45,787,368	I. 2,438,767

Shipments now are slow, the demand for ore not being urgent, and it is estimated that the season total will be between 48,000,000 and 49,000,000 tons.

A severe storm accompanied by unusually cold weather swept over the Lakes this week, causing a number of wrecks and interfering materially with the movement of iron ore.

Imports of Iron Ore in Germany nine months ended Sept. 30, were 10,629,812 metric tons; exports, 1,955,882 tons. Imports of manganese ore were 510,254 tons; exports, 6362 tons.

COKE

Production of coke in the Connellsville region continues quite steady, but shipments are falling off. Prices are still irregular but the tendency is downward.

Anthracite Shipments in October were 6,338,194 long tons, being 327,127 tons less than in October, 1912. For the 10 months ended Oct. 31 the total shipments were 51,500,540 tons in 1912, and 57,620,079 in 1913; an increase of 6,119,539 tons, or 11.9%, this year.

Coal Passing through Sault Ste. Marie Canals, season to Oct. 1, short tons:

	1912	1913	Changes
Anthracite.....	1,321,452	2,110,934	I. 789,482
Bituminous.....	9,544,129	12,610,557	I. 3,066,428
Total.....	10,865,581	14,721,491	I. 3,855,910

The gain in anthracite was 59.8%, and in bituminous, 24.3%; the total increase being 35.5% this year.

SAULT STE. MARIE CANALS

Freight passing through the Sault Ste. Marie Canals in September was 10,916,365 tons, being 579,077 tons less than in August, but 448,583 tons more than in September, 1912. For the season to Oct. 1 the total freight was, in short tons:

	1912	1913	Changes
East-bound.....	39,613,431	44,005,765	I. 4,392,334
West-bound.....	12,339,277	16,067,529	I. 3,728,252
Total.....	51,952,708	60,073,294	I. 8,120,586

The total number of vessel passages this year was 17,472, showing an average cargo of 3438 tons. The mineral freights included in the totals were, in short tons, except salt, which is in barrels:

	1912	1913	Changes
Coal.....	10,865,581	14,721,491	I. 3,855,910
Iron ore.....	35,096,829	38,018,387	I. 2,921,558
Pig and manufactured iron.....	459,756	281,160	D. 178,596
Copper.....	73,784	72,466	D. 1,318
Building stone.....	2,282	6,181	I. 3,899
Salt, bbl.....	486,719	504,659	I. 17,940

Iron ore was 63.3% of the total freight, and coal 24.5% this year.

Nitrate of Soda—The market is still dull and unsettled. Prices are unchanged at 2.25c. per lb. for October, 2.30c. for November and December and 2.35c. for January-May delivery.

Arsenic—The market continues dull, with good supplies, but little present demand. Prices are nominally unchanged, about \$3 per 100 lb. being asked.

Copper Sulphate—The market remains steady, though not very active. Prices are unchanged at \$5 per 100 lb. for carload lots and \$5.25 per 100 lb. for smaller parcels.

OTHER ORES

Recent British quotations for manganese ore reported as follows: Indian or Brazilian, 50%, 21½@22c. per unit; 48%, 20½@21c.; 45%, 20@20½c. Caucasian is quoted at 19@19½ for 50%, 18½@19c. per unit.

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.

	June	July	August	September	October
Alaska shipments.....	2,203,191	2,705,136	1,847,785	2,261,216	1,951,883
Anaconda.....	21,500,000	22,100,000	22,500,000	22,600,000	18,400,000
Arizona, Ltd.....	2,600,000	2,600,000	1,800,000	1,800,000	3,550,000
Copper Queen.....	7,477,936	8,369,607	8,252,404	8,434,803	8,292,929
Calumet & Ariz.....	4,000,000	3,800,000	4,500,000	4,000,000	.....
Chino.....	3,682,706	4,831,185	6,050,867	4,308,296	.....
Detroit.....	1,750,601	1,549,224	2,187,223	2,102,818	1,861,878
East Butte.....	1,055,646	1,060,257	1,162,007	1,233,018	.....
Giroux.....	598,240	584,546	524,953	198,178	.....
Mason Valley.....	1,097,014	908,892	867,060	918,000	1,052,000
Miami.....	2,612,000	.....	.....	.....	.....
Mammoth.....	1,750,000	1,800,000	1,750,000	1,750,000	1,700,000
Nevada Con.....	6,344,863	5,403,919	5,989,973	4,441,671	.....
Ohio.....	537,400	601,700	689,000	685,900	.....
Old Dominion.....	2,511,000	2,526,000	2,524,000	2,679,000	2,037,000
Ray.....	4,392,612	4,097,000	4,269,519	4,336,434	.....
Shannon.....	924,000	880,000	1,248,000	1,232,000	1,216,000
South Utah.....	185,000	140,000	223,498	241,843	.....
Tennessee.....	1,379,220	1,247,804	1,101,019	1,309,985	1,392,162
United Verde*.....	2,900,000	3,000,000	3,000,000	3,000,000	.....
Utah Copper Co.....	11,637,949	9,849,043	10,302,251	11,463,905	.....
Lake Superior*.....	16,500,000	17,500,000	9,700,000	6,950,008	5,500,000
Non-rep. mines*.....	6,000,000	6,200,000	6,200,000	6,000,000	.....
Total prod.....	104,051,138	101,758,167	96,769,607	92,037,034	.....
Imp., bars, etc.....	18,255,267	20,029,990	22,474,471	.....	.....
Total blister.....	122,306,405	130,788,157	119,244,077	.....	.....
Imp. ore & matte.....	7,497,002	8,527,046	9,171,351	.....	.....
Total Amer.....	129,803,407	139,315,203	128,415,428	.....	.....
Miamif.....	.....	2,890,000	3,097,500	2,688,000	2,862,050
Shattuck-Arizona.....	1,059,625	1,019,388	1,001,634	1,163,237	.....
Brit. Col. Cos.....	.....	.....	.....	.....	.....
British Col. Cop.....	634,238	618,379	647,905	621,120	.....
Granby.....	1,789,000	1,664,102	1,847,344	1,824,659	1,718,258
Mexican Cos.....	.....	.....	.....	.....	.....
Boleof.....	1,984,640	2,240,720	2,264,640	2,369,920	.....
Cananea.....	2,908,000	3,328,000	3,186,000	3,148,000	.....
Moctezuma.....	3,438,793	2,693,006	3,542,947	3,024,121	3,178,136
Other Foreign:	.....	.....	.....	.....	.....
Braden, Chile.....	1,804,000	1,046,000	1,572,000	1,332,000	2,006,000
Cape Cop., S. Af.....	414,400	.....	.....	.....	.....
Kyshtim, Russia.....	1,000,000	2,500,000	1,585,000	.....	.....
Spassky, Russia.....	835,520	660,800	1,048,320	1,025,920	.....
Exports from:	.....	.....	.....	.....	.....
Chile.....	5,824,000	9,856,000	8,736,000	5,600,000	.....
Australia.....	7,616,000	10,304,000	7,720,000	6,944,000	.....
Arrivals-Europe†.....	5,277,440	11,728,640	14,624,960	9,661,120	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister. From May 1, Miami copper is refined in the U. S. and appears under American mines. From July 1 Miami ore went back to Cananea.

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

CHEMICALS

NEW YORK—Nov. 12

The general market is rather quiet, with only moderate sales reported.

Imports and Exports of Chemicals and raw materials in the United States, eight months ended Aug. 31, were as follows:

	Imports		Exports	
	1912	1913	1912	1913
Arsenic, lb.....	3,503,731	5,301,887	.....	66,000
Copper sulphate, lb.....	.....	.....	5,537,588	3,603,593
Bleach, lb.....	48,515,139	42,861,542	400	13,200
Potash salts, lb.....	420,654,457	369,434,757	1,976,350	6,701,645
Soda salts, lb.....	3,260,089	7,943,743	328,362	423,878
Acetate of lime, lb.....	.....	.....	54,191,192	52,159,607
Nitrate of soda, tons.....	322,305	463,689	6,060	3,727
Sulphate of ammonia, tons.....	25,907	32,242	160	.....
Phosphates, tons.....	.....	.....	836,803	933,992
Sulphur, tons.....	16,854	4,841	28,147	52,654
Pyrites, tons.....	560,366	614,288	.....	.....
Magnetite, tons.....	69,657	112,010	861	723
Chrome ore, tons.....	36,646	45,779	.....	.....

Exports include reexports of foreign material. Some phosphate is imported, but it is not given separately in the returns.

STATISTICS OF COPPER

Month	United States			Visible Stocks.		
	U.S. Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
X, '12.....	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI.....	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII.....	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912.....	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.....	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II.....	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III.....	136,251,849	76,585,471	77,669,306	122,302,890	81,244,800	203,547,690
IV.....	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V.....	141,319,416	81,108,321	68,285,978	67,474,225	85,948,800	161,497,908
VI.....	121,860,853	68,362,571	68,067,901	52,814,606	77,235,200	144,709,425
VII.....	138,074,602	58,904,192	78,480,071	52,814,606	71,904,000	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	83,418,694
XI.....	.....	.....	.....	32,566,382	48,787,200	81,353,582

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Mining Companies—United States

Name of Company and Situation	Shares		Dividends		
	Issued	Par	Total	Latest	Amt.
Acacia, g.	1,438,989	\$ 1	\$ 129,618	Jan '11	\$0.01
Adams, s.l.c.	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c.	50,000	25	2,100,000	Oct. '13	3.00
Alaska Mexican, g.	180,000	5	3,241,381	Aug. '13	0.30
Alaska Treadwell, g.	200,000	25	13,385,000	Aug. '13	1.00
Alaska United, g.	180,200	5	1,397,150	Aug. '13	0.60
Am. Zinc, Lead & Sm.	165,360	25	985,820	Apr. '13	0.50
Anaconda, g.	4,332,500	25	81,418,125	Oct. '13	0.75
Argonaut, g.	200,000	5	1,200,000	June '10	0.05
Arizona Copper, pf.	1,426,120	1.20	1,836,780	Oct. '13	0.00
Arizona Copper, com.	1,519,896	1.20	15,983,475	Jan. '09	0.10
Bagdad-Chase, g. pf.	84,819	5	202,394	July '13	0.48
Baltic, c.	100,000	25	7,750,000	Dec. '12	7.00
Bingham N. H., c.	228,690	5	317,088	Sept. '13	0.10
Bonanza Dev., g.	300,000	1	1,425,000	Oct. '11	0.20
Bunker Hill Con., g.	200,000	1	781,000	Oct. '13	0.05
Bunker Hill & Sul., l.s.	327,000	10	14,565,750	Oct. '13	0.20
Butte-Alex Scott, c.	74,000	10	148,000	Oct. '13	0.50
Butte & Ballaklava, c.	250,000	10	125,000	Aug. '10	0.50
Caledonia, l.s.c.	1,300,000	1	52,000	June '10	0.01
Calumet & Arizona, c.	596,353	10	15,170,882	Sept. '13	1.25
Calumet & Hecla, c.	100,000	25	122,650,000	Sept. '13	10.00
Camp Bird, g.s.c.	1,100,051	5	9,650,812	Aug. '13	0.24
Centen'l-Eur., l.s.c.	100,000	5	3,750,000	Apr. '13	1.50
Center Creek, l.z.	100,000	10	425,000	July '13	0.05
Champion, c.	100,000	25	8,100,000	Oct. '13	1.00
Chief Consolidated, s.g.l.	876,453	1	175,290	Sept. '13	0.10
Cliff, g.	300,000	1	120,000	Jan. '13	0.10
Cliff, g.	100,000	1	180,000	Nov. '12	0.05
Colo. Gold Dredging.	100,000	10	325,000	Oct. '13	0.25
Colorado, l.s.g.	1,000,000	0.20	2,570,000	Dec. '12	0.03
Columbus Con., g.s.	285,540	5	226,832	Oct. '07	0.20
Commercial Gold.	1,750,000	1	43,750	Dec. '10	0.001
Con. Mercur, g.	1,000,000	1	3,415,313	July '12	0.03
Continental, z.l.	22,000	25	297,000	July '13	0.50
Copper Range Con., c.	393,445	100	13,985,021	Oct. '13	0.75
Daly Judge, s.l.	300,000	1	620,000	Oct. '13	0.15
Daly West, s.l.	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	3,000,000	0.10	45,000	Mar. '11	0.001
Doe Run, l.	65,782	100	3,500,974	Sept. '13	1.00
Elkton Con., g.	2,500,000	1	3,079,460	Aug. '13	0.02
El Paso, g.	490,000	5	1,658,545	Mar. '13	0.12
Emerald, g.s.	300,000	5	400,000	Dec. '12	0.00
Fed. M. & S., com.	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	120,000	100	9,207,851	Sept. '13	1.50
Florence, g.	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	200,000	2.50	180,000	Dec. '09	1.00
Fremont Con., g.	1,230	100	176,000	Oct. '13	0.02
Frontier, z.	1,230	100	176,272	Oct. '13	0.00
Gemini-Key'ne, l.g.s.	5,000	100	2,110,000	May '13	10.00
Gold Chain, g.	1,000,000	1	130,000	May '13	0.03
Gold Coin of Victor.	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con.	2,500,000	0.10	100,000	Dec. '12	0.001
Gold King Con., g.	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g.	1,500,000	5	2,576,000	Oct. '13	0.02
Golden Star, g.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	3,558,367	10	26,330,470	Oct. '13	0.40
Grand Central, g.	500,000	1	1,545,750	Sept. '13	0.01
Granite, g.	1,650,000	1	269,500	Nov. '12	0.01
Hazel, g.	900,000	1	873,000	Nov. '12	0.01
Hecla, l.s.	1,000,000	0.25	2,930,000	Oct. '13	0.02
Hercules, l.s.	1,000,000	1	3,650,000	July '11	0.06
Homestake, g.	218,400	100	33,695,309	Oct. '13	0.65
Horn Silver, l.s.z.	400,000	25	5,662,000	Sept. '07	0.05
Iowa, g.s.l.	1,666,667	1	216,832	July '13	0.001
Iowa-Tiger Leasing g.s.	12,655	1	13,921	Jan. '12	0.10
Iron Blossom, s.l.g.	1,000,000	0.10	1,770,000	Oct. '13	0.10
Iron Silver, s.l.g.	500,000	20	4,700,000	Apr. '13	0.10
Jamison, g.	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g.	2,500,000	0.10	150,000	Aug. '11	0.01
Kendall, g.	500,000	5	1,475,000	Nov. '12	0.02
Kennedy, g.	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	200,000	1	396,000	Aug. '09	0.12
Klar Piquette, z.l.	20,000	1	162,500	Dec. '12	0.50
Knob Hill, g.	1,000,000	1	45,000	May '12	0.001
Liberty Bell, g.	130,551	5	522,093	Oct. '10	1.00
Little Bell, l.s.	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	400,000	25	2,300,000	July '13	0.05
Mary McKinney, g.	1,309,252	1	1,077,558	Oct. '13	0.02
May Day, g.s.l.	800,000	0.25	148,000	Feb. '13	0.03
Mexican, g.s.	201,600	2.50	20,160	Aug. '11	0.10
Miami, c.	664,963	5	2,216,708	Aug. '13	0.50
Modoc, g.s.	500,000	1	273,000	Dec. '11	0.01
Mohawk, c.	100,000	25	3,175,000	Aug. '13	2.00
Monarch-Mad'a, g.s.l.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop. s.g.	921,865	1	530,000	Dec. '12	0.10
Mountain, c.	250,000	25	4,216,250	May '08	0.44
Nevada Con., g.	750,000	1	570,000	May '11	0.10
New Century, z.l.	1,999,394	5	12,987,776	Sept. '13	0.37
New Idria, q.	330,000	1	237,600	Oct. '09	0.01
North Butte, e.	100,000	15	1,720,000	Sept. '13	0.10
North Star, g.	410,000	10	11,275,000	Oct. '13	0.50
Old Dominion, M. & Sm.	162,000	25	3,936,989	Sept. '13	0.20
Ophir, s.g.	201,600	3	3,361,000	Oct. '13	1.25
Ophoro, g.s.l.	898,978	0.25	2,068,360	Jan. '12	0.10
Oronville Dredging.	700,000	5	80,907	Jan. '09	0.12
Oseola, c.	96,150	25	1,383,036	Dec. '13	0.02
Parrot, c.	229,850	10	11,891,225	Oct. '13	2.00
Pearl Con., g.	1,909,711	0.05	7,255,750	May '13	0.15
Pharmacist, g.	1,500,000	1	181,422	Dec. '10	0.02
Pioneer, g.	5,000,000	1	87,500	Feb. '10	0.001
Pittsburgh-Idaho, l.	803,000	1	4,041,526	Oct. '11	0.03
Pittsburgh Silver Peak, g.	2,790,000	1	216,810	Oct. '12	0.04
Portland, g.	3,000,000	1	667,600	Sept. '13	0.02
Quilp, g.	1,500,000	1	9,337,080	Aug. '13	0.02
Quincy, c.	110,000	25	67,500	Feb. '13	0.01
Republic, g.	1,000,000	1	110,000	Sept. '13	1.25
Rochester, l.z.	4,900	100	85,000	Dec. '10	0.01
Round Mountain, g.	866,426	1	188,396	Dec. '10	0.50
			363,365	Aug. '13	0.04

Mining Companies—United States—(Continued)

Name of Company and Situation	Shares		Dividends		
	Issued	Par	Total	Latest	Amt.
Seven Troughs Coal, g.	1,500,000	\$ 1	\$ 37,500	July '12	\$0.02
St. Joseph, l.	1,000,000	10	8,960,357	Sept. '13	0.10
Shannon, c.	300,000	10	750,000	Jan. '13	0.50
Shattuck-Arizona, c.	350,000	10	1,575,000	Oct. '13	0.50
Silver King Coal, l.s.	1,250,000	5	2,159,885	Apr. '13	0.15
Sioux Con., s.l.g.	745,389	1	872,097	July '11	0.04
Skidoo, g.	1,000,000	5	275,000	May '12	0.02
Smuggler, l.s.z.	1,000,000	1	2,235,000	Nov. '06	0.03
Snowstun, e.g.	1,500,000	1	1,192,103	Oct. '13	0.02
South Eureka, g.	299,981	1	366,881	Apr. '12	0.07
Standard Con., g.s.	178,394	10	5,229,809	Jan. '12	0.10
Stratton's Ind., g.	1,000,000	0.60	486,000	May '13	0.06
Success, z.	1,500,000	1	925,000	May '13	0.02
Superior & Pitts., c.	1,499,793	10	5,369,262	Sept. '13	0.38
Tamarack, c.	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	200,000	25	3,631,520	Sept. '13	0.75
Tomboy, g.s.	300,000	4.85	3,069,090	June '13	0.48
Tomboy, g.	909,555	1	1,537,012	Oct. '13	0.06
Tonopah Belm't, s.g.	1,500,000	1	5,093,000	Oct. '13	0.25
Tonopah Exp., g.s.	943,433	1	424,529	Oct. '13	0.05
Tonopah of Nev., s.g.	1,000,000	1	11,100,000	Sept. '13	0.25
Tri-Mountain, c.	800,000	25	1,250,000	Dec. '12	3.00
Tuolumne, c.	500,000	1	520,000	May '13	0.10
Uncle Sam, g.s.l.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	1,000,000	1	120,000	July '13	0.01
United (Crip. Ck.) g.	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	23,000	10	1,530,000	Oct. '13	7.50
Utah, s.l.	300,000	10	32,797,000	Oct. '13	0.75
Utah, s.l.	100,000	10	325,000	Dec. '10	0.02
Utah, c.	1,562,599	10	19,803,111	Sept. '13	0.75
Utah Con., c.	300,000	5	7,950,000	Oct. '13	0.50
Valley View, g.	1,000,000	1	240,000	Dec. '10	0.04
Victoria, g.s.l.	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	1,500,000	1	2,767,000	Oct. '13	0.03
Wasp No. 2, g.	500,000	1	436,965	Oct. '13	0.02
Wellington Mines, g.	10,000,000	1	260,000	July '13	0.001
Wolverine, c.	60,000	25	7,940,000	Apr. '13	5.00
Work, g.	1,500,000	1	172,500	July '08	0.001
Yak, s.l.	1,000,000	1	1,727,655	July '13	0.02
Yankee Con., g.s.	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	100,000	10	1,171,789	Oct. '13	0.05
Yellow Pine, l.z.s.	950,000	1	304,008	Oct. '13	0.02
Yukon Gold, g.	3,500,000	5	5,250,000	Sept. '13	0.07

Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,876	\$100	\$78,968,110	Aug. '13	\$1.50
Am. Sm. & Ref. com.	S.	500,000	100	24,833,333	Sept. '13	1.00
Am. Sm. & Ref. pf.	C. S.	500,000	100	45,481,333	Sept. '13	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	8,130,000	Oct. '13	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	12,357,000	Oct. '13	1.25
Cambria Steel.	Penn.	900,000	50	17,897,500	Aug. '13	0.62
Greene Cananea.	U. S.	2,471,314	25	2,426,877	Mar. '13	0.25
Guggenheim Expl.	U. S.	831,732	25	17,601,047	Oct. '13	0.62
Inter'l Nickel, com.	U. S.	115,826	100	10,089,316	Sept. '13	3.00
Inter'l Nickel, pf.	U. S.	89,126	100	4,140,503	Aug. '13	1.50
Inter'l Sm. & Ref.	U. S.	100,000	100	3,300,000	Aug. '13	2.00
National Lead, com.	N. Y.	206,554	100	7,540,308	Sept. '13	0.75
National Lead, pf.	N. Y.	243,676	100	27,560,940	Sept. '13	1.75
Old Dominion, c.	Ariz.	293,245	25	4,682,700	Oct. '13	1.25
Phelps, Dodge & Co.	U. S.	450,000	100	28,309,304	Sept. '13	4.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	194,403,851	Sept. '13	1.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	338,768,739	Aug. '13	1.75
U. S. S., R. & M., com.	U.S.-Mex.	486,320	50	5,572,183	Oct. '13	0.75
U. S. S., R. & M., pf.	U.S.-Mex.	351,105	50	12,965,225	Oct. '13	0.87</

Assessments

Company	Delinq.	Sale	Amt.
Alameda, Ida.	Oct. 21	Nov. 20	0.0015
Atlantic, Ida.	Nov. 3	Dec. 2	0.0005
Beaver Copper, Utah.	Nov. 12	Dec. 2	0.005
Bismarck, S. D.			0.01
Carbonate, Ida.	Nov. 3	Nov. 22	0.001
Cedar Extension, Utah.	Oct. 30	Nov. 17	0.005
Dennemora, Ida.	Oct. 20	Nov. 20	0.0005
Empire, Ida.	Oct. 20	Nov. 20	0.0025
Globe Cons., Utah.	Nov. 6	Nov. 28	0.001
Gold Bond, Utah.	Nov. 10	Nov. 24	0.001
Lead-Bullion, Utah.	Nov. 5	Nov. 26	0.004
Lehl Tintile, Utah.	Nov. 5	Nov. 29	0.0025
Lewis & Clark, Ida.	Oct. 15	Nov. 18	0.0075
Little North Fork, Ida.	Oct. 8	Dec. 1	0.001
Mountain Queen, Ida.	Oct. 17	Nov. 17	0.0005
North Star, Ida.	Nov. 10	Nov. 29	0.001
Orlolo, Wash.			0.002
Payson-Eldorado, Utah.	Oct. 31	Nov. 21	0.0005
Rarus, Utah.	Nov. 8	Nov. 24	0.001
Revenue Cons., Utah.	Oct. 29	Nov. 19	0.005
Rhode Island, Ida.	Sept. 26	Nov. 28	0.0005
Rochester, Utah.	Nov. 7	Nov. 29	0.0025
Sunset, Nev. (postpon'd)		Nov. 17	
Tonopah, Gypsy Queen.	Oct. 20	Nov. 24	0.01
Utah United, Utah.	Oct. 1	Oct. 30	0.01

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.890	60.361	24.583	28.038	27.825
June	53.043	61.290	58.990	24.486	28.215	27.199
July	52.630	60.654	58.721	24.286	27.919	27.074
August	52.171	61.606	59.293	24.082	28.375	27.335
September	52.440	63.078	60.640	24.209	29.088	27.986
October	53.340	63.471	60.793	24.594	29.299	28.083
November	55.719	62.792		25.649	29.012	
December	54.905	63.365		25.349	29.320	
Year	53.304	60.835		24.592	28.042	

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		1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.031	15.436	16.245	15.738	72.352	68.807
June	17.234	14.672	17.443	14.871	78.259	67.140
July	17.190	14.190	17.353	14.563	76.636	64.166
August	17.498	15.400	17.644	15.904	78.670	69.200
September	17.508	16.328	17.698	16.799	78.762	73.125
October	17.314	16.337	17.661	16.913	76.389	73.383
November	17.326		17.617		76.890	
December	17.376		17.600		75.516	
Year	16.341		16.560		72.942	

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

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	42.962	48.766	195.036	220.140
March	42.577	46.832	192.619	213.615
April	43.923	49.115	200.513	224.159
May	46.063	49.038	208.830	224.143
June	45.815	44.820	205.863	207.208
July	44.519	40.260	202.446	183.511
August	45.857	41.582	208.351	188.731
September	49.135	42.410	223.762	193.074
October	50.077	40.462	228.353	184.837
November	49.891		227.619	
December	49.815		226.875	
Av. year	46.096		209.322	

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

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	4.381	4.118	4.242	16.331	17.597
May	4.194	4.342	4.072	4.226	16.509	18.923
June	4.392	4.325	4.321	4.190	17.588	20.226
July	4.720	4.353	4.603	4.223	18.544	20.038
August	4.569	4.624	4.452	4.550	19.655	20.406
September	5.048	4.698	4.924	4.579	22.292	20.648
October	5.071	4.402	4.894	4.253	20.630	20.302
November	4.615		4.463		18.193	
December	4.303		4.152		18.069	
Year	4.471		4.360		17.929	

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

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6.483	5.491	25.644	25.313
May	6.679	5.406	6.529	5.256	25.790	24.583
June	6.877	5.124	6.727	4.974	25.763	22.143
July	7.116	5.278	6.966	5.128	26.174	20.592
August	7.028	5.658	6.878	5.508	26.443	20.706
September	7.454	5.694	7.313	5.544	27.048	21.148
October	7.426	5.340	7.276	5.188	27.543	20.614
November	7.371		7.221		26.804	
December	7.162		7.081		26.494	
Year	6.943		6.799		26.421	

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

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	\$15.12	\$18.15	\$13.32	\$17.35	\$14.00	\$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	17.90	13.90	16.71	14.15	16.40
May	15.14	17.68	13.90	15.80	14.12	15.40
June	15.15	17.14	14.11	15.40	14.22	15.10
July	15.15	16.31	14.38	15.13	14.38	14.74
August	15.43	16.63	14.90	15.00	14.85	14.88
September	16.86	16.65	16.03	15.04	15.63	14.93
October	17.10	16.60	17.18	14.61	17.22	14.80
November	18.07		17.09		18.00	
December	18.15		17.45		18.73	
Year	\$16.01		\$14.93		\$15.28	

STOCK QUOTATIONS

COLO. SPRINGS Nov. 11		SALT LAKE Nov. 11	
Name of Comp.	Bld.	Name of Comp.	Bld.
Acala	.03	Beek Tunnel	.03
Cripple Cr'k Con.	.01	Black Jack	.08
C. K. & N.	.08	Cedar Tailman	.00
Doctor Jack Pot.	.06	Colorado Mining	.09
Elkton Con.	.54	Columbus Con.	1.01
El Paso	2.90	Crown Point	.00
Flndlay	.02	Daly-Judge	5.00
Gold Dollar	.07	Grand Central	.50
Gold Sovereign	.02	Iron Blossom	1.12
Isabella	.09	Little Bell	1.10
Jack Pot.	.04	Lower Mammoth	.00
Jennie Sample	.04	Mason Valley	3.75
Jerry Johnson	.03	May Day	.04
Lexington	.003	Nevada Hills	.55
Moon Anchor	1.006	New York	.24
Old Gold	.01	Prince Con.	.24
Mary McKinney	.55	Silver King Coal'n.	3.50
Pharmacist	.01	Sloux Con.	.01
Portland	.96	Uncle Sam	1.03
Vindicator	.80	Yankee	.07

TORONTO Nov. 11

Name of Comp.	Bld.	Name of Comp.	Bld.
Bailey	.07	Foley O'Brien	.16
Coniagas	7.15	Hollinger	18.00
T. & Hudson Bay	170.00	Imperial	1.02
Timiskaming	.12	Jupiter	.08
Wettlaufer-Lor.	.07	Pearl Lake	.11
Apex	1.01	Porcu. Gold	.10
Big Dome	9.75	Preston E. D.	.03
Crown Chartered.	1.00	Rea	.10
Doble	1.10	Swastika	.03
Dome Exten.	.05	West Dome	.05

SAN FRANCISCO

Nov. 11

Name of Comp.	Bld.	Name of Comp.	Bld.
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.08	Belmont	7.00
Belcher	.34	MacNamara	.10
Best & Belcher	.06	Midway	.38
Caledonia	1.70	Mont-Tonopah	1.00
Challenge Con.	.11	North Star	.41
Chollar	.04	West End Con.	1.22
Confidence	.42	Atlanta	.10
Con. Virginia	.15	Booth	.02
Crown Point	.29	C.O.D. Con.	.03
Gould & Curry	.03	Comb. Frac.	.03
Hale & Norcross	.09	Jumbo Extension	.08
Mexican	1.40	Occidental	.70
Occidental	.70	Ophir	.24
Ophir	.24	Overman	.38
Overman	.38	Potosi	.03
Potosi	.03	Savage	.13
Savage	.13	Sierra Nevada	.11
Sierra Nevada	.11	Union Con.	.19
Union Con.	.19	Yellow Jacket	.36
Yellow Jacket	.36		

N. Y. EXCH. Nov. 11

Name of Comp.	Clg.
Amalgamated	69 1/2
Am. Agri. Chem.	42
Am.Sm.&Ref.,com.	61 1/2
Am. Sm. & Ref., pf.	99 1/2
Am. Sm. Sec., pf. B	81
Anaconda	33 1/2
Batopilas Min.	11
Bethlehem Steel, pf.	70
Chino	37 1/2
Federal M. & S., pf.	37
GreatNor.,ore.,ctf.	31
Guggen. Exp.	44 1/2
Honestake	108
Inspiration Con.	14 1/2
Miami Copper	22
Nat'l Lead, com.	42 1/2
National Lead, pf.	101 1/2
Nev. Consol.	14 1/2
Phelps Dodge	188
Pittsburg Coal, pf.	88
Quicksilver, pf.	3
Ray Con.	18
Republic I&S,com.	18 1/2
Republic I&S, pf.	78
Sloss-Sheffield,com.	26
Sloss-Sheffield, pf.	86
Tennessee Copper	28 1/2
Utah Copper	48 1/2
U. S. Steel, com.	54 1/2
U. S. Steel, pf.	105
Va.Car.Chem.,pf.	93

BOSTON EXCH Nov. 11

Name of Comp.	Clg.
Adventure	1 1/2
Ahmeek	273
Alaska Gold M.	20 1/2
Algoma	1
Allouez	33 1/2
Am. Zinc	17 1/2
Ariz. Com., cts	4 1/2
Bonanza	39
Boston & Corbin	60
Butte & Balak	4 1/2
Calumet & Ariz.	62
Calumet & Hecla	405
Centennial	121
Chif.	1
Copper Range	36 1/2
Daly West	21
East Butte	10 1/2
Franklin	3
Granby	68 1/2
Hancock	14 1/2
Hedley Gold	30
Idaho	30
Indiana	3
Island Cr'k, com.	47 1/2
Island Cr'k, pf.	82
Isole Royale	17
Keweenaw	2 1/2
Lake	7
La Salle	3 1/2
Mass.	2 1/2
Michigan	1
Mohawk	40 1/2
New Arcadian	1 1/2
New Idria Quick	2 1/2
North Butte	23
North Lake	1
Ojibway	50
Old Dominion	47
Osceola	73 1/2
Quincy	55
Shannon	61
Shattuck-Ariz.	26
Superior	21 1/2
Superior & Bost.	21
Tamarack	27
Trinity	