The Engineering and Mining Journal

VOLUME 97 APRIL 25, 1914 NUMBER 17

Mesabi Company Location

By Lee L. Wilcox*

SYNOPSIS—Description of houses built by the Republic Iron & Steel Co. for employees at its various Mesabi mines. The houses are of the same general type, but vary in size and in details. Warmth is important. Houses rented to employees and their coöperation enlisted toward making grounds and surroundings attractive.

Almost all of the mining companies on the Mesabi iron range furnish houses for at least some of their employees. A part of the company's property or its holding is reserved for these houses and is known as a "location." Light is usually provided and some sort of water system installed. The number of employees thus provided for varies with the different companies and the different mines. Sometimes merely the more highly paid men are furnished houses but not infrequently everyone, including the men underground, can have a home if they desire.

The Republic Iron & Steel Co. has five locations at its various properties on the range. Including boarding houses, it has a total of 71 dwellings. These buildings are located on lots varying in size from 50x125 ft. to 75x140 ft., depending on the amount of ground available. The lots are leveled, a lawn is planted and suitable sidewalks and fences are built by the company after which the employees are expected to keep their places in good condition. The streets and alleys are cared for and all refuse is removed by the company. Water is piped into the houses in the three most recently built locations and at the other two, which are at old and nearly exhausted mines, it is provided at easily accessible places.

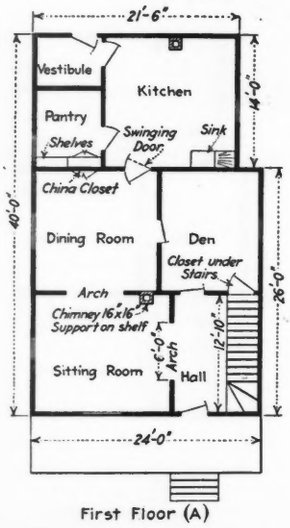
Without exception, the employees show a hearty desire to coöperate with the company in beautifying the lots; many of them have planted shrubbery of various kinds suitable to the climate, flower gardens, vines, etc. Most of the employees also maintain small kitchen gardens at the back of their lots, raising about all the common small vegetables for summer use and not a few for winter use.

Community gardens are being developed, one at the Pettit and Schley mines was started in 1912; and one at the Franklin in 1913. Others are being planned and by next spring at least four should be in operation. For these the company furnishes, clears and fences the ground and prepares it for planting. The employees do their own planting, care for it during the summer and do their own harvesting. Potatoes have been the principal crop, although cabbages and other vegetables have been raised. The employees have welcomed this feature

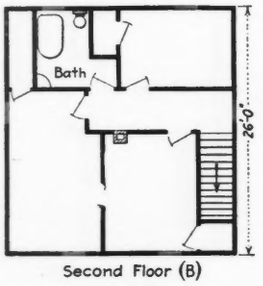
Typical Kitchen Garden—Corn, Peas, Beans, Lettuce and Tomatoes

Front Yard of a Cottage, Showing Lawn and Flowers

*Chief engineer, Republic Iron & Steel Co., Gilbert, Minn.

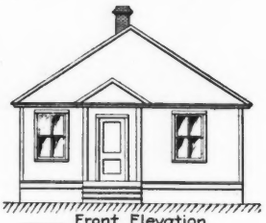


First Floor (A)

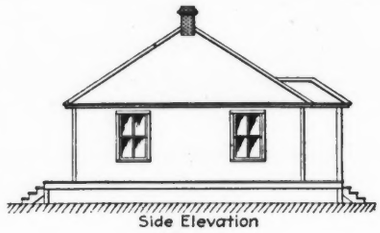


Second Floor (B)

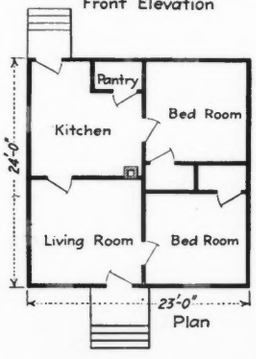
THE SEVEN-ROOM HOUSE (A. B. C. D.)



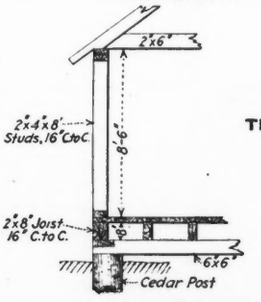
Front Elevation



Side Elevation

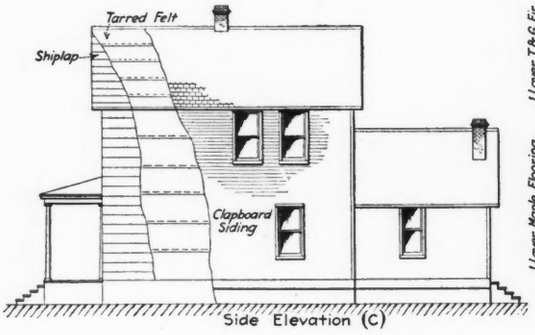


Plan

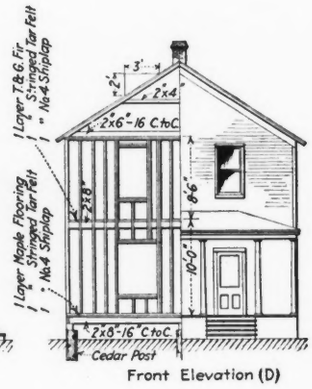


Section Enlarged

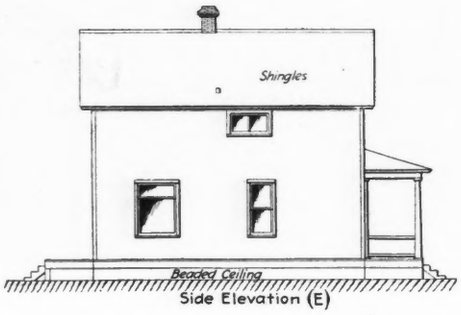
THE FOUR-ROOM COTTAGE



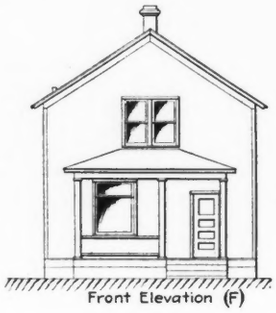
Side Elevation (C)



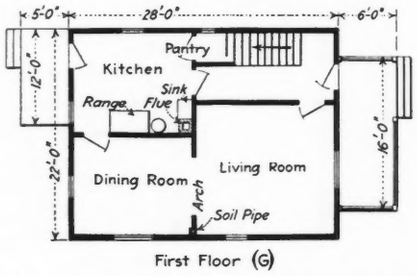
Front Elevation (D)



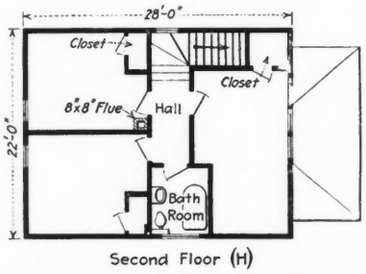
Side Elevation (E)



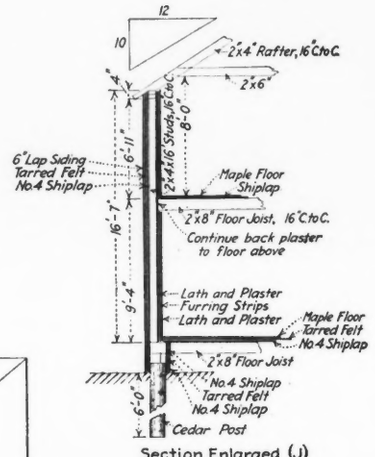
Front Elevation (F)



First Floor (G)



Second Floor (H)



Section Enlarged (J)

THE BRAY AND KINNEY SIX-ROOM HOUSE (E. F. G. H. J.)

PLANS AND ELEVATIONS OF TYPICAL EMPLOYEE'S HOUSES ERECTED BY THE REPUBLIC CO. ON THE MESABI.

Eng. & Min. Journal

of location life, as it helps materially in reducing the cost of living. It is considered of value also as tending to make the location more attractive.

At the Schley location, built during the fall and winter of 1909 and 1910, four different types of houses were constructed; a seven-room with bath, a six-room, a four-room cottage and an eight-room house for two families. These houses were planned with the idea of giving the occupants a comfortable home. The seven-room house is 24x26 ft. with 18-ft. studding, and a kitchen and pantry on the back 14x22 ft. It is finished with hardwood floors, yellow-pine trim downstairs and painted white pine upstairs. The six-room house is 20x26 ft., with 14-ft. studding, finished with white pine throughout. The cottages and eight-room houses are 22x24 ft. with 10- and 18-ft. studding, respectively, finished with pine throughout. The houses are electric lighted and supplied with water in every case. No cellars are excavated. The foundation consists of cedar posts sheathed in.

The accompanying plans show the four-room cottage, the seven-room house and the latest type of six-room house. The photographs indicate the unfavorable surroundings in which the locations must be placed and the success of the householders in making their dwellings attractive.

THE SCHLEY LOCATION AT GILBERT, SHOWING TYPICAL HOUSES, YARDS AND STREETS

They rent at from $5 to $10 per month, electric light is furnished at 6c. per kw.-hr., and water at $1 per month. The costs were $650 for the cottages, $1000 for the six-room and $2100 for the seven-room.

When the Kinney and Bray locations were built in 1912, it was decided to use only the six-room house, it being the one which gave the most satisfaction, and which seemed to fill the needs of the employees most fully. A new type was planned, including a bath. These houses were built on "company account" and every effort was made to have them warm and comfortable. Back plastering was employed throughout; the foundation posts were sheeted on both sides; and the entire exterior was covered with tarred felt, under the clapboards and shingles. Inside they were finished with hardwood floors throughout; they are electric lighted, painted and kalsomined. Thus far they have given excellent satisfaction.

The Recovery of Fine Gold and Black Sand

BY CARNEY HARTLEY*

The subject of fine-gold and black-sand recovery is so closely associated in practice with a certain form of placer deposits, as to make a separation of the subject itself somewhat difficult. The real problem involved is to recover black sand and fine gold from shallow placers which must be worked with machinery of moderate and small capacity and which demand the same high recovery and general economy of a low-grade lode property. Dredging losses, of today at least, are too small in actual amount to be probable material for further profit. Hydraulic tailings, however, should be profitable, especially in localities where black sand carries good value, if taken directly from the tail of the sluice.

The few attempts to develop equipment for this purpose have been principally valuable in eliminating the unsuitable and proving that there is a problem to be solved. The mining engineer has not generally grasped this fact as its solution is rather one of means, a problem for the mechanical man, and the latter is not usually in a position to appreciate the need. In the attempts which have been made, we find two mistakes usually responsible for failure; lack of knowledge of the mechanical require-

*Colorado Building, Denver, Colo.

ments, and lack of knowledge of the metallurgical requirements. An instance of the latter was the installing of an effective amalgamator to recover metal more than half of which could not by any practical means be made to amalgamate. The former is usually shown by the installation of cheap and ineffective equipment.

During the last few years a better realization of what is needed has come and a new set of ideas developed, while naturally there has followed an entirely new crop of machines. The reasoning which gave this result was along the line of ore milling rather than the old placer methods and, briefly, is concentration following sizing or classification. A different set of conditions, however, has made it necessary to develop machinery for this particular service. Comparatively low values demand capacity as the prime factor in low cost of doing the work, while economic and surface conditions usually make portable equipment necessary, in itself a limiting condition.

Considering the recovery end only, two general methods have been successfully tried. Screens as an obvious means of changing quantity to quality have naturally been used and with some success. They are, however, open to several objections. The fineness of the total product is limited by the size of the largest value, while the large area demanded by capacity is frequently an objection. With a fixed plant and screening in stages with water, there are many properties of such character that they may be successfully handled by this method. In one instance which came to my notice, a product of 30-mesh screen carried all the value and was about 25% of the original quantity. Preliminary screening to ¼ in. and finer, followed by further reduction in a wide sluice, have been tried with success. The sluice is fitted with shallow riffles, and has no more pitch and uses no more water than is necessary to move the material. Protected fine screens in the bottom take off the fine, valuable material, while the coarse is easily caught by the riffles. An improvement suggested by the writer, consisting of a false bottom of finely perforated plate, was satisfactory on a limited trial.

The most encouraging method of doing this work, especially in portable plants is by means of classifiers, of which two general types have been tried with encouraging results. One of these works like the old Cornish buddle, a reciprocating conveyor gently agitating the material and sweeping off the surface from a long, narrow tank, deeper at one end than the other. The resulting product consists of the fine sand and valuable material which gradually works to the bottom, whence it is drawn off for shipment or further treatment.

The screw-conveyor form of classifier does the same work and, if properly designed, will do it better and with greater capacity. The action is better and the separation of the coarse and fine material is rapid and complete. The advantages of machines of this type are large capacity, small power requirement, no loss of height, and the use of a limited amount of water. They adapt themselves nicely to usual conditions and to the design of portable equipment. Their use follows also the best practice as developed by ore milling and, while they have as yet only had a limited trial, we may reasonably expect much better results than from anything else so far tried.

Unless conditions are extremely favorable, it is necessary to concentrate further the enriched product from the above machines, this corresponding to fine concentration in ore milling. A general mistake has been made in attempting to get this final product at one operation, merely taking out the large boulders. This is illustrated in the continued use of sluices and large quantities of water to handle everything from 6-in. diameter down, an inconsistent proposition and one of proved inefficiency.

Here, again, we have met the need of special equipment. Numerous trials have proved conclusively that the moving concentrators will not handle placer material satisfactorily. The experiments of the Geological Survey at the Yukon Exposition gave this result, and the value of their work was largely in diverting effort into new directions. There are, however, successful concentrators for this purpose, their most general fault being lack of general application as a result of development on one property. Nevertheless, the writer has used one of these successfully on a wide range of material with uniform success from all essential standpoints. This machine recovers a high percentage of the free gold and valuable black sand, as well as any amalgam, even if in the floured state, and requires about the same amount of water as an ordinary shaking table.

In the matter of investment and costs, little data are available that would be of use. Local conditions are too closely involved and the machinery is in a too primitive state. Investment will not vary greatly from that of dredging in proportion to capacity, while costs will naturally be greater. A general mining depression and lack of pronounced success has held back the development of this work, but there has been all the time the usual quiet work, just beginning to show up and to exert its influence in diverting the general effort into more modern channels.

Lake Superior Drilling Costs

The accompanying table, compiled from the report for 1913, of the Naumkeag Copper Co., contains some interesting figures as to diamond-drilling costs in the Michigan copper district. Under the immediate supervision of Supt. S. S. Lang, the Cole & McDonald Exploration Co., of Virginia, Minn., which has the contract for this work, drilled 11 holes having a total footage of 13,913 ft. The individual holes ranged from 707 to 1627 ft. in depth, and total cost of drilling was $32,109. The highest cost per foot was $2.805 in hole *F*, the lowest $2.069 in hole *D*, the average for the 11 holes being $2.301.

Those familiar with drilling costs in this district will recognize at once that this figure is below the average cost of $2.50 for the first 1000 ft. It should be remembered, too, that this figure is the cost to the Naumkeag Copper Co., and includes all overhead charges. The contractor's cost must necessarily have been still lower.

The Cole & McDonald Exploration Co. used two Sullivan diamond drills with "A" rods, having an outside diameter of 1⅝ in., and giving a 1-in. core. The officials of the copper company report that the drill work was entirely creditable in every way and that unusually long and strong cores were obtained.

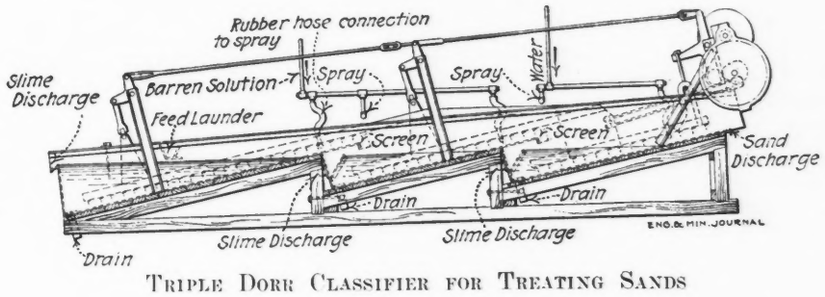
Hole	Depth	Total Cost	Cost per Ft.
A	1401	$3221.11	$2.299
B	1378	3102.03	2.251
C	1423	3194.06	2.244
D	1067	2207.76	2.069
E	1181	2747.62	2.326
F	1170	3281.94	2.805
G	1584	3847.00	2.428
H	1627	3742.32	2.300
J	1162	2513.13	2.162
K	707	1570.15	2.220
L	1213	2682.09	2.211
Average			2.301

Ore Classification for Cyanidation

By Herbert A. Megraw

SYNOPSIS—Classification is an important detail of the cyanide process, as it is depended upon to select proper material for certain kinds of treatment. Hydraulic, mechanical and screen classification are practiced, and these, though essentially different, are similar in some details. Cones are familiar devices, but are faulty in requiring too close attention. The mechanical devices are most popular now, although screens are valuable and would be more used if they were not so costly to operate.

One of the steps in the cyanide treatment of ores has received an extremely small amount of study as compared with the process in general. The step referred to is the classification of material. Classification really forms an important step in ore treatment, and proper arrangement for it will not only result in greater convenience, but may materially improve extractions. The whole reason for classification is that material of different kinds requires different treatment. To secure maximum satisfaction in results, each class of material must receive that kind and amount of treatment which is calculated to extract the greatest amount of its contained metal at the lowest possible cost. For greatest extraction, the ore particles must be crushed fine enough, but for cost considerations, not one atom finer than absolutely necessary. Cost considerations also require that work which is most economically done by one machine, must by no chance be done by any other. To insure these conditions of efficiency, classification is required.



Triple Dorr Classifier for Treating Sands

Classification at the Grizzly

The classification of ores, at least as far as the mill is concerned, begins at the grizzly, where all material which is so small that the crusher cannot do any further economical work on it, is bypassed to the next machine which can attack it economically. The classification here is based on size, a basis which is practically carried through all parts of the mill, although some modifications are made in special cases, and more should be.

The bypassing of grizzly undersize is typical of the classification of material in order to subject it to subdivision in the proper machines. There exists, naturally, in the general run of ore, a large quantity of material already smaller than the product of the crusher. If this were allowed to go to the machine, it would tend to clog it and require it to break these small pieces still smaller, forcing upon the crusher more work than it ought to do, and expending extra power on work that it is not fitted to do cheaply.

Classification by means of the grizzly is purely a classification of size; character or value, having nothing whatever to do with it. Most mill classification is based on the size of pieces or particles, although it is often true that one process involves automatically a segregation of material of a certain character in one locality. When classification is designed primarily to collect in one class material which contains certain minerals and in another those which do not contain them, the process is called concentration. It is usually designed to separate that portion of the mineral which is richest in the desired metal, and either regard it as the final product of the mill or subject it to further treatment. In cyaniding mills, it is often a prime object of concentration to remove minerals or materials which might be detrimental to subsequent treatment or which is more difficult to beneficiate and will not give up its contents under the same treatment as the rest of the ore. It is thus easily seen that concentration is merely a form of classification. Arbitrarily, we may say that concentration is a separation based on quality, while classification is a separation based on size. As will be seen, however, the two overlap at times, and instances are not lacking of classification systems which concentrate materials of certain characteristics into one class.

Classifying the Stamp-Mill Product

Any primary crushing machine delivers a product which is not uniform in character, consisting of varying quantities of every size from minus 200-mesh up to the maximum size of the screen opening. This is true of stamps, rolls, chilean mills and all other machines used for the purpose. Usually these primary crushing machines do not deliver a product the maximum size of which is small enough for treatment purposes. The portion which is too large must evidently be reground, and it is just as evident that the part already small enough should not have any more money spent upon it in reducing it to a smaller size. Classification must then be resorted to, and the coarse material sent to the proper machine for finishing the process, usually tube mills.

To make this separation, many methods are in practical use. Up to comparatively a few years ago hydraulic or screen classifications were the rule, the preponderance of opinion being in favor of the hydraulic systems. This was on account of their cheaper operation, it being admitted that results were not as accurate as could be produced by screens.

Hydraulic Classifiers

Many forms of hydraulic separating devices have been in use in milling operations for many years. All of them,

This is the ninth of a second series of articles by Mr. Megraw. It deals with the comparative details of cyanide practice, discussing points of possible improvement. Preceding articles of this series appeared in the issues of Sept. 6, Oct. 4, Nov. 1, Nov. 15, Dec. 20, Jan. 31, Mar. 7 and Mar. 21. The next article will deal with "Filtering Slimes in Cyanidation," and will appear in the issue of May 23, 1914.

however, are based on the cone, and most of them are essentially cones in form, although there are variations and combinations of many kinds.

The hydraulic cone is designed to separate two or more classes of pulp by taking advantage of the varied rate of settling of the pulp in a water column. Materials of different weight, and consequently usually of different size, are separated, making products which are more or less uniform, when a mixed pulp is introduced into a vessel containing clear water, the heaviest and largest pieces will settle at the highest rate, followed by particles of less and less weight, the final result of the settling being successive beds of classified material. The heaviest material, settling most rapidly, forms a bed of this class upon the bottom of the vessel. Immediately following it is a bed of the next size, and so on, until the top bed consists of the very finest slime, which takes a long time to settle. The lines of differentiation between the beds of material of different size are not sharp, but grade off, one into another, so that the bed is really a gradually diminishing one in sizes, from coarse to fine, without any sharp differentiation between the beds of different sized particles.

An examination of the settled bed will show that, according to the general rule, the heaviest pieces are the largest and *vice versa*. This settlement, however, is subject to some modification, because it is evident that of two pieces of exactly the same volume, the one having the highest specific gravity will settle through water quicker. Consequently, it will be seen that one particle of crushed ore may be smaller than another, but may have a higher specific gravity, so that in classifying with a water column, it will take its place with larger pieces of less specific gravity. It may be seen, then, that hydraulic classification will produce a separation based on weight of particles, rather than their size. Depending upon the objects of the classification, this may be more or less satisfactory.

Basis of Hydraulic Classification

Hydraulic classification is based on so regulating the flow rate of a pulp stream that particles of a given weight will settle while all particles of less than that weight will be carried on by the pulp stream. The object is usually accomplished by allowing the mixed pulp to flow into a vessel, arranging a bottom discharge to remove the settled oversize, and allowing the undersize to overflow from the top of the vessel. The most common vessel for classification of this kind is the cone, in which the settled oversize is discharged through an opening in the vertex of the cone, which is installed inverted, and the undersize overflows the entire periphery at the top. The cone shape has been adopted on account of its obvious advantages, among which are the continuously decreasing diameter, suited to the reduced amount of material, and increasing the speed of settling. It also presents a smooth, inclined surface to the descending material, free from obstructions and offering no opportunity for settling and consequent blocking. The top of the cone has a periphery of great extent compared with its other dimensions and the whole of it may be used for overflow by placing an appropriate launder directly below it. By this means, the rate of flow at any point is reduced, avoiding the carrying over of material which should be allowed to settle.

Specific Gravity and Size

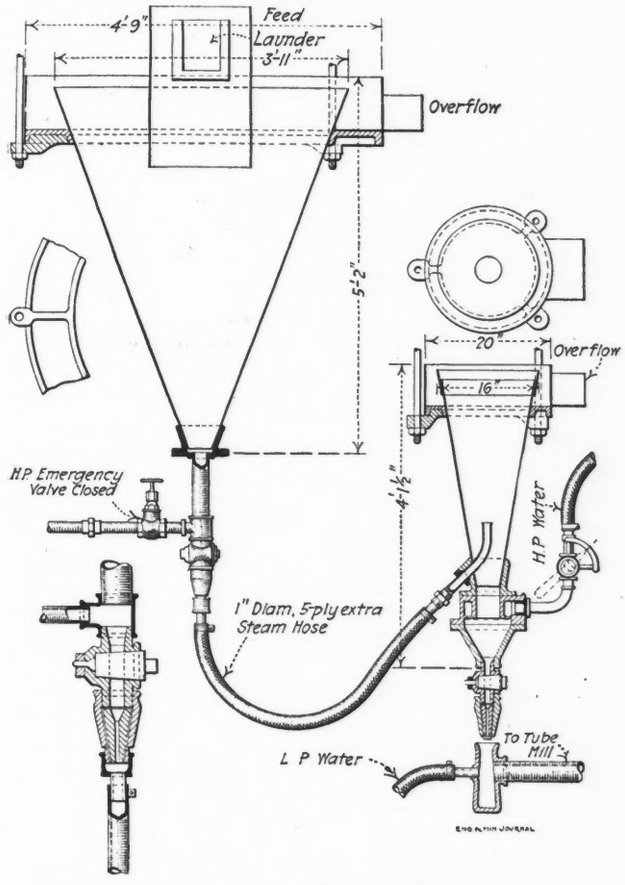
An examination of the physics of cone separation will show that, as with all hydraulic-classifying processes, it gives a product based rather on specific gravity than on actual size, but as a matter of practical fact the separation will be very nearly the same as if it were made in a way depending entirely upon the size of the particle. As has been already stated, and as will be understood by all operators, it is the object in almost any system of metallurgy to produce a pulp each particle of which will be crushed to exactly that size required to allow it to render its value most efficiently, and that it shall be crushed no farther than that point. In other words, the endeavor is to produce a pulp in which the particles are as nearly the same size as possible. It is not essential to the point of this discussion to determine whether these uniform particles are required to be large or small, so long as it is understood that uniformity is desired. It is, of course, not within the bounds of possibility to produce a pulp the particles of which are entirely uniform, but the effort is to get as near that point as possible. Therefore, when the question of hydraulic classification is considered, it will be seen that having the particles nearly the same size, the separation will be due largely to specific gravity. In other words, hydraulic classification would amount to practical concentration.

In considering the matter of the difference of size of particles, it must be borne in mind that material of high specific gravity, such as sulphide, which is most commonly encountered in commercial ore, is more friable than the less valuable portions which consist of rock matter of different kinds. Sulphides are naturally, in the course of crushing operations, reduced to a point much finer than the barren rock matter itself, and this difference of friability extends in more or less degree to the portions of the ore which contain more or less of the sulphide mineral. In such cases it may be seen that hydraulic classification will be likely to give a product consisting of material of various sizes. The barren material of large size will have more or less the same weight as rich material of smaller size having a higher specific gravity. Depending then upon the purposes for which the classification is attempted, hydraulic classification will be more or less valuable than some other system in which the separation is made more closely on a basis of size. For cyanidation, the classification of pulp issuing from the batteries must be almost absolutely on the basis of size, it having already been pointed out that part of the material is already sufficiently fine to give up its contained value, while another portion has not been sufficiently ground, and must receive suitable treatment to reduce it still more.

Cone Classifiers

On the mixed pulp, then, an attempt must be made to separate material above and below a certain size, which is the dividing point. The machines most usually used for this purpose are cones of different kinds, with or without a rising current of water. It may be said that the general practice at this stage of classification is to use simple cones without much, if any, rising water current. Such devices, particularly those having an exceptionally small outlet at the apex, are particularly difficult to operate, in that they require constant and continuous attention. My own experience has been that cones cannot

be successfully operated unless an operator is near at hand in order to correct any vagaries, and such vagaries will always be caused by a difference of rate of the flow into the cones, or a difference of the dilution of their feed. A cone whose outlet has been regulated to deliver material of a certain defined size, at the quantity and dilution of feed coming into it, will be altogether disturbed if such feed is changed by so little as 10%, or if its specific gravity is only slightly varied. The delivery from the opening in the cone apex can only be the same amount as when the cone was receiving the normal feed, so that if the feed is abnormally large, a portion of the material which should be delivered from the apex will rise and overflow, while if the feed be too small in quantity, the cone will tend to settle fine material or empty itself, the latter condition being one which will most certainly be



MERRILL GRAVITY AND CONCENTRATING CONES

reached if the diminished feed is continued for any great length of time.

In order to overcome some of the vagaries of ordinary cones, modifications have been proposed which tend to more or less correct their troubles. While it is true that not all cones have given extreme difficulty, they all require attention and are by no means certain in operation. Among the cones which may be mentioned as having avoided the more common difficulties, are the Caldecott and Callow designs, which are now so well known to metallurgists.

OTHER HYDRAULIC CLASSIFIERS

Cones by no means complete the list of hydraulic separating machines. There is a device known as the Merrill concentrating cone, which is really a kind of a spitzlutte and which is described by Clark and Sharwood.[1] A drawing of this device is given above. These cones are 4 ft. in diameter by 70° slope. They are provided with relatively small discharge bushings, and as they are heavily fed, their overflow carries nearly 88% of the tailings, including much fine sand and considerable coarse material, the latter, however, of low gold and sulphur content.

Attached to the holder of the bushing of each gravity cone and forming a tight joint with it as a hose connection, the other end of which is similarly attached to the feed-nozzle of a concentrating cone. This nozzle enters the side of the cone, through a stuffing-box, at a point near its apex, and discharges the sand in an ascending stream at the axis of the cone, while water at about 30-lb. pressure is introduced below the entry point of this pulp. These concentrating cones are 16 in. diameter by 80° slope.

The proportion of sand taken from the discharge of the concentrating cone is determined by the size of bushing, amount of classifying water used, and, more particularly, by the difference in elevation between the gravity and concentrating cone forming the unit. This system is steady in operation, requires little attention and few renewals other than the replacing of worn bushings. They are used for 90 days and are sometimes available for further use in another battery of cones.

Spitzkasten and spitzlutten are older forms of classifying machines, but in later years have not been considered altogether satisfactory. They are old standard devices and are not within the province of this present article, as they are fully explained in all the standard text-books on ore-dressing machinery. Suffice it to say that they do not fill the bill as separators of over- and undersize material when making a separation for the purpose of grinding.

SCREEN CLASSIFICATION

Sizing by screen has always been considered the most satisfactory system of this class of work. The great objection to screen sizing heretofore has been its high cost as compared with hydraulic separation. It is undoubted that screens, properly maintained and operated, will give a definite size separation, putting in one place the material over the desired size, and in another class all material under that size. The oversize material may go directly to regrinding systems, while the undersize is taken either directly to the agitation department for cyanide treatment, or to a system which classifies according to the character of the particles, such as concentration. An advantage of screen-sizing systems, particularly in large mills, is that the floor space is usually less than that required for hydraulic classification, since the latter requires considerable area for settling of the finer particles. There are many schemes now offered which will serve the purpose of separating over- from undersize material, and it is only a question of experiment to determine which is the best in particular instances. The efficiency, and consequent practicability, of screen sizing will depend largely upon the character of the ore handled. An ore in which the ground particles are largely in granular form will be much more easily handled by screens than will a finely ground product which consists largely of clay or colloid

[1] I. M. M., November, 1912.

particles. It is true that granular particles may tend more or less to wedge into the screen apertures and to stay there on account of the high friction developed, but it is even more disastrous to successful screening to have colloid particles stick in the apertures because these will bank up, one above another, and coalesce into a homogeneous, gummy mass which it is impossible to dislocate, even with streams of water under considerable head. The average screen, without shaking devices, is a hopeless alternative on colloid material of this kind, while if shaking or bumping devices are resorted to, the life of the screen is materially shortened. Particularly is this true of the finer grades of screens, where the wires forming the mesh are extremely fine and delicate, so that a high degree of abrasion or a great amount of jarring or vibrating so reduces the life of the screen that the process is economically impossible.

Mechanical Sizing

Mechanical sizing is a system which differs from the other two, which have already been mentioned, but is in reality a modification of hydraulic methods. The machine uses no screen, but depends upon the hydraulic separation of the material of different sizes, combined with a mechanical extraction or removal of the two classes of material. In this way it may be seen that the capacity of a machine of this kind depends upon the rate of flow of the pulp. The slower the flow of pulp, the greater is the chance for solids of smaller size to settle, while, with higher rate of flow, less material will be settled. Naturally, particles of the larger size, or those having the higher specific gravity, will settle first; therefore, in classifiers in which it is desired to remove only the coarser particles, the pulp will have a rather high rate of flow; while with machines intended to settle finer material, the rate of pulp flow will be slower.

There are several machines of the mechanical type now on the market. Probably, the best known of these are the Dorr, Akins, Ovoca, and the Esperanza drag classifiers. The Dorr classifier is a well known machine in which the settled oversize is removed from the settling chamber by means of a reciprocating rake, which moves the settled material up an inclined plane. In addition to the efficient moving of the oversize material, the Dorr classifier has the advantage of turning it over several times during the course of its travel up the incline, this movement being very efficient in washing out any slime which may have been held mechanically in the sand.

It is true that in many cases classification produces sands which will not repay the expense of further treatment. In the cyanide process, however, such sands contain solution which is valuable both for its dissolved metal value and for the cyanide it contains. Before throwing away such sands, it is necessary to recover the greatest possible amount of this solution. To do this cheaply and effectively, the tandem arrangement of Dorr classifier was designed. The accompanying drawing shows the construction of the machine. The pulp enters the first section in the usual manner, the slime overflowing. The sands are raked up the first incline and washed in the second compartment with barren solution through a screen. Emerging therefrom, a stream of water washes them into the final compartment. Further washing, with barren solution from spray pipes attached to the rakes, is done in the first two compartments, and with water as it emerges from the last, ready for the dump. This thorough washing causes the sand to be discharged practically free from gold and cyanide. The same machine can be used to remove the last traces of clayey material from a sand.

The Akins classifier utilizes identically the same principle, but removes the settled oversize material by means of a spiral screw, which moves the settled material up an incline. The spiral flight is interrupted at intervals so that there may be a more or less efficient turning over of the sand, with a resulting washing effect, such as is gained in the Dorr classifier. The Akins machine takes up somewhat less room than the Dorr to accomplish the same work, but it is not generally considered quite so efficient in delivering a clean sand. As far as power and expense of operation are concerned, there is probably very little to choose between them.

The Ovoca classifier is a device which has been invented by Philip Argall, of Denver, Colo. The machine is installed at Stratton's Independence mill, where it was first put into service, and at several other mills throughout the United States. The system is much like that of the Akins classifier, a spiral screw being used to elevate the oversize material. In the Ovoca classifier, the screw flight is not interrupted, but the cleaning of the oversize is more carefully done in the settling basin, and side launders are provided to return the slimes worked out in the ascent.

A classifier which attempts to perform the same work as the Dorr, and a machine more cheaply built and installed, is the Esperanza drag classifier. This machine simply duplicates the Dorr rake action by means of flat rake blades attached to a continuous chain belt, working over sprocket wheels, and dragging the oversize up an inclined plane, as in the Dorr classifier. In the Esperanza machine, the action is slow, steady and continuous, and while it rakes out the oversize in a satisfactory manner, it does not offer the same chance that is found in either of the other machines, and particularly in the Dorr, of turning over the sand so that the slime may be satisfactorily washed out of it.

The object of mechanical sizing, as with screen sizing, is to prepare the material for further treatment. In cyanide plants, with which this article is particularly concerned, mechanical classifiers, such as those which have just been mentioned, are used to separate slimes from sands, the slimes going directly to treatment systems by agitation, and the sands going either to leaching tanks, or to regrinding machines for further subdivision. A common feature in modern practice is to join the classifier and tube mill in one unit. For instance, the classifier is placed alongside a tube mill, and the oversize, or the coarse sand, is delivered to the intake of the tube mill directly. The tube mill is usually fitted with a large spiral-screw feeder arrangement so that the sand may enter the tube mill without further handling. The discharge of the tube mill leads directly to the classifier again. The material, which has been reground, passes the overflow as slimes, while the material which has not been sufficiently reground, joins the coarse, oversize product and is returned to the tube mill again. In this way a closed circuit is formed, by means of which only slime fine enough to overflow the classifier is delivered. This slime usually goes to the agitation-treatment plant, where it is treated with cyanide solution.

Quality Classification

Classification of a different kind, that based on the specific gravity of the pulp particles, is usually called concentration. By this means, those particles which have the highest specific gravity are separated from those of lower specific gravity. As the particles of high specific gravity contain more mineral, they are usually the richest. In addition to being the richest, that part is usually the most refractory, so that by one process the richest and most refractory part of an ore may be separated from the rest of it and removed from the treatment system. This plan has many advantages. It removes a rich section of the ore which may be then sold direct to smelting plants, and it also removes a rebellious element which may be difficult to handle in the regular cyanide circuit. Should it be considered inadvisable to ship this material to a smelter, it can be treated with cyanide by a special method in a specially designed small plant adapted to such work. This is a procedure which is becoming more and more frequent in modern practice.

Concentration is such a well known and specialized process, that it would be entirely without the province of this article to discuss it. However, it would not be out of reason to refer to the requirements for successful concentration. The process may be performed either before or after regrinding, as there are special machines for coarse and fine material. When one considers, however, that concentration depends altogether upon the difference in weight of these smaller particles in the ore pulp, the highest requirement is a sharp differentiation in the rate of settling, which presupposes a sharp differentiation in their relative weight. Clearly, then, if all of the particles were to be of the same size, the differentiation between the heavy and light particles would be the sharpest possible, that is to say, the differentiation between the particles containing large quantities of mineral and the particles containing little or no mineral, would be about as sharp as could be obtained by any known method. Therefore, it seems to follow reasonably that the most successful concentration is upon sized pulps, or a pulp containing particles of one size, or nearly one size, is fed to one machine, while particles of other sizes are fed to other machines, the feed to any one machine being as nearly uniform as it is possible to make it. To secure absolutely uniform size of particles, screens are the most essential machines, as has already been mentioned. There are those who oppose the theory of a sized pulp for concentration, and it is certain that other factors influence the result, such as the greater friction developed between sulphide particles and the concentrating surface, than between gangue and the surface. It does seem quite safe, however, to say that a sized pulp will give better results, since it does not oppose any of the conditions advantageous to concentration, but tends rather to emphasize them.

In the cyanide plant, then, classification is practiced for two purposes, to separate, mechanically, particles of different sizes, so that the part which requires it may be further operated upon, while the part which does not require it is passed on; and to separate material according to quality. The two objects are distinct, and different machines must be used to accomplish them. They are equally important, however, where both are used, although under certain circumstances one may be followed without the necessity of using the other.

Allouez

The 1913 annual report of the Allouez Mining Co., Calumet, Mich., shows a profit of $155,728, after treating 236,663 tons of ore, yielding 17.29 lb. of copper per ton, and producing 4,091,129 lb. of refined copper. A summary of the production as given in the last four annual reports, shows the following:

Year Ended Dec. 31	Tons of Ore Treated	Average Yield, Lb.	Total Lb. Copper	Net Cost (a) c.
1910.....	247,119	18.84	4,655,702	11.1
1911.....	288,610	16.56	4,780,494	13.1
1912.....	333,618	16.56	5,525,455	13.4
1913.....	236,663	17.29	4,091,129	11.8

(a) After deducting miscellaneous credits.

There were 239,704 tons of ore hoisted from the mine, from which 3041 tons, or 1.269% were discarded as waste. The cost of mining, transportation, stamping and taxes was $1.687 per ton of ore treated, compared with $1.613 for the previous year. Not deducting miscellaneous earnings, the cost of copper was as follows: Mining, transporting and milling, 9.76c.; construction, 0.16c.; smelting, freights, commissions, Eastern office, etc., 1.94c.; interest paid, 0.23c.; total, 12.09c. per lb. of copper. No dividends have been paid. The following table shows the operating results for the last five years:

Year Ended Dec. 31	Profit	Loss	Balance of Quick Assets.
1909.....	$3,065	.....	$142,417*
1910.....	71,096	.....	71,321*
1911.....	.....	$6,379	77,700*
1912.....	171,264	.....	93,564
1913.....	155,728	.....	249,292

*Deficit.

On Mar. 9, 1914, the company was employing 339 men, compared with 308 at the time the strike was called last July. It is stated that as many strikers occupy company houses and have not been evicted, it was necessary to build three new houses to care for new men.

Centennial

According to the 1913 report of the Centennial Copper Mining Co., Houghton, Mich., operations are fast assuming normal proportions; on Mar. 9, 1914, there were 164 men in its employ, compared with 118 men when the strike was called in July. The statements show a profit of $31,549 and balance of quick assets amounting to $27,847, the first time current assets have exceeded current liabilities for several years. The tonnage treated during the last year was less than the previous year, but an improvement in the grade of ore brought the copper production up to about normal, as compared with the past records. A summary of production for four years follows:

Year Ended Dec. 31	Tons of Ore Treated	Yield per Ton	Total Lb. Copper	Net Cost per Lb. c.
1910.....	102,133	15.40	1,572,566	14.3
1911.....	86,543	17.26	1,493,834	12.7
1912.....	106,517	16.36	1,742,338	13.4
1913.....	85,443	18.87	1,612,262	13.4

Of the rock hoisted, 90,883 tons, about 6% was discarded at the rockhouse as waste. Mining, transportating ore, stamping and taxes amounted to $2.179 per ton of ore treated. Items in the cost of producing copper were: Mining, transporting and milling, 11.55c.; smelting, freight, commissions and head-office expense, 1.37c.; interest, 0.46c.; total, 13.38c. per lb. In 1911 profits were $6045; 1912, $50,511; from 1906 to 1910, inclusive, expenditures exceeded receipts.

The Analysis of Mining Company Reports

By A. H. Sawyer*

SYNOPSIS—A discussion of the principles by which the mining investor may judge to some extent from company reports whether or not his proposed investment is safe.

The object of a report of a mining company is, or should be, to give a statement as to the physical and financial condition of the company for some stated period, usually a year, and also to give such information as is possible regarding its future prospects.

In a general way, it may be said that the report of a mining company consists of four parts, as follows: (1) Report of directors; (2) report of consulting engineer, general manager or superintendent; (3) revenue or income and expenditures account; (4) balance sheet or statement of assets and liabilities.

The report of the directors is usually signed by the president for the directors and is a resumé of the operations of the company during period which the report covers. It deals with questions of policy and finance, such as the acquiring and sale of property, the issuing of stock and bonds, the calling of assessments, etc.

The report of the consulting engineer, general manager or superintendent is made by the operating head of the company to the president or board of directors. It commonly contains the most valuable information regarding the physical condition of the property. The revenue or income and expenditures account is issued by the treasurer of the company or sometimes by an independent auditor.

In the treatment of expenditures, there are two methods employed: (a) In which all expenditures are charged to operating expense; (b) in which capital accounts are carried and these accounts gradually eliminated by making more or less regular charges against operation for what is considered as consumed during the period covered by the report.

The balance sheet or statement of assets and liabilities contains the balances standing in all accounts, after the books are closed.

Here we find two methods employed: (a) In which fixed assets and liabilities are included; (b) in which only deferred and current assets and liabilities are shown, all amounts paid for property, plant, equipment, etc., having been charged to the revenue account as the debts were incurred.

In addition to the information mentioned above, various other data are often included. An account of receipts and expenditures from date of organization is given by some companies. A list of all dividends paid, various comparisons with the record of previous years, tables showing the number of men employed, hospital records of accidents and sickness are among the other information often included in the report.

Deductions from the Study of Reports

At best, reports are history of work done and the reader is more interested in the present and future than in the past. Their value lies in the fact that it is only by the past that we can judge the future.

The all important point which the stockholder wishes to ascertain is the value of the stock. "Value" may have several meanings and it is well at the start clearly to understand them. As applied to stock there are: (1) Par value; (2) book value; (3) assessed value; (4) investment value; and (5) market value.

Par value is the face value placed upon the stock certificates by the organizers of the company. It is nothing more than a name. However, when dividends of a certain per cent. are declared, it means that per cent. of the par value.

By examining the report of a mining company whose balance sheet shows fixed as well as other assets, it will be seen that by adding together all assets, subtracting from the total all liabilities other than capital stock, surplus and undivided profits, and dividing the result by the number of shares outstanding, a figure is obtained, which may be called the book value. In companies that do not show fixed assets, this computation would give the book value of deferred and current assets only.

In mining stock, book value means little. At best, it means that the assets per share cost so much, either in cash or stock; it does not follow that because they cost so much they are worth that much. The so called assets may be worth practically nothing or they may be worth many times what they cost. This applies particularly to fixed assets and to a lesser degree to deferred assets. The book value per share of cash assets is important to the stockholder and should be computed.

At regular intervals mining property, in common with other property, is assessed that taxes may be levied thereon. As the valuation is decided by the amount of taxes to be raised divided by the normal tax rate, it will be seen that this valuation considered alone means little. Rarely, as in Michigan in 1911, a more scientific appraisal of property is attempted.

The investment value of mining stock is of the greatest importance to the investor. It may be defined as that value upon which the mining company can earn and pay in dividends periodical sums of sufficient size to yield adequate interest and in addition furnish an amount, which, if reinvested in safe securities, will equal the original investment by the end of the life of the company.

Hoover states in "Principles of Mining," that the value of a metal mine depends upon (a) the profit that may be won from ore exposed; (b) the prospective profit to be derived from extension of the ore beyond exposures; (c) the effect of a higher or lower price of metal (except in gold mines); (d) the efficieney of the management during realization.

If we add to this statement the income that may be derived from other assets owned by the company, it will apply to the investment value of the stock of the company. Thus it will be seen that the investment value depends upon many factors and it can be computed, even by experts, only after a lengthy and painstaking examination of the resources of the company.

*Mining engineer, 412 American Trust Bldg. Birmingham, Ala.

Nor can it be assumed that this value is a constant one. Depending as it does upon continually changing factors, it must fluctuate accordingly. Its accuracy, therefore, depends largely upon the experience and judgment of the investigator. However, the stockholder should attempt to approximate the investment value.

The market value is the price obtained by the sale of the stock. This price is usually a compromise between brokers on the stock exchange acting as agents for the buyer and seller.

This value fluctuates widely and continually and often varies considerably from the investment value. It is entirely proper that this should be so, for the factors affecting market value are even more numerous than those affecting the investment value. It is, therefore, the investment value which should interest the stockholder most, although the other values should be given due consideration.

As the principal asset of a mining company is the mine or mines owned we will consider Hoover's factors upon which the value of a metal mine depends.

(a) The profit that may be won from ore exposed. Hoover says that this may be termed the positive value. It is, however, not absolutely certain. Profit is the difference between gross earnings and total cost. Ore exposed depends largely upon the geological character of the deposit. Hoover classifies the ore in a mine as follows:

PROVED ORE—Ore where there is practically no risk of failure of continuity.

PROBABLE ORE—Ore where there is some risk, yet warrantable justification for assumption of continuity.

PROSPECTIVE ORE—Ore which cannot be included in the above classes, nor definitely known or stated in any terms of tonnage.

The first two classes—proved ore and probable ore—only can be used in computing the profit to be won from ore exposed.

(b) The prospective profit to be derived from extension of the ore beyond exposures. This profit is entirely speculative but it is necessary to make an estimate of it as the shares of mining companies almost never sell on a basis of proved and probable ore only. Besides, while there are many mines without investment value of consequence, there are few without speculative value, and it is none the less a true value because we have no means of ascertaining it. The only basis upon which the stockholder can estimate its worth is the record of adjoining mines and of the district in general for continuity of values. If he wishes geological data on the subject, he must employ a geologist to report upon the property.

(c) The effect of a higher or lower price of metal (except in gold mines). While a higher or lower price of metal is of the greatest concern in estimating the value of a mine, there is not a great deal in the reports of mining companies to enable the reader to judge what the price may be at any future time. This is governed by the industrial activity and financial condition of the business world. One's success in the investment of money in mining stocks, as well as in other securities, is largely dependent upon knowledge of business conditions and investors should make a study of them.

(d) The efficiency of the management during realization. With the decreasing value per ton of ore mined and the increasing cost of labor, supplies, etc., an efficient management is necessary to the profitable development and operation of any mining enterprise.

We see then from the above, that the student of reports of mining companies should endeavor to obtain answers to the following questions.

(1) What was the cost of production of metals per unit during the period covered by the report?

(2) Is this cost of production likely to be maintained during the life of the mine or is there evidence that it will increase or decrease, and if so, to what extent?

(3) What average price can safely be estimated for the metals which the mine produces? (While some data on this subject can be obtained from reports, information from other sources must be considered in answering this question.)

(4) Does the mine contain sufficient ore to insure a reasonably long life?

(5) Is the management honest and efficient?

(6) What value, if any, can be placed upon other assets of the company?

(1) What was the cost of production of metals per unit during the period covered by the report?

The important point in ascertaining the cost of production is to make sure that all necessary charges have been made against operating expense.

It is the custom of the Lake Superior copper companies to charge all expense to operating. In these instances, therefore, the stockholder may be sure that the costs given include all expenditures for the year under review. He cannot be sure, however, that they are the true costs for there may more or less than the normal development, construction and repair work done.

When the company carries property, plant, development and equipment accounts as fixed assets, it may be well to repeat that the stockholder should see that reasonable charges have been made against operation for stripping, depreciation, etc.

(2) Is this cost of production likely to be maintained? If the expenses incurred during the year have been normal, it may be assumed that the cost of production will remain practically the same for the coming year at least. This means, however, that the average amount of development work should be done—at least enough to replace the ore extracted. It means that the rate of production, the grade of the ore and the percentage of extraction remain about normal.

Wherever possible, it is advisable to compare a report with those of three or five previous years in order to determine what may be considered averages in the above cases.

It is often a good plan to plot such data to scale, as it reveals increases and decreases in a remarkably clear way.

(3) What average price can safely be estimated for the metals which the mine produces? Hoover in "Principles of Mining," 1909, gives the following table of metal prices which he believes are justifiable for some time to come, providing the present tariff schedules are maintained in the United States. New York prices only are given.

	Lead	Spelter	Copper	Tin	Silver
Basic price...	$0.035	$0.040	$0.115	$0.220	$0.44
Normal price.	0.043	0.050	0.140	0.290	0.52

It seems probable, however, that the average price of copper for some time will be about 15c. per pound.

(4) Does the mine contain sufficient ore to insure a reasonably long life? In the case of most mines, this is a difficult question to answer. In ore deposits of the disseminated type, the values are so uniformly distributed

that it is relatively a simple matter to estimate the total amount of minable ore within a property. The companies working such deposits make public their ore reserves and the investor can estimate the life of the mine accurately.

A fairly good estimate can be made of bedded deposits, such as the copper lodes of Michigan, by computing the total tons of ore contained in the lode down to some certain depth, subtracting the quantity already mined and dividing by the average number of tons mined per year. This method was used by Finlay in his appraisal of mines of Michigan, in 1911.

In mineral deposits of the fissure-vein type, such as at Butte, Montana, the problem is still more difficult. Ingalls, in "Some Observations in Butte, Mont.," ENG. AND MIN. JOURN., Mar. 16, 1912, by assuming that the total production to date had come from a block of country about 1400 ft. in depth, figures that at the rate of production of 300,000,000 lb. per annum, it will take 20 years to work the mines out to a depth of 3100 feet.

It is suggested that the amount of development work done each year serves as a check on such estimates and the investor is advised to tabulate and compare the yearly records of such work. A gradual and regular decrease of development work is apt to indicate approaching exhaustion, while on the other hand, an abnormally large amount of such work may mean a desperate attempt to open new reserves. The record of a mine in a healthy condition shows considerable development work each year, usually more in prosperous times than in adverse times.

Great care should be taken in comparing the amount of development work of companies working one type of deposit with those working another type, as the quantity of ore developed per lineal foot of drifts, raises, etc., may be much larger or smaller in one case than in the other.

(5) Is the management honest and efficient?

Evidence of stock manipulation by officers of a company is undoubtedly evidence of dishonesty.

It is often interesting and illuminating to note increases or decreases in the amount of stock owned by directors and large stockholders. It is well, wherever possible, to inquire into the business standing and experience of the directors.

The efficiency of the management may be tested largely by the results obtained by its conduct of the business of the company. But, a rich mine can be made to yield large returns even by an inefficient management. The tons of ore produced per man employed, the percentage of extraction in concentrating and smelting the ore, the ratio of production to capacity, the proper maintenance of the plant and equipment of the company, the treatment of labor problems, the safeguarding of employees against accidents and sickness all have their bearing on efficiency.

(6) What value, if any, can be placed upon other assets of the company? We have considered the chief asset—the mine itself—of mining companies and it only remains to look into what other assets there may be, the idea being to determine, if possible, the liquidating value of the stock on the assumption that the mine is worthless.

While it is possible that the plant and equipment may have some value, it is best to neglect them entirely. A large part of all construction work consists of labor and materials for foundations, buildings, etc., and is of practically no value if moved. Machinery and other equipment may bring something if sold but not enough to be of importance.

Materials and supplies are of somewhat doubtful value. The value given in balance sheets represents cost at the works and therefore includes freight. Much of such material is peculiar to the mining business and if disposed of must be sold to another mining company. A large part of this item often consists of fuel which is difficult and costly to transport and deteriorates with age. On the whole, if considered at all, it is not safe to value material and supplies at more than 50% of the book value.

Investments in other companies, where itemized, may be appraised roughly, depending on their nature, in a similar manner to that which we are pursuing. Many times, however, these consist of stock in companies which depend on the company in question for their success. This is true of railroad companies whose chief income is derived from hauling the mining company's ore, mercantile and realty companies. Such investments in reality represent property of the mining company but segregated under separate corporate existence. Their value in the event of the liquidation of the parent organization is, therefore, exceedingly doubtful.

Only too often is the bills receivable item the indebtedness of such subsidiary companies as those mentioned above. In such instances it would have no liquidating value. So much can be concealed under this vague title that it is often better to ignore it entirely.

Cash may be taken at its full value but even here it is wise to deduct bills and accounts payable as these items have to be met and in case bills receivable should prove of no value, they would have to be paid out of cash.

THE PERMANENT EXISTENCE OF MINING COMPANIES

In order that a mining company should remain in a healthier condition there must be from time to time, an interchange of fixed and current assets. In the early life of a mining company, current assets derived from the sale of stock and bonds are transferred into fixed assets, such as property, plant, equipmnt and mine development. When the producing stage is reached, a gradual return from fixed to current assets takes place from the sale of the product of the mine.

As no one mineral deposit, if exploited, can have perpetual existence, it becomes necessary for the company to expend a portion of its profits in the development of new ore reserves to replace those exhausted.

In conclusion, it is suggested that if the investor has satisfied himself as to: (1) The average cost of production; (2) the average price or prices of the product of the mine; (3) that the mine contains sufficient ore to last, at the present rate of production, say from 15 to 20 years, and that the management pursues the policy of replacing exhausted ore reserves with new ones; and (4) that the property is honestly and efficiently managed, he is justified in appraising the stock at a price equal to ten times the net earnings per share (figured on average costs and average prices received for output) plus the value per share of the net liquid assets of the company.

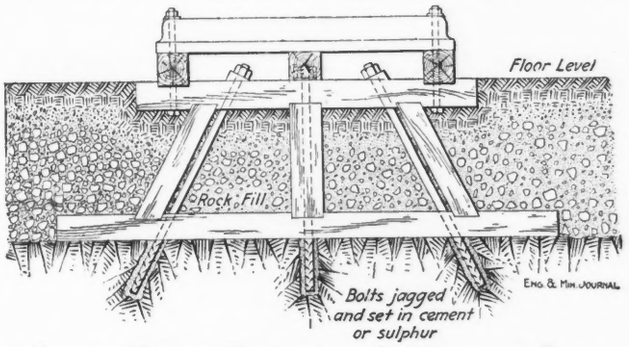
The Union Minière, Katanga, Produced 4000 tons of copper, says the "Mining Journal," in the first eight months of 1913 of which 1900 were smelted in July and August, during which two months the two water-jacket furnaces of the company were both working.

Details of Practical Mining

Timber Foundations for Engines

By A. Livingstone Oke*

Sometimes, for reasons of economy or for temporary purposes, it is necessary to use timber for the foundations of small engines, such as hoists, pumps, etc., and the sketch shows one method which gives a rigid setting. In the case shown, several feet of soft soil overlies a rock bottom; in such cases it is desirable to make the foundation of such depth that it will rest directly on rock, as shown. An alternative is to place long, heavy bearers transverse to the upper framing and bolt to these, but



Engine Timber Foundation Anchored to Rock

the former method is always to be preferred. It is particularly necessary to place the bolts inclined as shown, for the reason that end movement of the foundation tends to tighten an inclined bolt, while the converse is true with a vertical one. The bolts may be made jagged at their bottoms and run in with neat cement, sand and cement, or sulphur.

Clean Water for Pumps

Occasionally the discharge of pumps falls off, due to chips or refuse getting into the suction end of the pump. For the centrifugal pumps of the Penn Iron Mining Co., this difficulty is guarded against as much as possible by having duplicate wire screens in the suction tank, so that all the water from the mine has to pass through a screen (*Bull.* A. I. M. E., February, 1914). The screens are in duplicate, so that there may always be one in place when the other is raised for cleaning. In these mines it has been found that the best protection against grit in the water is to be had from good ditches, which keep the water in the drifts below the traveling road. The internal wear of the water passages due to grit has been exceedingly small. The water, however, is free from acid and without corrosive effect.

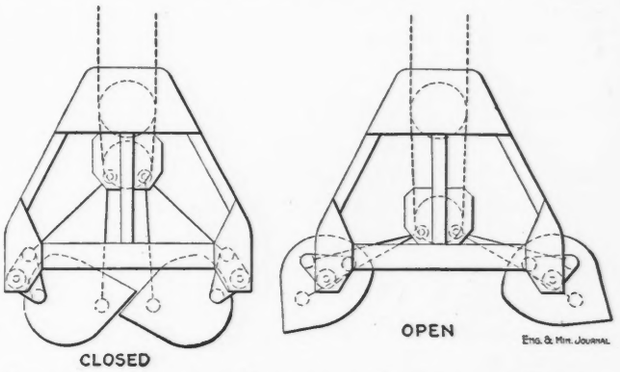
Double-Pole Switches for Electric Blasting Circuits are a necessary safety precaution. ("Journ." Chem., Met. & Min. Soc. of S. Africa, October, 1913.) With a single-pole switch current leakages to the lead wires are possible as the result of accidental grounding on the side of the circuit not broken by the open switch. Such a leakage can easily cause a premature blast.

*Mining engineer, Penzance, Cornwall, England.

Bucket for Unloading Hard Ores

By Alfred Gradenwitz*

One of the modern devices for unloading ores from ships is the automatic grab, which consists of two cups or shovels connected by joints or hinged to a frame, these cups or shovels being drawn together by a tackle, scraping the material together and holding it within the tightly closing edges. These grabs must cut through any pieces which at the moment of closure happen to be between the edges. Though such grabs are designed to close with sufficient energy to crush soft ore, they fail in this



Sketches Showing Eccentric Pivoting of Unloading Buckets

function with most iron ores and many kinds of raw phosphates.

Edges of Bucket Not Collinear

J. Pohlig, Ltd., of Cologne, Germany, has recently designed an ore grab able to take up automatically the hardest and coarsest ores. This has been achieved by abandoning the principle of the grab as generally used. In fact, in the new design, the two shovels, so far from closing tightly after taking up the material, leave a considerable gap between the edges, thus doing away with any necessity of cutting through the ore, yet, the ore is kept safely within the shovels and is prevented from flowing out, by the front edges of the two shovels which are raised much higher than in ordinary self-acting grabs.

The design of these shovels involved difficulties. In order, in fact, to turn the shovels much farther than ordinary automatic grabs, the locking mechanism of the shovels, that is, the tackle, had to traverse a longer path. This again entailed the arrangement of a much higher grab frame, and former endeavors made in the same direction had resulted in excessively high grabs, heavy at the top, so that they overturned on coming down on a slightly sloping ore heap.

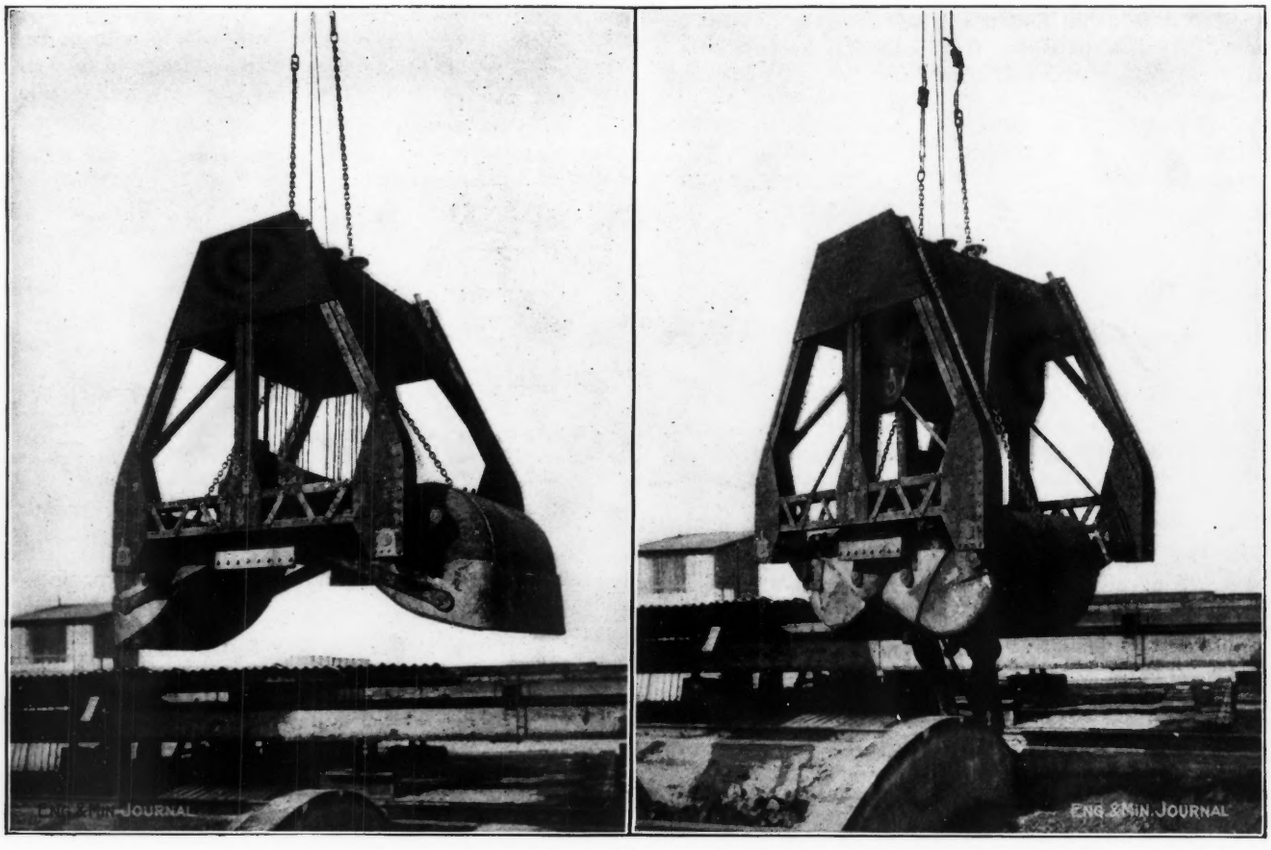
This difficulty has been overcome in an ingenious manner by fitting the shovels to the grab frame through the intermediary of rocking levers, turned round during the

*Gosslerstrasse 20, Berlin-Friedenau, Germany.

operation of the shovels. The latter are not only lifted in front, as with the usual type of grab, but at the same time are pressed down at the back, thus shifting the pivots. This reduces the path of the tackle by half and allows using a low frame. The accompanying sketches and photographic views of the bucket in opened and closed position show the mechanism and design.

There were, however, some further difficulties to be dealt with, giving the working shovel edges with the most advantageous digging curves, and finally preventing part of the material scraped together from remaining in position when the shovels were raised, which would be bound to occur were the shovels arranged at sufficient distance from one another for the working edges not to touch on rising. This problem was solved by causing the shovel edges to overlap somewhat in their closing position, to effect which the driving gear of the shovels was so designed that one of the shovels is slightly in advance of the other in closing.

The ore grab recently built on these lines has a carrying capacity of 2½ cu.m. and weighs 8½ tons. It requires for its operation a crane of 15 to 20 tons lifting capacity. Under normal conditions, using an uptodate electrically operated 3-motor crane, the grab will make from 30 to 40 runs per hour, corresponding in the case of iron ores, to an output of 150 to 200 tons. An advantage of the new ore grab is the absence of the enormous momentary strains obtained in the case of ordinary grabs at the moment of closure, which reduce the life of the apparatus.



UNLOADING BUCKET OF NEW DESIGN IN OPEN AND CLOSED POSITIONS

The edges of the bucket roll closed, one edge within the other so that while ore is withheld, hard lumps do not keep jaws open nor is it necessary to cut through them.

Pipes for Transporting Filling Underground

In the anthracite fields of Pennsylvania where hydraulic filling is used for the exhausted mine workings, transportation in pipes is frequently necessary underground in horizontal or ascending workings, whereas in descending workings unconfined flow is possible. Materials used for such pipes are wood, steel, wrought iron, cast iron, terra cotta, porcelain and glass.

Wood-stave pipe is probably the most extensively used. The staves are of the tongue-and-groove type made of such hard woods as oak, ash or maple. The pipe is spirally wound with galvanized wire or steel bands, and is given a protecting coating of tar, sprinkled with sand, granulated slag or sawdust. Connection is made by the usual male and female ends, but since this does not permit of easy breaking, flanges must be inserted at intervals, and for this purpose short lengths of pipe with two male ends are required to fit the flanges. Wood-stave pipe possesses the advantage of being immune to chemical attacks, an important point where the mine water is acid. It has a tough wearing surface, although inferior in this respect to metal pipe. To increase its life, it should be turned slightly at frequent intervals, say one-eight or one-quarter turn, thus bringing the brunt of the wear on a new portion of the interior. Being in short lengths, wood pipe can be more easily turned than can

Note—An abstract from Bull. 60, "Hydraulic Mine Filling," U. S. Bureau of Mines.

metal pipe. If frequent flange connections are inserted it is easily broken and cleaned of stoppages. It is cheaply installed, since it is in short lengths, and is light. It can be carried easily through difficult situations and gives considerable flexibility for irregular alignment. Its disadvantages are that it dries out and collapses if not used steadily, that it wears unevenly, that it springs easily out of line, and that it is relatively short lived.

Where the working pressure of the water-hammer in the pipe line is likely to exceed 100 lb., steel or iron pipes should be used. A plain sleeve-coupling is cheap and is easily applied, the joints being packed with burlap, oakum, soft wood wedges, etc. The chief disadvantage of steel and wrought-iron pipe is that it is subject to corrosion. Wear can be largely avoided by inserting plenty of flange unions, and turning at frequent intervals, as with wood pipe. Flanges are also necessary where changes in alignment are required, this being impossible with screw joints. Around curves, the outer side of the pipe is subject to excessive wear. Steel or wrought-iron pipe is harder to turn and harder to install in out-of-the-way places, as it is in long lengths.

Cast-iron pipe is particularly advantageous where the installation is likely to be long continued and the pipe is subject to frequent inspection. Flange connections are sometimes used, but the bell-and-spigot, packed with oakum or old hemp rope and secured with soft wood wedges, is more common. The fact that it comes in 12-ft. lengths affords considerable advantage, making it more applicable where irregular alignment is necessary. The life of cast-iron pipe is about twice that of wood pipe. Under 100-lb. pressure it is about three times that of wrought-iron pipe, and about five times that of steel pipe. Its great weight is an objection under certain conditions. It is much less subject to corrosion than steel or wrought-iron pipe. It is easily turned and cleaned, provided flange unions are inserted at frequent intervals. It wears better than either wood, steel, or wrought-iron pipe.

Wood-lined pipe consists of a cast-iron flanged shell with a wood-stave lining. The wood swells when wet and makes a tight bond. Such pipe possesses about the wearing and acid-resisting qualities of wood pipe, and the strength of cast-iron pipe.

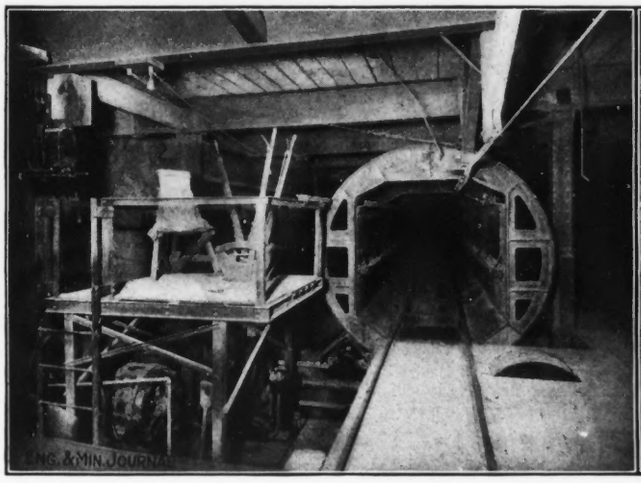
Terra cotta pipe is available for the purpose of transporting filling underground where the danger of exterior damage is small and there is no back pressure on the line. It comes in lengths of 3 to 4 ft. Ordinarily the joints are packed with hemp or oakum, a thin layer of cement mortar put around this and held in place by a wrought-iron clamp bolted flush with the edge of the bell flange. Terra cotta pipe requires frequent turning. Its chief field is for descending lines in flat workings. The interior glaze soon wears off, and rapid cutting results, together with frictional resistance to flow. Terra cotta pipes are cheap and easily installed in crooked workings.

Porcelain-lined pipe consists of a metal shell of wrought-iron or steel with flange connections, together with a porcelain lining about ½-in. thick, divided into sections 10 to 15 in. long. The space between the shell and the lining is filled with cement grouting. Such pipe has high resistance to wear and low frictional resistance, but when coarse material is transported, breakage occurs where the larger fragments impinge on the walls at turns.

Glass pipe has been tried in an experimental way, particularly for bends and elbows. It offers good wearing resistance with low friction, but is extremely expensive and is likely to be little used, especially for straight lines.

Electrically Driven Cylindrical Tipple

The accompanying photographs exhibit a cylindrical tipple used underground by the Ray Consolidated Cop-



End View of Tipple, Control Platform on Left

Tipple Partly Revolved, Dumping Two Cars

per Co. The tipple is designed to hold three cars. It is electrically driven through a series of gears as shown. The employment of such a tipple where large quantities of ore are to be handled offers several advantages, particularly that of permitting the use of stronger and cheaper mine cars.

Compressed Air Induced Ventilation

Ventilation by means of compressed air introduced through a nozzle into a larger pipe so as to create an air current, is not uncommon. The question of its efficiency often arises and figures on which this can be judged are not easily obtainable. For this reason, the accompanying

table is of some value. It gives the results of tests made at the Geldenhuis Deep mine, on the Rand, by E. Pam and reported by him in the *Journal* of the Chem. Met. & Min. Soc., of South Africa, November, 1913.

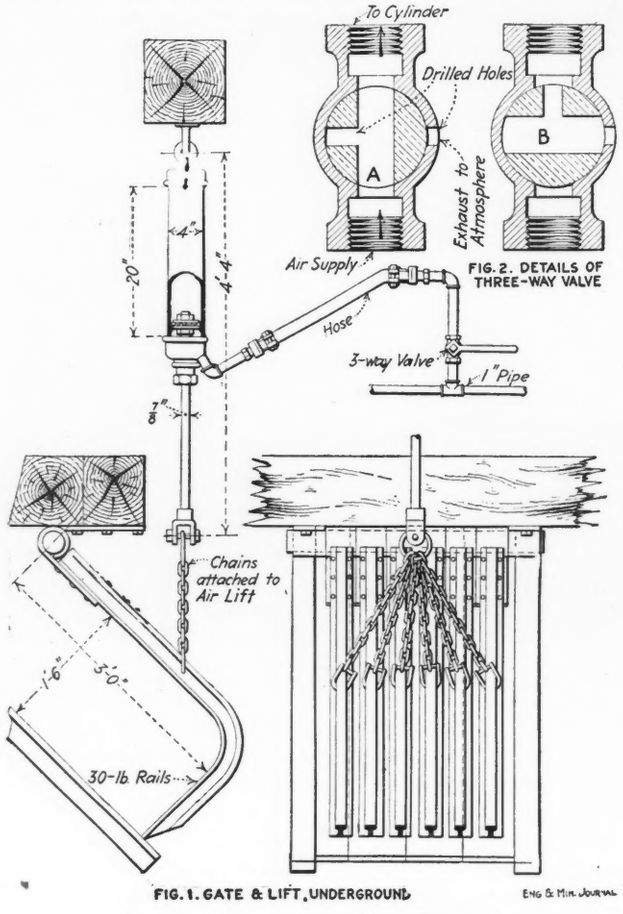
FLOW OF AIR FOR VARIOUS NOZZLES

	Size of Nozzle, In.	Discharge in Cu.Ft. per Min.	Free Air per Min. Furnished by Jet (Theoretical from Tables)
Flange off	1/16	210	5
	1/8	530	19
	3/16	770	43
	1/4	1080	76
Blind flange on intake of pipe	1/16	30	These figures give the quantity of air as actually measured coming out of the nozzle.
	1/4	80	

The pipe was 9 in. in diameter and 538 ft. long with four right-angled bends. The air pressure was 72 lb. The conditions are much more favorable than in ordinary practice, the pipe being straighter and the joints tighter.

Air Lift Finger Chute Gate

For most of the important ore chutes of the Oliver mines, at Ely, Minn., a modified finger gate with a home-made air lift is used. The drawing, Fig. 1, represents



GATE AS INSTALLED UNDERGROUND

the arrangement for one of the underground skip loading chutes, and the photograph, Fig. 3, shows a chute in the Pioneer-A headframe for loading ore in the railroad cars.

The fingers of the gate are made of rails, the weight depending chiefly on the stock of material which it is desired to use up. In some cases, instead of bending the rails, they are made in two pieces and riveted together.

The lift cylinder is made of a piece of 4-in. pipe. One end of this is closed with an ordinary cap and lift is hung by this. The other end is closed with a reducer which contains an inlet for the air and a stuffing box through which the rod runs. The piston forming the end of the rod consists of a leather gasket with turned-down edges, between two metal disks, with nuts on each side.

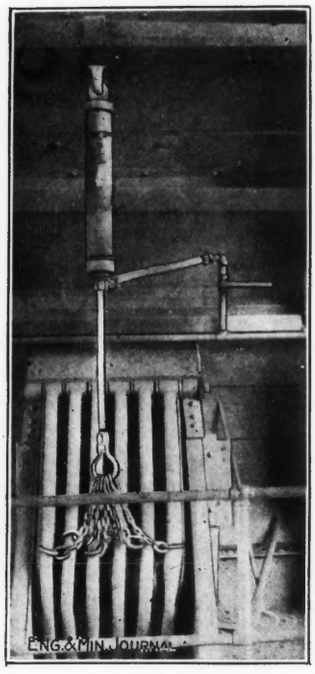
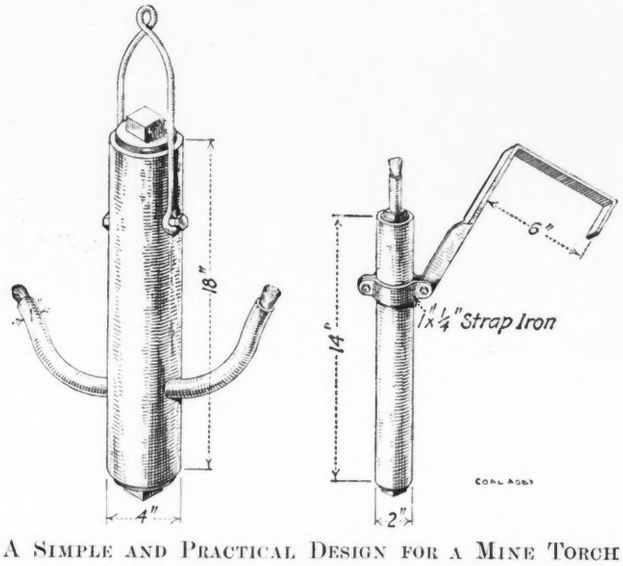


FIG. 3. CHUTE ARRANGEMENT IN A STEEL HEADFRAME

The release of the air to drop the gate is effected by the same valve that admits the air. This is a three-way valve made from an ordinary stop-cock. The body and plug are drilled as shown in Fig. 2. Position *A* shows the valve open to the compressed-air supply for raising the gate. By turning 90° *B*, the drilled hole in the plug, registers with the passage to the cylinder and the port through the plug registers with the hole drilled in the body, thus permitting the air to exhaust.

Torches of Scrap Pipe

Two types of mine torch are here shown, constructed of scrap material largely pipe and fittings (*Coal Age*,



A SIMPLE AND PRACTICAL DESIGN FOR A MINE TORCH

Feb. 28, 1914). Oil-burning torches of this description are frequently useful to supplement other forms of illumination and find a special applicability in shaft sinking.

Details of Milling and Smelting

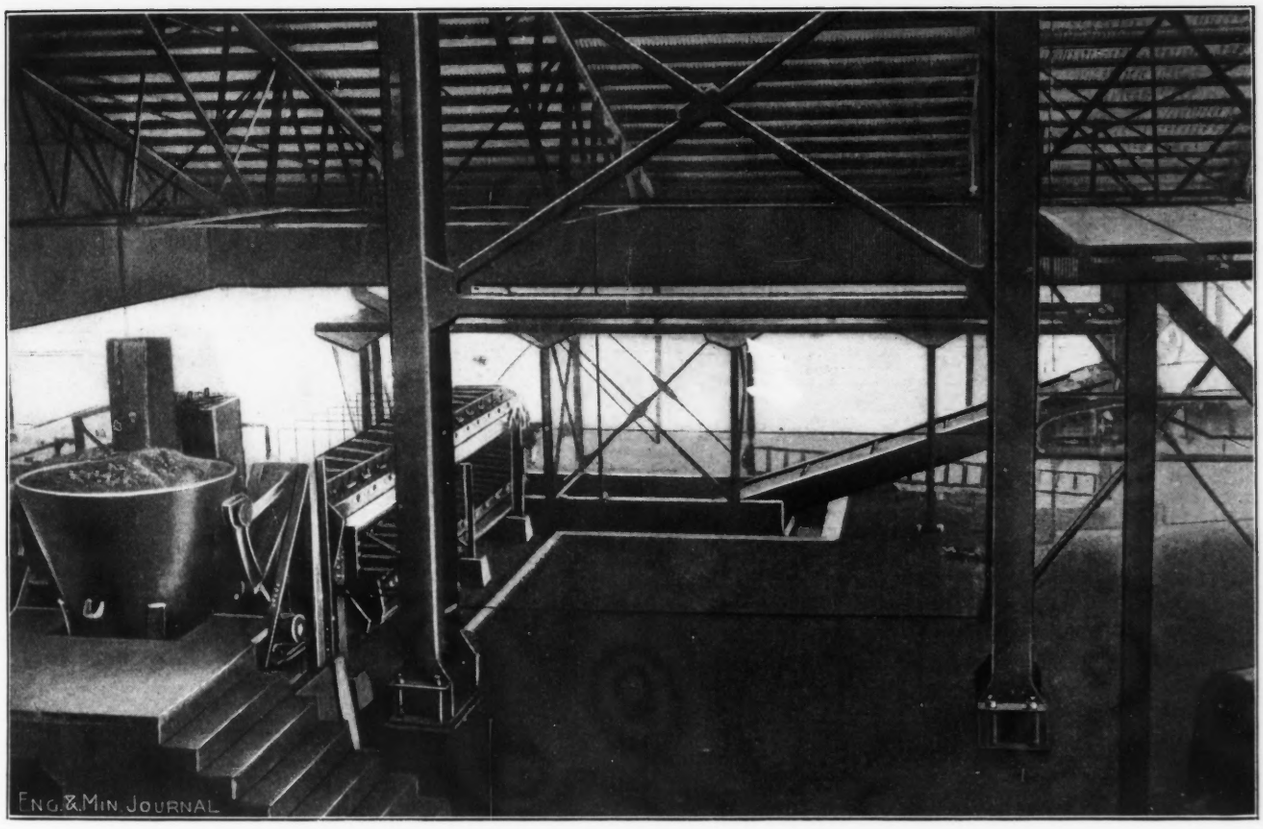
Straight-Line Copper Casting Machines

In a number of the newer smelting plants in the Southwest, built from the plans of Repath & McGregor, of Douglas, Ariz., straight-line copper-casting machines of the type shown herewith have been installed. Casting machines of this type were installed at the Calumet & Arizona Mining Co.'s new works, at Douglas, at the Arizona Copper Co.'s plant, at Clifton, and in the new United Verde works, at Clarkdale.

The general arrangement of the twin equipments at the Arizona Copper Co.'s plant is shown in the accompanying engraving. The copper-handling equipment consists essentially of a ladle-tilting device, a pouring spoon, a straight-line conveyor carrying the copper molds, a bosh for cooling and a conveyor for elevating the copper bars to the loading platform; and in the installation shown, a radial crane with small air hoist and "grip" for picking up and stacking the bullion bars on the loading platform. The tilting of the ladle and pouring spoon, the operation of the mold and bosh conveyors are all controlled by one man, at an operating platform from which a good view of the whole operation is obtained.

When a ladle of copper is to be poured, it is spotted into the tilting cradle by the traveling crane. The tilting cradle consists of two cast-steel sectors pivoted at a point in line with the ladle spout, so that the point of the ladle spout does not change its position from the time the ladle starts pouring until it is emptied. The sectors have gear teeth on their outer circumference which mesh with pinions mounted on a pinion shaft turned through a worm gear by a 20-hp., type MC Westinghouse motor.

The copper from the ladle is poured through a tilting spoon operated hydraulically to insure a steady stream. The copper molds, 40 in number, are mounted on roller-chain carriers. The molds are of cast iron, and the dimensions are approximately 2 ft. 4 in. by 1 ft. 6 in. by 3¼ in. The mold conveyor is moved through sprockets and worm gear driven by a mill-type motor of the same capacity as the motor that tilts the ladle. The molds can be moved at a speed of approximately 60.75 ft. per min., when the motor is operated at 610 r.p.m. A swinging crane of 1½ tons capacity is mounted near the pouring end of the conveyor to facilitate the replacement of molds and other repairs. Spray pipes over the mold conveyor cool the molten copper, so that it solidifies by the time it reaches the end of the conveyor and is dumped into the bosh.

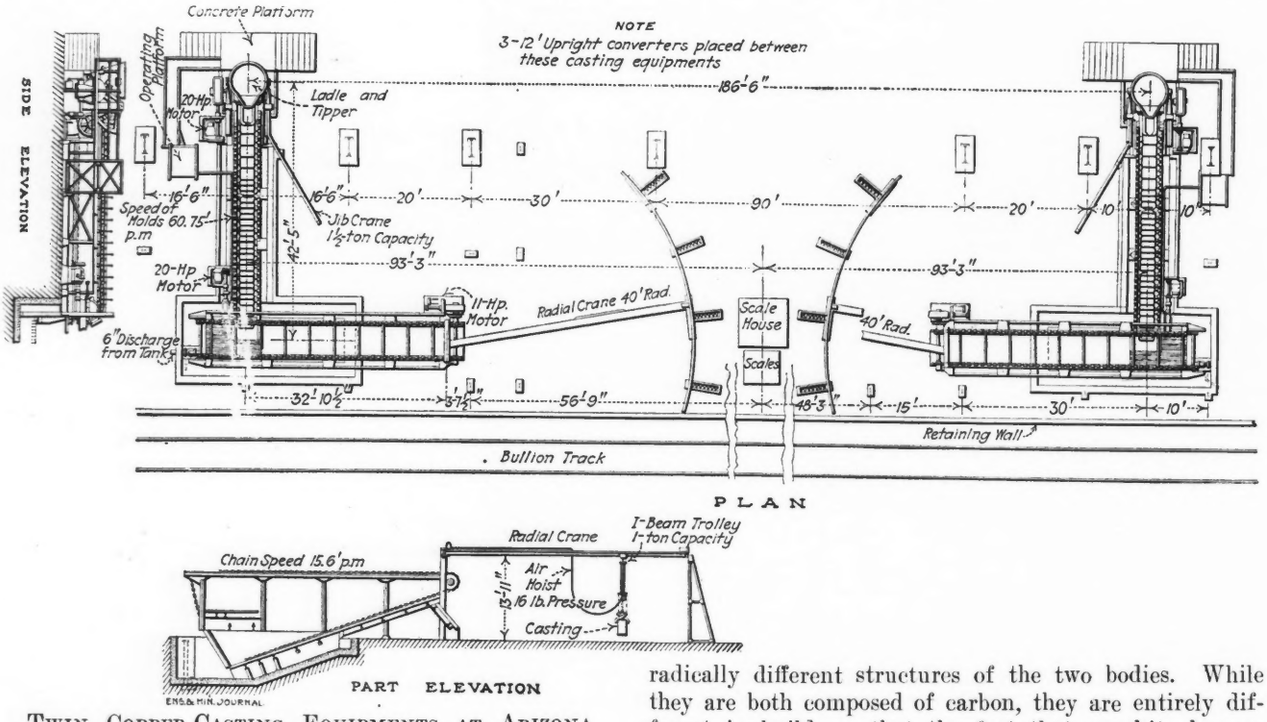


COPPER-CASTING MACHINE AT CALUMET & ARIZONA WORKS AT DOUGLAS, ARIZ.

To insure the ejection of the copper cakes from the molds, there is a countersunk pin in each mold; the head of the pin is flush with the bottom of the mold when it is in the receiving position for copper; as the mold approaches the discharge end of the conveyor, the point of the pin comes in contact with a wheel or large roller mounted on the discharge-sprocket shaft; this causes the pin to rise and loosens the copper cake from the mold, and permits it to fall freely into the water bosh at the end of the mold conveyor.

At the Calumet & Arizona and United Verde plants, a lime-water-spray nozzle and tank is arranged under the returning molds; compressed air is used for mixing and applying the spray to the lower line of molds; the excess water drains back into the tank.

The bosh conveyor consists merely of roller-chain carriers connected by crossbars at each 4 ft. The arrangement of this conveyor is clearly shown in the accompanying illustration. The crossbars drag the copper cakes up



TWIN COPPER-CASTING EQUIPMENTS AT ARIZONA COPPER CO.

the incline and allow them to fall on the loading platform. The bosh conveyor is operated by an 11-hp. mill-type Westinghouse motor, which at 730 r.p.m. gives a chain speed of 15.6 ft. per min. When the copper bars are delivered on the loading platform, they are picked up and piled by a radial crane equipped with I-beam trolley and air hoist. The air hoist has a 7-in. cylinder and 4-ft. 6-in. stroke, and uses air at 16-lb. pressure. When convenient, the copper bars are loaded on trucks which pass over scales situated between the two casting units.

Manganese-steel Linings in the Tube Mills have proved a distinct success, the wear and tear being nothing like so great as with chilled linings, according to the annual report by George Chalmers, superintendent of the St. John del Rey mine, Brazil. The direct gear-drive from motor to the tube mill makes a compact arrangement and does away with a large amount of shafting and belting used in the experimental plant. It is considered strongly advisable to gradually replace the old tube mills by the improved form, as the cost of the upkeep of the former is heavy and results not so good.

Charcoal Precipitation from Cyanide Solutions

The precipitation of gold and silver from cyanide solutions by means of charcoal, has been receiving a good deal of study from operators who are trying to determine what the cause of precipitation is. Admittedly, the carbon itself does not cause it, and most authorities place the responsibility upon the gases occluded in the porous mass of the charcoal. In discussing this phase of the matter, A. F. Crosse[1] agrees that the gases condensed in the charcoal are much more active than in the ordinary free state. Admitting also that both oxygen and carbon monoxide have been found in charcoal, he asks why, under these conditions of activity, the two do not combine to form carbon dioxide.

Continuing the same discussion, F. J. Pooler claims that an analogy between the action of charcoal and graphite cannot be of corroborative value on account of the radically different structures of the two bodies. While they are both composed of carbon, they are entirely different in build, so that the fact that graphite has no effect on cyanide solutions is not conclusive evidence of the inert nature of carbon. He continues by asking, since carbon monoxide passed into an ordinary gold-bearing solution would not precipitate gold, what reason is there for believing that it does so in charcoal, unless the charcoal itself has some action? The catalytic action of fine carbon deposited in the charcoal may be responsible for the action. Catalysis, however, does not necessarily mean that the action takes place with or without the aid of carbon monoxide. The trial of charcoal and other forms of carbon as precipitants of gold and silver from solutions other than cyanide might throw some light on the question. It seems possible that the fine carbon functions, both in the absorption of gas phenomena and through catalytic action. Potassium cyanide is so unstable that the structure of the deposited carbon may have some effect on the solution.

[1]Journ. Chem., Met. & Min. Soc. S. A., February, 1914.

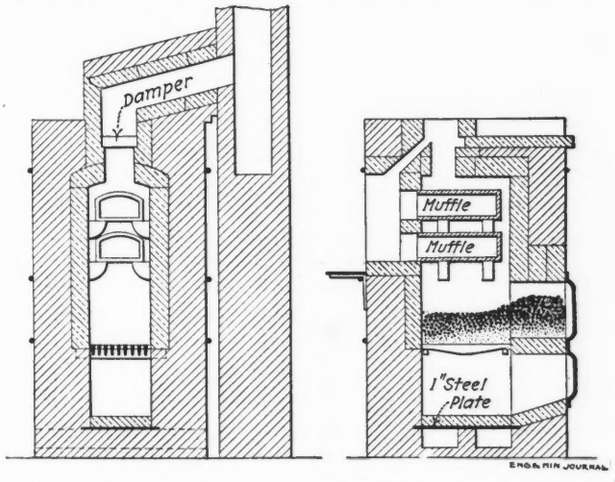
The Assayer and Chemist

Coal-Fired Muffle Furnace

By W. W. Case, Jr.*

Most coal-fired, muffle-type, assay furnaces are built on the same general principles. However, there is much room for economy in their construction and operation. These furnaces are built with tile lining or fire-brick lining. The outside is of red brick with angle irons and tie rods.

In constructing these furnaces, it is advisable to leave but little space between the side walls and the sides of the muffles, thus the maximum efficiency of the fuel used in firing is utilized in the muffle. It is also advisable to have a damper in the top of the furnace, leading to the flue, so that the furnace is under control at all times, in spite of wind or atmospheric conditions. The stack for single, two- or three-muffle furnaces should be built



Method of Stoking a Coal-Fired Assay Furnace

independent of the furnace, the brick work running from the ground up a distance of 10 or 12 ft. From there, it is advisable to use a sheet-iron stack. This stack should be 9 or 10 in. in diameter and from 24 to 40 ft. in height from the ground.

The tile-lined furnace has, in every instance, proved the most successful. The furnaces have a tendency to slag, and, when removing the slag and clinkers, if the fire-clay should have a tendency to come out with the slag or clinkers, it merely scallops out in the form of oyster shells, which again fills up with slag and the wall is left in perfect condition, whereas, with the brick-lined furnace, it often happens that half a brick will pull out, thus the entire furnace lining is weakened and has a tendency to cave.

The fuel should be coal burning with a long flame. In firing, the fuel should be placed as close to the fire door as possible, in a high pile, nearly to the top of the fire door, as shown in the accompanying illustration. As it ignites, it cokes, the gases are consumed and thus the furnace becomes practically a gas furnace. After the coal has become thoroughly ignited, it is pushed over on the grate bars in a thin layer and more fuel is added at the door. This keeps the temperature of the furnace constant, saves considerable fuel and eliminates the variation in the temperature within the muffle. Some men fire these furnaces by throwing fresh coal clear inside of the furnace upon the grate bars. This means that after the coals have become thoroughly ignited, the furnace very hot, and cold coal is then put on top of it, the temperature of the muffles drops several hundred degrees.

*President, Denver Fire Clay Co., Denver, Colo.

Preparation of Pure Precipitates

An interesting method for the preparation of precipitates free from occlusions of the precipitant is given by J. Johnson, in the *Journal of the American Chemical Society,* January, 1914. Sparingly soluble substances can be precipitated in a state of great purity by allowing the reacting materials to come slowly into contact with each other as the result of diffusion. For example, a large vessel is filled with water, or a saturated solution of the substance to be prepared, or a solution containing some foreign substance which increases the solubility of the substance to be prepared, but does not separate with it as a double salt. Two small dishes containing the reacting substances are placed at opposite sides of the large vessel. Or a vessel containing the main bulk of liquid, covered with a layer of paraffin to prevent evaporation, may be placed inside a steam bath, and the reacting solutions allowed to flow slowly in through siphons from flasks disposed above; the air-inlet tubes of the flasks are drawn out to very fine capillaries to insure a very slow flow of the solutions through the siphons. Hexagonal prisms of calcium hydroxide, 2 to 3 mm. long by 1 mm. thick, were prepared in this way from calcium chloride and sodium hydroxide at the ordinary temperature and crystals of barium sulphate, 1 to 2 mm. long, and free from retained material, were prepared at 100° Centigrade.

Detection of Traces of Aluminum

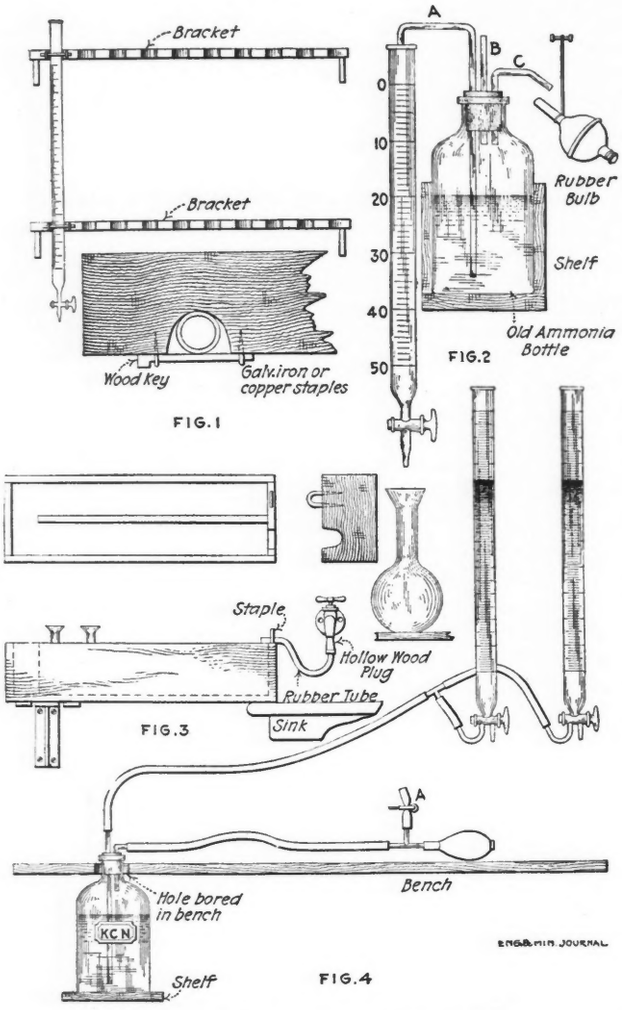
A method is given by G. H. Petit (*Journ. Pharm. Chim.,* 1914, p. 66, for the detection of traces of aluminum. The hydroxides of iron, chromium and aluminum precipitated in the usual way are washed thoroughly, transferred to a beaker by means of water, heated to boiling with solid barium hydroxide and filtered. The filtrate is acidified with hydrochloric acid, boiled and made alkaline with ammonia which has been kept over barium chloride. Aluminum when present is immediately precipitated. Where traces only of aluminum are present, the filtrate obtained after boiling the precipitate with barium hydroxide is made slightly acid with sulphuric acid, concentrated, filtered and ammonia added drop by

drop (not more than 4 to 5 drops). It is then heated just to boiling and allowed to stand, when the aluminum hydroxide settles down if present. This method will detect 5 mg. of aluminum in the presence of 5 grams of iron.

Kinks for the Copper Laboratory

By E. H. Dickenson*

The assayer at a remote mine where it takes a month or more to order and receive a new piece of apparatus often finds it necessary to devise his own. While assaying for



Convenient Laboratory Appliances

a copper company in southwestern Alaska the laboratory gradually came to contain many home-made pieces of apparatus, a description of some of which may be of interest to others in a similar position. In order that the necessity for these may be seen the method of assay is briefly given as follows:

From ½ to 2 grams of ore, according to richness, is taken and placed in a flask, 10 c.c. of concentrate HNO_2 are added, and the flask heated until the brown fumes begin to come off copiously. From ½ to 2 grams $KClO_3$, according to the amount of sulphur present are added and the heating continued until the yellow fumes have been driven off and the sulphur is all in solution, or only a clean yellow ball remains. The assay is then diluted with hot water to about 25 c.c. and brought to a vigorous boil. It is then removed from the plate, diluted with cold water to about 100 c.c., then 40 c.c. 1:1 NH_4OH are added and the assay is allowed to cool. When cold it is titrated with KCN solution in the presence of the iron.

The first problem met in fitting up the wet-assay room was to find a convenient method of supporting the burettes. That shown in Fig. 1 was finally used and proved satisfactory. The next problem was to find a satisfactory method of measuring out the nitric acid. A large burette holding 250 c.c. had been ordered but arrived broken, so the arrangement shown in Fig. 2 was installed. The rubber bulb when not in use is disconnected and let hang as the fumes soon destroy the tubing if this is not done. *B* is closed with the finger until the burette is full, on removing the finger the acid siphons back and the burette sets itself. The burette should be chosen with as long a space as possible between the zero and the top to prevent overflow.

A simple cooler is shown in Fig. 3. This is easily made of whatever capacity may be desired and works well. The notch should be cut so that the water will not rise sufficiently high to overturn the flasks.

Fig. 4 shows a simple method of handling the cyanide solution which can be rigged up with the materials usually at hand. On releasing *A*, the solution can be run back into the bottle again from the burettes.

In connection with this last device another idea was originated which was often extremely useful. The end burette was not connected up with the others, but was kept filled with a dilute solution of ammoniacal copper nitrate. Occasionally in rapid work an assay would be overrun. When this happened 5 c.c. of this solution were run into an empty flask, a little ammonia added and the volume brought up to the usual assay volume. This was then titrated with cyanide, which can be done rapidly, there being no iron present. Suppose this takes 4 c.c. of cyanide solution; 5 c.c. of copper nitrate solution are then added to the overrun assay, the corresponding burette is set back 4 c.c., and the assay finished as though nothing unusual had happened.

The Gravimetric Determination of Selenium

Julius Meyer has shown that the evaporation of nitric-acid solutions of selenious acid leads to the loss of appreciable amounts of the substance, and that the loss may be serious when the dry residue is heated for a long time on the water bath (*Zeit. anal. Chem.*, 1914, p. 145). Although several of the best authorities recommend the removal of nitric acid in the course of analysis by repeated evaporation with strong hydrochloric acid, Meyer has found that this operation leads to serious losses even in the presence of potassium or sodium chloride. For instance, nearly one-half of 0.14 gram of selenium was lost by evaporating its nitric-acid solution to dryness twice with concentrated hydrochloric acid. The author recommends the employment of hydrazine hydrate for the precipitation of selenium, and he states that the interfering effect of nitric acid may be overcome by the addition of ammonia and some hydrochloric acid.

*Regent Apartments, Amesbury Ave., Montreal, Canada.

Company Reports

Calumet & Arizona

The annual report of the Calumet & Arizona and its subsidiary, Superior & Pittsburg, for the year ended Dec. 31, 1913, shows a combined profit of $4,074,637. This profit was made on a production of 52,897,383 lb. of copper, 880,914 oz. of silver and 18,988 oz. of gold. Deducting gold and silver value, the average cost of this copper was 7.65c. per lb. Dividends aggregating $3,059,208 were paid by the Calumet & Arizona. The report differs from past reports in that production statistics are not as complete. From this report it is impossible to figure the exact production for the Calumet & Arizona and Superior & Pittsburg separately. The copper contents for 1913 given in the following tables, were computed from averages given, no figures were stated for gold and silver contents.

A statement of income and expenditures of the Calumet & Arizona shows a net income of $3,001,150 for the year. An analysis of the company's accounts compared with 1912 statements shows the following:

CALUMET & ARIZONA

Balance of quick assets on hand Dec. 31, 1912		$1,362,654.19
Balance of current liabilities, Dec. 31, 1913		740,066.82
Total decrease in quick assets		$2,102,721.01
Dividends paid during 1913		3,059,208.75
Apparent balance over operating, capital expenditures, investments		$1,956,487.74
Receipts were as follows:		
From capital stock	$177,500.00	
Sale of product, etc	2,424,428.47	
Dividends from investments	2,128,838.03	
Total receipts		$4,730,766.50
Apparent total operating and capital expenditures and investments		$3,774,278.76
Capital expenditures and investments:		
Mine property		$170,000.00
Real estate		15,861.91
New smeltery		1,024,690.07
Investments		1,035,704.62
Payments on property		55,813.12
Total		$2,302,069.72
Apparent cash expenditure for operations		$1,472,209.04

The following is a summary of production for the last seven years.

CALUMET & ARIZONA PRODUCTION

Year Ended Dec. 31	Tons of Ore	Average Yield Lb. Cu	Total Lb. Cu Produced
1907	232,460	131	30,688,289
1908	265,344	105	28,048,658
1909	290,360	94.17	27,630,100
1910	298,667	94	28,031,924
1911	212,370	97.67	21,476,739
1912	159,513	92.129	16,490,229
1913	134,336*	91.6	12,315,383

* No custom ore included.

SEVEN-YEAR SUMMARY OF CALUMET & ARIZONA RECEIPTS, DIVIDENDS, AND QUICK ASSETS

Year Ended Dec. 31	Total Receipts (a)	Dividends Paid	Balance Quick Assets Increased	Balance Quick Assets (b) Decreased
1907	not given	$3,300,000	.....	$1,640,059
1908	$3,940,382	800,000	255,196	.....
1909	4,145,431	800,000	.....	267,775
1910	4,361,598	800,000	365,216	.....
1911	3,457,667	1,989,059	.....	1,041,317
1912	4,710,755	2,542,781	.....	949,239
1912	4,553,266	3,059,208	.....	(b) 2,102,721

(a) Dividends on investments included.
(b) Investments not included as quick asset.

The company has purchased 688,623 shares of the New Cornelia Copper Co. and has options on additional shares that will make its total holdings equal to 76.57% of the stock. It is estimated that this property has 40,258,000 tons of 1.51% copper ore in reserve.

The Calumet & Arizona now owns 1,402,653 shares of the Superior & Pittsburg out of a total of 1,499,792 shares, and it is expected that the remaining outstanding stock will be turned in for exchange at an early date. Experiments have been made on the sulphide ores for concentration by oil flotation, results show that a high saving can be made. The total expenditures for the new smeltery were $2,218,218, or 13.86% in excess of the first estimate.

The accounts of the Superior & Pittsburgh show an operating profit of $3,202,324 from 342,301 tons of ore yielding 115.698 lb. of copper per ton. A summary of past production follows:

SUPERIOR & PITTSBURG PRODUCTION

Year Ended Dec. 31	Tons of Ore Treated	Average Yield Lb. Cu	Total Lb. Cu Produced
1906	95,779	94.43	9,045,750
1907	111,710	85.95	9,690,281
1908	214,847	102	21,924,359
1909	222,416	109	24,440,410
1910	227,114	115	26,183,146
1911	206,234	138	28,469,166
1912	288,429	127	36,618,399
1913	342,301	115.698	39,603,541

A SEVEN-YEAR SUMMARY OF SUPERIOR & PITTSBURGH RECEIPTS. DIVIDENDS AND QUICK ASSETS

Year Ended Dec. 31	Total Receipts	Dividends Paid	Balance Quick Assets Increased	Balance Quick Assets Decreased
1907	not given	.....	.....	$1,125,390
1908	$2,977,763	.....	.....	25,895
1909	3,454,996	.....	$789,833	.....
1910	3,445,167	.....	1,039,340	.....
1911	3,859,018	$1,739,758	.....	79,789
1912	6,206,665	1,919,733	1,469,986	.....
1931	6,785,402	2,279,688	901,719	.....

The Junction shaft was concreted from 1530 ft. to the surface in 295 days actual working time. A total of 8374 cu.yd. of cement was used. The combined balance of quick assets for the two companies is $2,786,491 as shown by a study of their statements.

Isle Royale

The annual report of the Isle Royale Mining Co., Houghton, Mich., shows that while the company paid $150,000 dividends in 1913, its expenditures, including $100,000 paid for lands, exceeded its receipts by $232,302, thereby reducing its quick assets $382,302. As is the case of all other Lake Superior copper mines, the Isle Royale's production was curtailed on account of the strike. The following is a summary of the last four years' production and costs after deducting receipts for silver:

Year Ended Dec. 31	Tons Stamped	Yield per Ton	Total Lb. Copper	Net Cost per Lb. c.
1910	520,860	14.5	7,567,394	11.3
1911	457,440	16.4	7,490,120	10.5
1912	531,105	15.4	8,186,957	11.4
1913	314,679	13.2	4,158,548	18.5

Total expenditures for 1913, including lands purchased, amounted to 20.6c. per lb. of copper. Operating expenditures, not crediting silver sales, amounted to 18.81c. per lb. of copper, made up as follows: Mining and milling, 16.07c.; construction, 0.73c.; shafts and explorations, 0.28c.; unwatering Huron mine, 0.10c.; smelting,

freights, commissions and Eastern office, etc., 1.53c.; interest, 0.10c. per lb. Mining, transporting rock to mill and stamping cost, $2.12 per ton of rock stamped. Rock hoisted amounted to 371,774 tons, of which 15.4% was discarded as waste at the rock house. The following is a summary of operating results for the eight years:

Year Ended Dec. 31	Receipts Over Expenditures	Expenditures Over Receipts	Balance Quick Assets
1906	$150,960	.....	.....
1907	.....	$271,435 (a)	$501,157
1908	.....	451,210	49,946
1909	.....	160,991	111,045 (e)
1910	92,313	.....	18,731 (e)
1911	156,708	.....	137,976
1912	419,766 (b)	.....	557,743
1913	.....	232,302 (c)	175,441 (d)

(a) $223,100 for lands purchased. (b) $2300 for lands purchased. (c) $100,000 for lands purchased. (d) In addition to expenditures, a dividend of $150,000 was paid, the only dividend paid by this company. (e) Deficit.

During the shutdown the wooden floors in the mill were replaced with concrete and other repairs made. Just before the strike some mules were purchased to be used for tramming, they have been used successfully in another mine in the district, and it is hoped they will prove satisfactory at the Isle Royale. On Mar. 14, 1914, the company was employing 502 men, compared with a force of 709 men when the strike was called.

North Star Mines

The North Star Mines Co., Grass Valley, Calif., in its report for 1913 shows a gross production of $1,200,096. Interest and dividends on funds invested amounted to $35,757, making total income from the North Star Mine, $1,235,853. Operations and development cost $551,998, outlays for property purchase and improvements, $13,302, leaving net earnings for the year, before deducting depreciation and outlay on account of Champion mine, of $670,553. Dividends amounting to $300,000, or 12%, were paid, bringing the total dividend payments of the company up to 143%. Of the total production 78.18% was recovered by amalgamation and 21.82% by cyanide process, including 1629 tons of concentrates cyanided. The assay value of the tailings from the cyanide plant was 28c. per ton, indicating a mill extraction of 97.5%.

The company exercised its option on the Champion mines and completed payments therefor in April. The Champion 40-stamp mill was run during the year at about half capacity, and in an experimental way, treating 26,850 tons of rock yielding $124,179. Operating and development expenses exceeded the production by $117,159. Including improvements, operations and payments for the property, the total outlay for the Champion mines for the year was $487,148, not crediting income from production. At the end of 1913 the total outlay for the Champion was $858,100, with a total production of $154,528. It is expected that a better showing will be made during 1914. The mine produced 112,110 tons of ore from which 6020 tons were sorted out as waste, leaving 106,090 tons crushed by the mill. Operating costs were as follows per ton of ore crushed: Mining, $2.895; milling, 47.6c.; concentrating, 11.5c.; cyaniding, 45.2c.; bullion, 3.1c.; miscellaneous, 25.3c.; New York office, 15.4c.; taxes, 26.7c.; accident and benefit, 10.4c.; 3158 ft. of development, 48c.; total operating and development per ton of ore, $5.227. Sundry receipts amounted to 2.4c. per ton, leaving a net operating cost of $5.203 per ton crushed. Based on tons mined the cost would be $4.903. Depreciation and current construction are not included in these costs. Construction amounted to about 12c. per ton of ore crushed.

A statement of receipts and expenditures from May, 1884, to the end of 1913, shows that the mine has produced 1,141,284 tons of ore yielding an average of $13.358 per ton. Apparently operating expenses have averaged about $6.94 and development work, $1.43, making a total of $8.37 per ton of ore. In addition to this amount construction has amounted to about 73c. per ton. Income from investments, interest, etc., amounts to approximately 31c. per ton. These figures do not include property purchases.

Goldfield Consolidated

According to its report for 1913 the Goldfield Consolidated Mines Co., Goldfield, Nev., closed the year with a cash balance of $1,074,372, compared with $728,823 for 1912. The property produced 349,465 tons of ore, of which 330,217 tons having an average gross value of $14.88 per ton were milled, and 19,248 tons having an average gross value of $27.39 per ton were shipped to smelters. Loss in mill tailings amounted to $1.19 per ton and smelting deductions, $4.99 per ton. Total value realized, after deducting $8363 for purchased ores, was $4,942,828. Total costs are stated to have been $6.38 per ton, including construction, and $6.32 per ton after deducting miscellaneous earnings. Net realization was $2,731,945, or $7.82 per ton. Development work performed totaled 38,696 ft., at a cost of $8.42 per ft. Dividends aggregating $2,491,403 were paid. It is stated that operating conditions at the mines were far from ideal; 90% of the present tonnage coming from pillars, ends and sides of old stopes.

The measurable orebodies exposed on two sides are estimated to contain 135,000 tons of milling ore and 1000 tons of shipping ore. The average grade of this ore is estimated to be between $13 and $14 per ton. No attempt was made to estimate the total ore reserve. Experiments have been made for developing some profitable plan of working large bodies of low-grade ore but so far without success.: Surface dumps supplied 12,756 tons of mill ore in 1913 and are being drawn upon to supply the mill during shortages of mine ore. The 'easing system is being started in parts of the mine where small bunches of ore are known to exist.

Rochester Weaver

The annual report of the Rochester Weaver Mining Co., Lovelock, Nev., for 1913, states that the company has been operating its property under the leasing system. From all leases, 935 tons have been shipped for which returns have been made amounting to $30,254 or $31.74 per ton. This value has been distributed as follows: $13.27 per ton to leases; $5.85 for wagon haul, $2.92 to the company for royalties and $9.70 per ton for railroad freights and treatment at smelter. This does not include smelter deductions or loss in treatment. Development work consisted of 5860 cu.ft. of trenches and cuts, 2500 ft. of drifts and crosscuts, 100 ft. of shafts, 242 ft. of raises and 262 ft. of winzes. It is claimed that ore has been practically established to a depth of 350 ft. The company now owns the Weaver, Weaver No. 1, No. 2, Weaver Extension and Oversight Fraction claims, all unpatented.

American Electrochemical Society

SYNOPSIS—Day-by-day report of the twenty-fifth general meeting of the Society in New York, Apr. 16, 17 and 18.

A successful meeting of the American Electrochemical Society was held in New York last week under the auspices of the New York section, about 280 members and guests being registered for this occasion. It was the 25th general meeting and was convened at the Chemists' Club, on Apr. 16, with President E. F. Roeber in the chair. After a brief address of welcome by Lawrence Addicks, chairman of the New York section, the business of the convention was taken up. The election of officers resulted as follows: President, F. Austin Lidbury; vice-presidents, Carl Hering, W. D. Bancroft, William Brady; managers, H. C. Parmelee, W. R. Whitney, C. G. Fink; treasurer, P. G. Salom; secretary, Joseph W. Richards. At the meeting of the board of directors on the previous evening, Niagara Falls was selected as the place for the October meeting, and tentative plans were laid for holding the next spring meeting in the South. The autumn meeting in 1915 was definitely slated for San Francisco during the week of Sept. 13, in connection with the International Electrical Congress.

Thursday's Sessions

Thursday morning was devoted to a symposium on power problems in electrochemistry, at which the following papers were read: "Characteristics of Electrical Energy as Affecting Chemical industries," by C. P. Steinmetz; "Efficiency of Power Transmission vs. Utilization in Local Electrochemical Industries," by P. Sothman; "Some Economies in the Use of Electric Furnaces," by F. A. J. FitzGerald; "The Thury Electric Furnace Regulator," by Robert Turnbull. In his paper on electric-furnace economy, Mr. FitzGerald cited common errors into which many people have fallen in the effort to reach economy: (1) The exaggerated importance given to the saving of heat units generated by the electric current; (2) the inefficient and expensive machinery used for this purpose with the result of slightly increasing the efficiency of the furnace, with a greatly increased loss of energy. The fundamental error was the attempt to force too rapidly a natural evolution from the simple to the complex. Thus he noted the attempts to prevent great waste by preheating the furnace charges, utilizing CO gas to obtain preliminary reduction, etc., before operators have thoroughly worked out the simple furnace problems. He deprecated the hasty adoption of cumbersome machinery; also the exaggerated importance of the continuous process, saying that for the present continuous furnaces were in many cases more costly than well developed intermittent furnaces in which interruptions were not so expensive. Good voltage regulation, and keeping the power used close to 100% of the contracted power were simple efforts that would be better repaid than the use of complex devices and half-baked applications of efficiency ideas.

Mr. FitzGerald, in this connection, cited the analogous error in which many people have fallen in connection with the governmental production of radium. He said that many otherwise intelligent people believe: (1) That cheap radium is one of the most important things for the welfare of the human race; (2) that government meddling will result in the production of radium at a low cost. As regards the first belief, he said that we do not know the extent to which radium is applicable as a curative agent, but however important it may be, there is no doubt that it has been greatly exaggerated; as to the second belief, he said that even a superficial knowledge of the subject would show that while governmental meddling may mean selling radium at a lower price, its production will be at greatly increased cost, since in all lines of activity outside its proper functions, there was no more inefficient and expensive machine than a government.

An interesting question was brought up at the Thursday morning session by Robert Turnbull, who asked for information as to the cost of off-peak or "valley" power; this is a subject of much importance to electrochemical operations that do not require continuous power for 24 hr. per day. There was no great response from the power men to this interesting question. P. Sothman said that he had made contracts in Canada for off-peak power, but that power contracts did not mean anything unless it was explained how the power was measured and where it was measured and whether there were "gifts or no gifts" in the contract. He cited the one case where power was purchased at $28.50 if steadily used; if 80% of this power could be shut off for 1½ hr. for the three winter months, power could be supplied for $24. He thought that reductions for the use of "valley" power would, in some cases, amount to as much as 34%. In the steel industry, he thought there would be a big field for the use of off-peak power. It paid to buy off-peak power where labor costs were a small proportion of the total cost, or where the process would not be interfered with by the interruptions; but in signing a power contract, he said, one should open one's eyes twice. In the afternoon session it was brought out that at one central-station plant where power was normally purchased at $51.30 per kilowatt-year, if an electrochemical works near the generating plant desired to purchase "valley" power, it would be able to buy such current at 15 to 30% reduction in price.

Electrochemistry Outgrowing Natural Water Powers

In W. S. Horry's paper on "Power for Electric Furnace Work," it was stated that the electrochemical industries were rapidly outgrowing the available supply of electricity generated by the natural water powers, and that in the near future these industries must be carried on with power generated from coal. He alluded to the power costs, mentioned by H. M. Hobart, before the American Institute of Electrical Engineers, namely, $35 per kw. for large powers generated at 60 cycles by steam-turbine machinery and operating costs of 0.25c. per kw.-hr. at the minimum in cases where all conditions were favorable—as where electric furnaces constitute almost the entire load. In the discussion of this paper, P. M. Lincoln said that the cost of power, as presented by Mr. Hobart, was more or less ideal, and might be misleading. If one were to use 50,000 kw. and could have a 100% load, and could guarantee 20 years' use, one might attain Mr. Hobart's costs. But with new men and new processes and the usual commercial uncertainties, he did not think it

would be practical for any members to use these figures in estimating the cost of power for new enterprises.

President-elect Lidbury commented on the complexity of considerations in deciding technical problems, each phase of which must be separately studied. For example, it might be interesting to know the ratio of labor cost to power cost and to have some discussion of this subject; electrochemical plants probably began with the ratio of about 20 hp. per employee and that the upper limit might be 100 hp. per employee or possibly more, depending upon the geographical location and the nature of the process, but that it was dangerous to generalize on such problems.

A danger of generalization was that practices would be recommended without a clear statement of the limiting conditions. The complex equipment of a large plant might be profitable there, but it would not necessarily be profitable at a small plant where the ratio of output to labor might be decidedly different. Operating engineers, he said, were for the most part prejudiced in favor of simplicity, and related the comments of an engineer where an elaborate system of efficiency had been installed. After a year of operation, the efficiency expert asked the engineer how the system was working, and the engineer replied that the system was working perfectly; the expert then asked how business was coming in, to which the engineer replied: "Oh! Business? Well, I don't think we've had much business. You see we've been so busy with that efficiency system that we've had no time to do any business."

C. P. Steinmetz said that in the ultimate analysis attempts to get high power factor and eliminate reactance was not always productive of good results; he thought it was better to try for constant power instead of endeavoring to get too high a power factor, and suggested that one should not try for a power factor much above 80%. Papers on the power problem in the electrolytic deposition of metals, by Lawrence Addicks and H. E. Longwell, and on "Sources of Direct Current for Electrochemical Industries," by F. D. Newbury, were read by title.

Bureau of Mines Explains Its Radium Position

Before the close of the morning session, the president read a letter from Director J. A. Holmes, of the U. S. Bureau of Mines, expressing regret that business detained him in Washington; in anticipation of attacks on the Bureau's activity in the radium industry, he explained that the Bureau was merely acting for the Government as its chemist or engineer, just as a consulting engineer would for any clients. He said that the Government needed radium for use in its hospitals, and that the quantity necessary for such use would, at present prices, cost between $3,000,000 and $4,000,000; the chemists and engineers of the Bureau estimated that this could be produced at about one-half existing market price. Doctor Holmes wrote that this was the extent of the governmental activity contemplated by the Bureau, and disclaimed much of the proposed legislation on this subject at Washington.

The Thursday afternoon session was begun with an illustrated lecture by Prof. W. D. Bancroft, on "Electrolytic Flames." Doctor Bancroft called attention to the fact that metals do not give the same flame color for all of their salts. He also pointed out that many reactions take place in flames, and these may cause the emission of different colors; tin changed to stannous salt gave a carmine color, but stannous salt changed to stannic gave a green color. Different color effects were found in different flames, such as the hydrochlorine, oxyacetylene and the ordinary bunsen flame. Following this lecture, C. A. Hansen read his paper on "Electrical Steel Castings," and also the paper of E. B. Clarke on "Electric Furnaces for Steel Making." Most of the afternoon was occupied in the discussion of these papers. E. P. Humbert, in commenting on the use of Heroult furnaces, said that for certain purposes, electric steel was cheaper than crucible steel; no reducers such as ferrosilicon or aluminum were necessary in the electric furnace. K. G. Frank said that electric steel had found a more ready reception in Germany than here and had proved satisfactory; he reported that the tonnage of electric steel had increased from 75,000 tons in 1912 to 101,000 tons in 1913. H. Hess, who had had some experience in the operation of Stassano furnaces, said that it was a common impression that the horizontal arc was harder on the roof than on other parts of the furnace. This impression he had found to be incorrect, as the roof of his furnace had never shown signs of distress until the sides were affected.

C. A. Hansen, in discussing Mr. Clarke's paper, said that in operation arc furnaces ran smoothly after a film of slag was once obtained, and hence synchronous condensers and similar apparatus which many people were trying to sell electric-furnace users, were unnecessary after the first 5 or 10 min.; the Stassano furnace, however, was independent of the slag. C. G. Schluederberg spoke of the Heroult furnace he had seen at Latrobe, Penn. This furnace was making a manganese-steel product and had an excellent load curve, approximately straight after three-quarters of an hour. Interlacing the leads gave a power factor of practically unity. Mr. Hansen gave the cost of electric-steel castings at $60 to $80 per ton when made in a ½-ton furnace; $23 to $26 when made in a 5-ton furnace, and a cost of approximately $21, when made in a 20-ton furnace; his opinion was that at present a 5-ton casting furnace was the most practical unit.

A statement that electric-steel castings were superior to other steel castings, brought out a sharp disclaimer from Mr. Hess, who said that this might be so, but that he had been unable to convince his customer; he thought that the advantage of the electric-steel furnace was that the quality of the product could be more definitely foretold, but that steels of the same composition would have the same qualities. Someone suggested that steel made in an alternating furnace might have a structural advantage from the shaking effect. H. D. Hibbard thought that consideration should be given to the hearths upon which the steel was made; for example, the electric steel was made on a basic hearth, crucible steel on a graphite hearth and openhearth steel on a hearth containing a large amount of oxide of iron. The papers of G. C. Stone on "Improvements in the Metallurgy of Zinc"; "Electric Zinc Smelting," by W. R. Ingalls, and "Advantages of Southeastern Alaska for Hydro-Electrochemical Industries," by W. P. Lass, were read by title.

The Presidential Address

The presidential address of Dr. E. F. Roeber was on "Some Economic and Aesthetic Aspects of Electrochemistry." Doctor Roeber contended that there was beauty in electrochemistry, that the research electrochemists in

working out a new process proceeds along the same lines as the sculptor, painter or poet. The artist must take nature as it is, but for his work he takes from nature only what his imagination tells him is essential to the idea he has in mind. This was done when artificial graphite superior to the natural graphite was made in the electric furnace, when aluminum was reduced from its oxide, and calcium carbide from lime and coke. He pointed out that it was the mission of the electrochemist to improve upon nature and to prevent waste, that this had already been accomplished in many fields. He referred to the waste of energy in our water falls and said that to preserve these water falls after we had discovered how to utilize them, was an economic waste. The element of bigness, which was an element of beauty to our ancestors in viewing Niagara Falls, has become to us the reverse, emphasizing the almost criminal negligence in letting waste on such a tremendous scale go on. Following the presidential address, the guests were entertained by a smoker, which kept most of the members at the Chemists' Club until midnight.

Trip Down New York Harbor

Friday was given up to visiting metallurgical plants in New York harbor, and visits were made to the works of the American Smelting & Refining Co., at Maurer, N. J., and the adjoining United Lead Co., where the production of lead shot and sheet-lead products were viewed. Some of the visitors then went to the Sewaren plant of the Electric Smelting & Aluminum Co., and others visited the wire-drawing mills of the Waclark Wire Co., at Bayway. For the purpose of visiting these plants the New York section had chartered the steamer "Isabel," which made a convenient and pleasant means of reaching these harbor plants, and promoted social intercourse between the visitors in a manner much superior to the usual trips by trolley or railroad. The committee in charge was favored by beautiful weather, which added to the lavish entertainment provided on the boat; this included music and dancing, a luncheon and tea.

Saturday morning's session was held jointly with the Electroplater's Society. The feature of the occasion was E. A. Cappelen Smith's lecture on the Chuquicamata experimental work, of which we present an almost verbatim report below. The papers were: "Hydroelectric Treatment of Copper Ores," R. R. Goodrich; "Leaching of Copper Tailings," R. Gahl; "Metal Inventory in an Electrolytic Copper Refinery," R. W. Deacon; "Electrolytic Zinc," J. W. Richards; "Addition Agents in Zinc Deposition from a Sulphate Solution," O. P. Watts and A. C. Shape; "Electrodeposition of Cadmium," F. C. Mathers and H. M. Marble; "Electrodeposition of Nickel," C. W. Bennett, H. C. Kenny and R. P. Dugliss; "Electrolytic Deposition of Brass on a Rotating Cathode," C. W. Bennett and A. W. Davison; "A New Method for the Determination of Free Cyanide in Electroplating Solutions," G. E. F. Lundell. Lunch was served at the Columbia University Commons.

On Saturday afternoon, Prof. Edwin F. Northrup of Princeton, gave an illustrated lecture on "Electric Conduction at High Temperatures and Methods of Measurement." He said that he was convinced that practically every metal lost its function as a conductor of electricity when heated to a temperature of 1600° to 1700° C. This was followed by a paper by F. A. J. FitzGerald on some electrical properties of silver sulphide as applied in the thermoscope, or automatic fire alarm invented by Eugene Garretson. Dr. R. Beutner, of the Rockefeller Institute, discussed a "New Cell Arrangement for the Direct Determination of Free Energy," and E. L. Marshall spoke of a "New Railway Track Cell," developed to meet the demand of railroads for a cell with a low voltage and a high internal resistance. All other papers were read by title only to enable the members to attend the lecture on "Radio-Activity," at Fayerweather Hall, by Professor Rutherford, of Manchester University. The convention ended on Saturday evening with a banquet, followed by dancing, at the Chemists' Club.

Leaching at Chuquicamata

The Chuquicamata mine, Chile, lies about 165 miles by railroad from Antofagasta, 82 miles in a bee line from the coast, and 9500 ft. above sea level. The deposit is in the so called atacamite district, and has been mined for years by the natives, so that in the old workings are found stone utensils, hammers, etc. The deposit is a brochantite mineral contained in cleavages of granodiorite, mixed in part with chalcanthite and atacamite, and with a deposit of salt. Some *caliche* containing nitrates is present in the upper part of the orebody.

The so called Llampera orebody is about 8000 ft. long by 500 ft. wide. Numerous tunnels have been run through the orebody, and some opencuts made. Raises have been made from the tunnels almost to the surface, only a shell 8 to 12 in. thick being left in places. Seven shafts have also been sunk in the deposits, the deepest, 110 m. deep. The natives formerly worked these deposits by crushing the ore and screening the product, and smelting the screenings, which carried the brittle copper minerals.

The property is held by the Chile Exploration Co., promoted by A. C. Burrage, of Boston, and M. Guggenheim's Sons. It has been explored by churn drilling and an orebody of over 200,000,000 tons developed, but most of the drill holes were stopped in ore. Some drill holes have been sunk at a considerable distance west of the Llampera, which encountered chalcocite and chalcopyrite after penetrating 300 or 400 ft. of capping. The indications are that Chuquicamata is the largest known copper deposit.

It was formerly assumed that the deposit was atacamite, which could not be profitably treated by established methods because of the siliceous nature of the ore and the absence of sulphides and water, and on account of the volatilization of the cuprous chloride. However, it was eventually shown the ore was brochantite and salt, and not atacamite (oxychloride). Brochantite is insoluble in water, but readily soluble in dilute sulphuric acid.

About 600 tons of the ore, an average sample, so far as could be taken, were shipped to New York for experiment, first on a laboratory scale, then in a 2-ton per day plant. The problems to be solved were: Solubility of the copper in dilute sulphuric acid; the chemicals required; the impurities dissolved; the electrolytic precipitation.

It was quickly found that the copper was readily soluble in cold dilute sulphuric acid, and that only coarse crushing was required. The acid from the ore (oxysulphate) more than made up the losses of the acid used up in dissolving other materials than copper (mainly CaO), and the waste of solution in the discarded residue.

The 2-ton experimental plant was run as a self-contained unit, leaching the ore, washing, purifying and electrolyzing the solutions, and leaching the following lots of ore with the previously electrolyzed solution.

It was shown in running 131 charges, that no harmful impurities except chlorine had a tendency to accumulate in solution. This is from the salt which is practically confined to the upper 50 ft., and principally to the upper 25 ft. of the orebody. The same solution was used on the whole 131 charges, and at the end contained: Cu, 50 grams per liter; Fe, 3.7; Mn, 0.7; P, 0.06; As, Sb, none; CaO, 0.8; MgO, 3.3; Al_2O_3, 1.61; Na_2O, 21.6; K_2O, 5.0; SO_3, 122.7; Cl, 11.5; NO_3, 4.0 grams per liter. The results on the last charge were as good as those on the first. The average extraction was 90.98 per cent.

Following the experiments in the 2-ton plant, a leaching tank was built of concrete, 4x6x15 ft. deep, holding 15 tons of ore, allowing the use of the full height of ore column since adopted for Chuquicamata. This gave equally good results, showing this height of column was feasible.

A wooden filter bottom with coco matting has been employed in both the 2-ton and 15-ton tanks, although a great number of leachings were made without any filter bottom, simply placing a piece of coco matting over the outflow pipe. The leachings were made without extraneous heat. Washing was by the "piston" method, with a final water wash, and the final tailings carried about 12% moisture and 0.04% Cu. The leaching results to date, based on weighing and sampling heads and tails, have been: In the 100-kg. plant, 90.62%; in the 2-ton plant, 131 charges, 90.99%; in the 15-ton plant, 25 charges, 90.96%. Based on head samples and electrolytic copper recovered, the extraction is 89.6%. The discrepancy lies in solutions not inventoried, samples removed, and the spills incidental to small-scale working.

Ore More Than Supplies Acid Necessary

The gain in acid in the experimental work amounts to about 9 lb. H_2SO_4 per ton of ore treated. Since this was made treating ore which averages higher in chlorine than even the average of the upper layers of the ore, and the greatest loss of acid is in forming Na_2SO_4, in final practice the acid gain should exceed this.

The main impurity in the solutions is, as said, chlorine. It was at first thought desirable to electrolyze direct the chlorine-bearing solutions, which was feasible in covered tanks, maintaining a slight vacuum, and drawing off the gas through fans. However, only a part of the chlorine was thus eliminated, an appreciable quantity being deposited with the cathode copper.

Further experiments showed the feasibility of eliminating the chlorine from solution as cuprous chloride, by treatment with shot copper. Cuprous chloride formed on metallic copper sticks tight to copper shot, and it is necessary to present constantly clean surfaces to maintain effective precipitation. After trying several methods it was decided that the best apparatus for this purpose would be revolving drums similar to tube mills, containing the shot copper. Cuprous oxide also works well as a precipitant, but at a lower efficiency, even after allowing for the theoretical difference.

It is the intention to filter press the cuprous-chloride precipitate, mix the cake with limestone and coke, and smelt. A liquid calcium-chloride slag is obtained practically free from copper, and there is no loss of cuprous chloride by volatilization.

The solution, freed from chlorine, is electrolyzed, using copper starting-sheet cathodes and fused magnetite anodes [see article on p. 870—Editor.]. The cathodes are practically free from chlorine, and are free from arsenic and antimony, as these are not in the electrolyte. The solution will enter the head tank containing about 5% Cu, and 2½ to 3% free acid, and will leave the last tank of the cascade at about 1.5% Cu and 8 to 9% free acid. Within these limits it is always possible to produce a good, hard cathode, equal to or better than the usual standard.

Plant to Treat 10,000 Tons of Ore per Day

The first unit of the Chuquicamata plant is designed to treat 10,000 tons of ore per day. The electrolytic refinery will have a capacity of 335,000 lb. per day. The ore will be mined by steam shovels. The ore will be taken to the mill, about 2½ miles away, in standard-gage 60-ton cars. At the plant it will first pass through gyratory crushers, thence through Symons disk crusher, and finally through Garfield rolls, until a ¼-in. mesh product is obtained. After sampling, the ore will go by conveyor belt to the leaching tanks, of which there will be six, end to end, 110 ft. wide, 160 ft. long and 15 ft. high.

The belt will be discharged into the leaching tanks by an electric traveling bridge. The leached and washed residue will be removed by a 15-ton grab bucket traveling on an unloading bridge, and after sampling, will be delivered to a conveyor belt for disposal to the tailings dump.

The tanks are being built of heavily reinforced concrete, and will be lined with mastic asphalt 1½ in. thick. This lining is made of one part Trinidad asphalt, to which is added three parts crushed quartz or granite. The lining has been in use in the experimental plant over a year, both in the leaching and electrolytic tanks, and not a single leak has developed. It does not soften at 50° C., but probably softens between 50 and 70° C. In one case a 250-lb. cathode was dropped 5 ft., so that one of its sharp corners struck the tank bottom. In this case, a piece of lining only about ⅛ in. thick and 2 in. in diameter was broken out, so the lining also seems to stand up to physical tests. It is unaffected either by strong or weak acid solutions. Its development is due to the Vulcanite Paving Co., of Philadelphia.

From the bottom of the leaching tanks the solution will be removed through eight 6-in. openings evenly spaced over the tanks. A filter bottom, consisting of 2-in. planks with a layer of coco matting between, will be employed. This will be raised 4 in. above the tank bottom.

For the main solution circuits, 9-in. and 16-in. lead-lined iron pipe will be used. Open-boot horizontal centrifugal pumps, made of type metal, will be used for pumping the solutions. The pumps will have a capacity of 550 cu.ft. per min., elevating to a height of 60 ft.

The leaching cycle will be approximately six days, of which one day will be occupied in filling the tank, two days in leaching, two days in washing and draining and one day in discharging. The solutions will be conducted to the leaching tanks by gravity from nine solution-storage tanks: Two tanks, 12x130x150 ft.; seven tanks, 12x70x150 feet.

From the strong-solution tank, the solution will flow by gravity through the dechlorinating plant, consisting of twenty-one 30x4-ft. inside diameter revolving steel drums lined with duriron. These drums will be half full of shot copper. From these drums the solution, containing the cuprous chloride in suspension, will flow to seven Dorr thickeners made of concrete and lined with mastic asphalt. The clear solution overflowing will travel by gravity to the electrolytic refinery, while the thickened cuprous chloride, together with approximately 1% of the original solution, will go to filter presses.

The electrolytic refinery will consist of 510 electrolytic tanks 19 ft. long, 3 ft. 6 in. wide, 4 ft. 10 in. deep. They will be made of concrete, lined with mastic asphalt, and will be set through the floor, having inspection aisles underneath and a concrete working platform between the rows of tanks. The tank house will be of concrete and steel construction.

Of the 510 tanks, 30 will be used for making cathode starting sheets, and the balance, 480 tanks, will be used for electrolytic deposition of the copper from solutions. The tanks will be arranged in five electrical circuits, with 96 tanks to a circuit, and will be divided into 30 solution circuits, the solution in each circuit flowing through 16 tanks placed in cascade. The anodes, made of magnetite, will be 5 in. wide, 2 in. thick and 4 ft. long, five to a cross rod. The cathodes will be 3 ft. wide by 4 ft. deep.

The spent electrolyte, containing about 1.5% copper, will be pumped back to the storage tanks to be used for leaching subsequent batches of ore. The cuprous chloride from the dechlorination plant will be smelted and cast into shot copper for use in the dechlorinating drums as outlined above.

The power plant will consist of a primary power station at the coast, using oil-fired Babcock & Wilcox boilers driving four steam turbines connected to four 10,000-kw. alternating-current generators. The current will be transmitted 85 miles at 100,000 volts to a substation located at the mill site. The substation for the electrolytic refinery will consist of seven motor-generator sets, each of 2500 kw. capacity.

In summing up, Mr. Smith said:

"It has been our endeavor in conducting the experiments to operate each part of the apparatus on what we might term a cross-section scale of the plant to be erected at Chuquicamata. We have thus used a leaching tank with the full depth of ore column, the important point in leaching, and we have used the same material for filter bottoms as will be used in the large plant. We have had full-size solution valves installed. In connection with the dechlorinating plant we built a full cross-section drum. In the electrolytic tanks we have been operating with full-size cathodes and anodes. In short, the idea has been to approach in our experiments, as far as possible, operating conditions similar to those which we will have in the large plant." Mr. Smith in conclusion expressed his appreciation of the work of three of his assistants, C. A. Rose, Leonard M. Green and M. R. Thompson.

Aerial Tram to Transport Mine Filling

By G. D. Delprat*

An aërial tramway of the Bleichert type was installed by the Broken Hill Proprietary Co., Ltd., to convey waste material on the surface to the various chutes into its mine at Broken Hill and that of its neighbor, the Broken Hill Proprietary Block 10 Co.; this material is used to fill depleted stopes underground.

The tailings used for the purpose are carried by conveyor belts from the zinc-flotation plant across an open-cut, and are discharged from a boom over a crater-shaped mill hole in the tailing dump. From the bottom of this, three hoppers are filled, as shown in Fig. 1, and each of these in turn feeds a conveyor belt 20 in. wide, the flow being regulated by a sliding door. The conveyor belt carries the material to a bin from which the buckets of the aërial tram are filled.

The total length of the tram is 2950 ft., with one angle of 25° at a distance of 620 ft. from the loading station; the greatest span is 1177 ft.; the material is tipped at four different points. The steepest grade of the cable is 38°, and the difference in level from the highest point of the ropeway to the collar of the lowest mine chute is 270 feet.

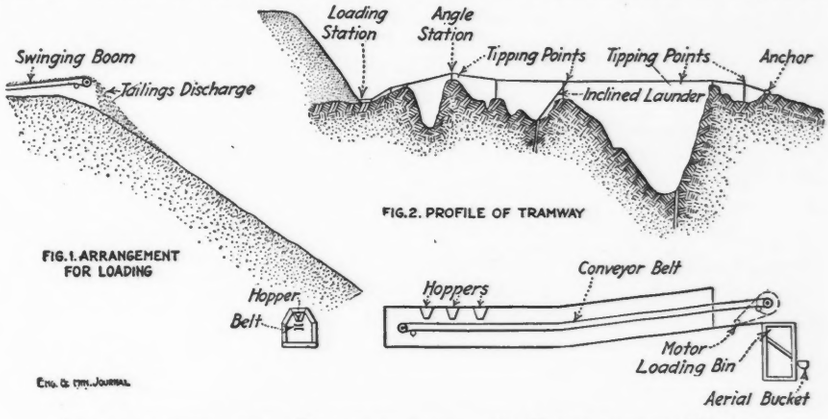


FIG. 1. ARRANGEMENT FOR LOADING

FIG. 2. PROFILE OF TRAMWAY

Arrangements for Transporting and Discharging Tailings for Filling

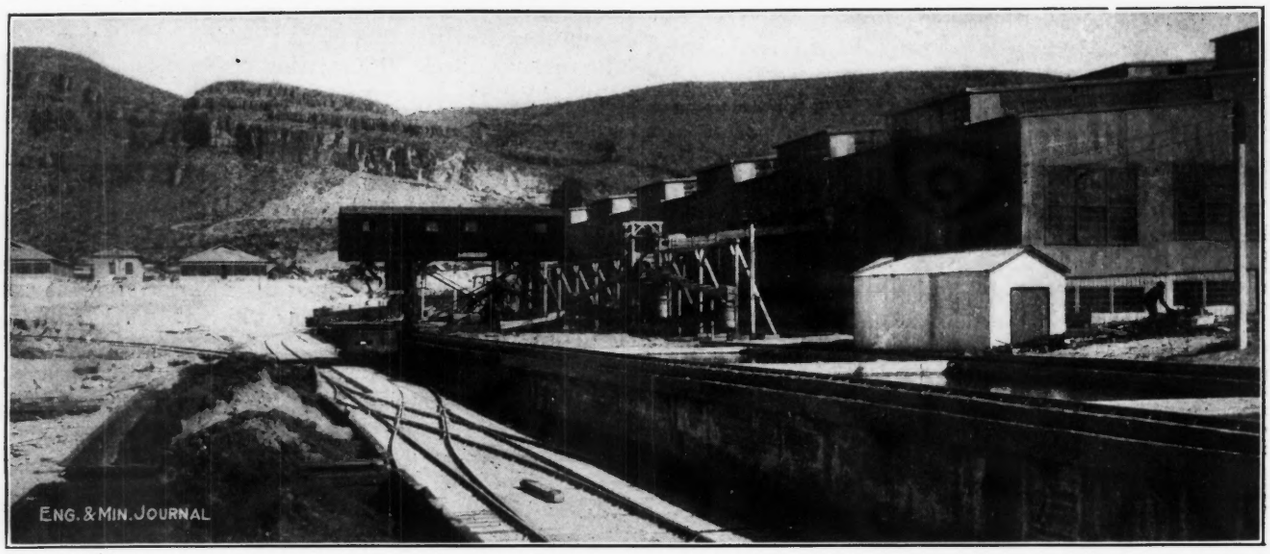
These features are illustrated in Fig. 2. The foundations of the trestle supports are of concrete; the trestles themselves are of timber, the highest being 55 ft. above the surface of the ground.

The track cables are of lock-coil steel, the loaded one being 1½ in. in diameter and the other ⅞ in.; the haulage line is of flexible wire rope $\frac{9}{16}$ in. in diameter. The buckets hold 12 cwt. each of tailings, and when spaced 180 ft., traveling at a rate of 325 ft. per min., convey to the various passes about 450 tons per shift of eight hours.

Tension boxes loaded with sand are used at the ends of the cables, that for the loaded cable weighing 18¾ tons, and that for the light cable 6¼ tons, and one at the loading station, connected to a sliding rope sheave of the haulage rope, weighing 1 ton. The installation is driven by a 3-hp. motor through bevel gearing to a main vertical shaft carrying the haulage rope sheave; the actual horsepower required is about 20, as an average.

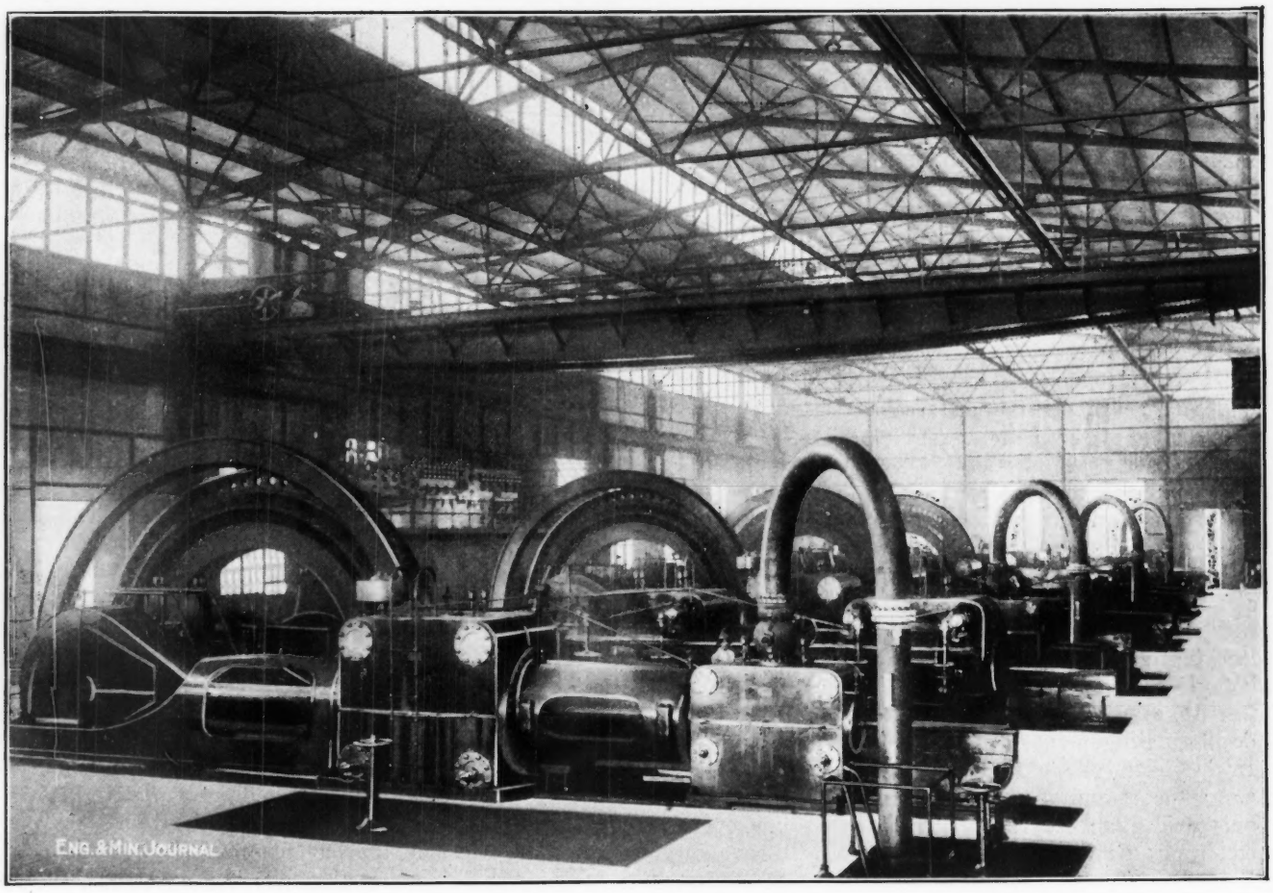
*General manager, Broken Hill Proprietary Co., Ltd., Melbourne, Victoria.

Ray Consolidated Concentrator



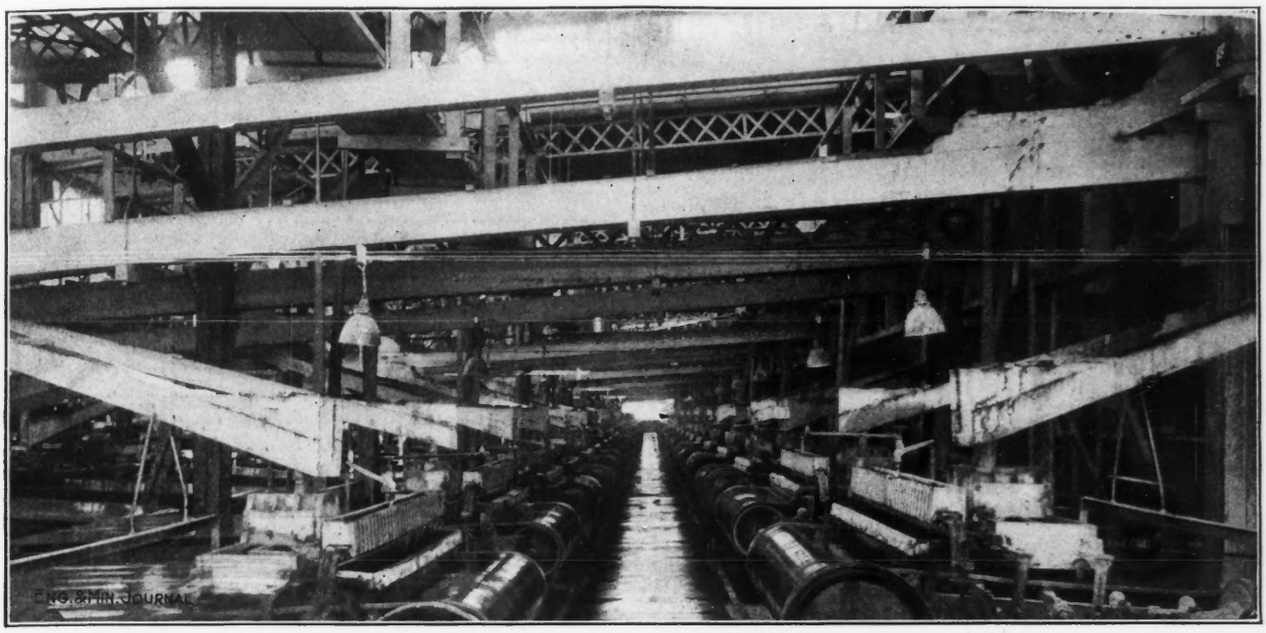
THE CONCENTRATE BINS AT THE CONCENTRATOR OF THE RAY CONSOLIDATED COPPER CO., AT HAYDEN, ARIZ.

The concentrates are loaded into railroad cars from the elevated structure overhanging the track. The concentrator has a nominal capacity of 8000 tons of ore per day. A supplement of a later issue of the "Journal" will show the entire works at Hayden, including mill and smelting plant.



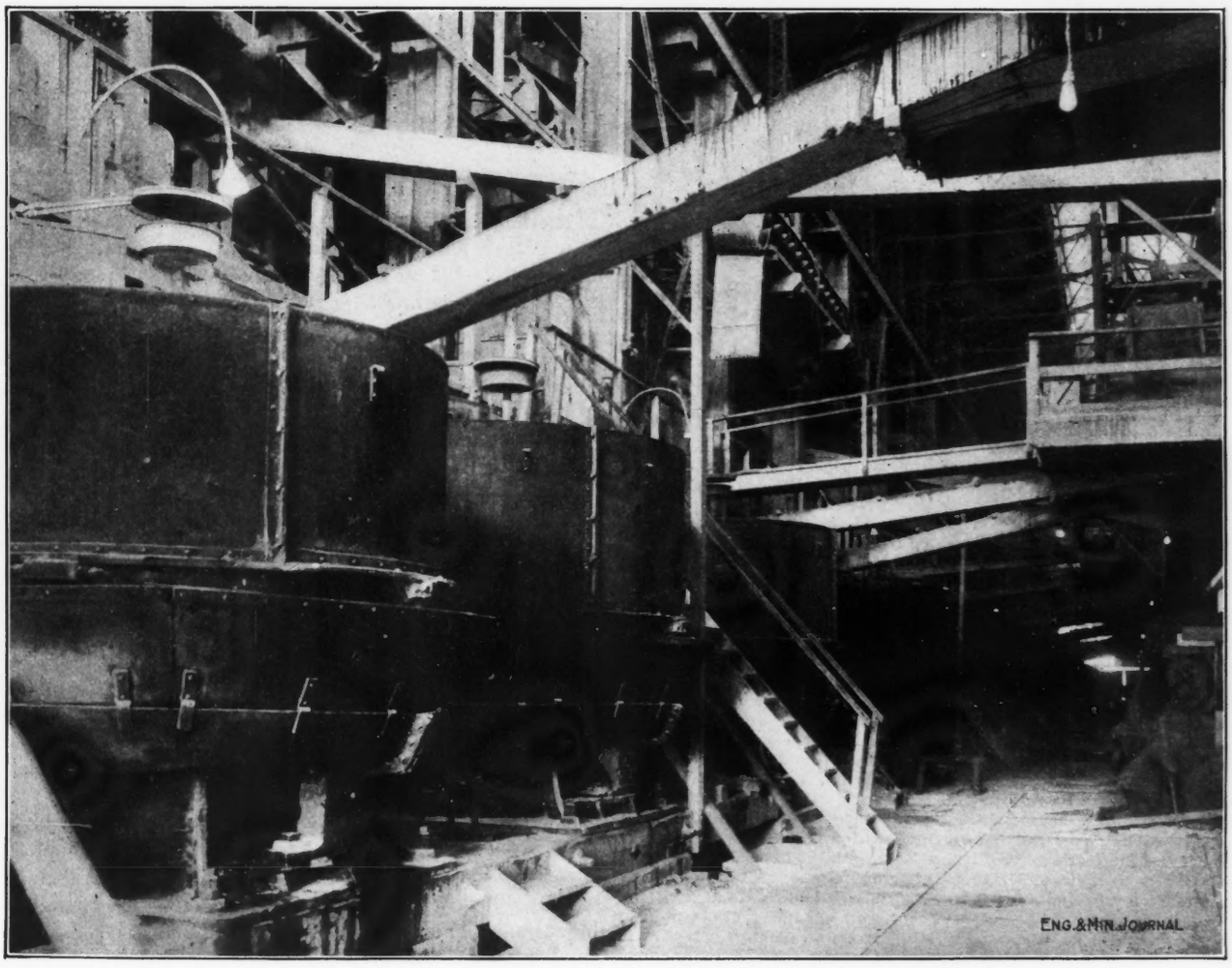
INTERIOR OF THE HAYDEN POWER PLANT, SHOWING FOUR 1750-KW., ALLIS-CHALMERS GENERATORS

This plant supplies electricity for the entire Ray property. The triple-expansion, direct-connected engines are supplied with steam by water-tube oil-heated boilers.



VIEW SHOWING A PORTION OF THE VANNER ROOM

The mill is built in eight sections, each of 1000 tons capacity, so designed that it may be enlarged. The mill equipment comprises rolls, Garfield mills, impact screens, Garfield and Wilfley tables, and vanners. The ore is crushed to 1 in. at the mine.



GARFIELD CHILEAN MILLS, OF WHICH THERE ARE 24 IN THE RAY MILL

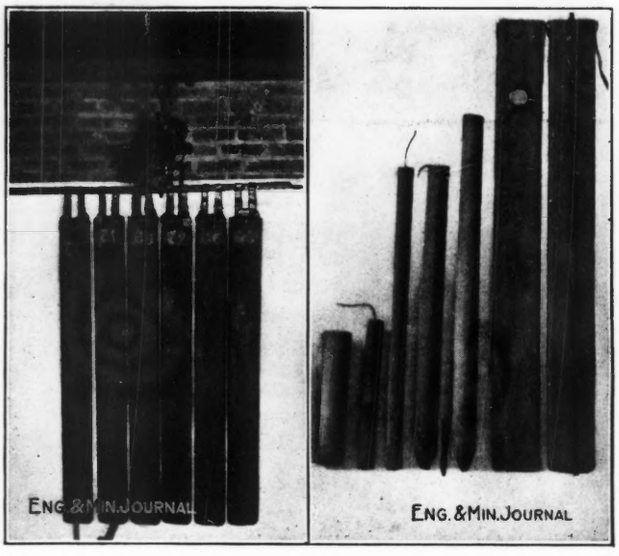
The method of treatment of the ore, and design and layout of the mill are essentially the same as the Magna mill of the Utah Copper Co.

Magnetite Anodes

We have several times mentioned the new development of magnetite electrodes, unaffected by oxygen, chlorine, or SO_4 ions. In the accompanying illustration, we are enabled to show six of the large anodes ready to hang in the tanks of the Chile Exploration Co., and on the right, a series of electrodes showing their development by the Chemische Fabrik Griesheim Electron, of Frankfort-on-Main, along the lines indicated by E. A. Cappelen Smith, from the small anodes first made, to the present anode, 50x120 mm. in cross-section, and about 4 ft. long.

The process of manufacture of these anodes from fused magnetite is kept secret, but the following is taken from H. Speeketer's U. S. pat. 931,513. This patent is assigned to the Griesheim works:

I have found that when Fe_2O_3 is melted, oxygen escapes and Fe_3O_4, together with a small proportion of FeO are formed. The presence of this FeO is objectionable for two



FUSED MAGNETITE ANODES

On the left is seen a set ready for hanging in the tank. On the right is shown the development under E. A. C. Smith's direction, from the original round type to the rectangular Chuquicamata anodes.

reasons—first, it causes the electrodes to break on the setting of the melt for the reason that the protoxide does not crystallize uniformly with the magnetic oxide, second, the product will not resist chlorine or anodic actions during electrolysis, and is dissolved by them so that after a certain time the electrodes become ineffective. To obviate these defects and to convert the FeO, formed during the melting of the Fe_2O_3 as aforesaid into Fe_3O_4 I add to the mixture, while in a molten state, a small quantity of unmelted, finely pulverized Fe_2O_3, which unites with the FeO to form Fe_3O_4, so that the entire mixture will be of the same composition. The proportion of pulverized iron oxide must be at least sufficient to convert the whole of the existing protoxide into magnetic iron oxide, but an excess of the Fe_2O_3 is not objectionable because it dissolves in the melt in a uniform manner and crystallizes homogeneously. The oxide of iron (Fe_2O_3) added to the molten mixture being in an unmelted condition, and such addition preferably occurring when the mixture is removed from the furnace, is not heated sufficiently to form the objectionable FeO. In lieu of iron oxide other oxides which combine with ferrous oxide (FeO) to form a compound which dissolves in magnetic oxide (Fe_3O_4) to form a homogeneous crystallizing melt, such, for instance, as sesquioxide of chromium (Cr_2O_3), which combines with FeO to form iron chromite ($FeO.Cr_2O_3$), or sesquioxide of manganese (Mn_2O_3), which combines to form iron manganite ($FeO.Mn_2O_3$), may be used. The homogeneous crystallizing melt thus produced is poured into molds, closed at the bottom.

The mass solidifies gradually from the outside so that a rigid layer is first formed in the exterior, which layer gradually increases in thickness toward the center of the mass. When such layer has reached the desired thickness, the remainder of the fluid contents of the mold is returned to the melted vessel to be used for a new charge. The mold is then opened and the electrode, which is closed at its lower end, is removed and allowed to cool slowly. The cooled electrode may for the purpose of increasing its conductivity be provided on its inside with a coating of metal applied by electro-deposition or otherwise, or a bar or rod of good conducting metal, such, for instance, as copper, nickel, or the like, may be introduced into the central part of the mass, while it is still liquid, so that the bar or rod will form an integral part of the electrode when the mass is completely solidified.

In practice, however, the weight of a large anode made with a solid bar forming the core would be too great, so the anodes are cast hollow, as described in the patent, and the interior of the anode is electroplated heavily, and copper contact strips cemented on. The anode walls are about ¼ in. thick. These contact strips may be seen coming from the top of the anodes in the illustration. This plating must be heavy and uniform throughout the length of the anode, otherwise too great a proportion of the current goes out through the top of the anode, giving excessive current density at the top of the cathode. The anode weighs 35 lb., the joint will stand a pull of about 350 pounds.

It is understood that a small amount of silica is beneficial in making these electrodes, so that in practice calcined Rio Tinto cinder is said to be used as the basis of them. Posibly this silica is effective in combining with the FeO. Contrary to popular belief, magnetite is said to melt at easily attained temperatures, about 1350° C. Although highly resistant to chemical corrosion, the anodes are extremely subject to sudden alterations in temperature. Thus, in the early experiments, Mr. Smith tried fastening in the contact strips by plugging the anode with cotton waste a little below the top, then pouring in molten lead. After a few weeks, the anodes developed hair cracks, and a little later over 25% had broken from this cause. They will, however, stand hot asphalt, or the ordinary variations in tank temperature. They are also brittle, and must be handled with great care. Their life is determined by their mechanical properties, and not by chemical corrosion.

It is planned to use about 90,000 of these anodes in the precipitating tanks of the Chile Exploration Co., at Chuquicamata. The Chile Exploration Co., 165 Broadway, will act as American agent for the Griesheim works, and inquiries concerning these anodes may be directed to it.

Anaconda Absorbs International Smelting

The Anaconda Copper Mining Co. will take over all the properties of the International Smelting & Refining Co., exchanging 3.3 shares of Anaconda for each share of International. New financing was necessary to complete the smelting plant at Miami, Ariz., and in the present money market, it was judged inadvisable to attempt to float any new stock offering. In addition it is understood the New Jersey laws regarding holding companies have greatly limited the International's power to extend its business. The plants taken over will be the Tooele, Utah, smelting plant; the East Chicago, Ind., lead refinery, and the Raritan Copper Works, Perth Amboy, N. J. International has paid $2 quarterly since it began operations.

Correspondence and Discussion

Precipitation of Copper-Leaching Solutions

Noting the editorial in the JOURNAL of Dec. 27, 1913, and the article on copper leaching in the JOURNAL of Jan. 10, 1914, I wish to offer the following comments regarding the precipitation of the leached copper.

Of course the method of treatment for any ore must be governed by the character of that ore and the local conditions under which the operations are conducted. I think it is generally conceded that the commercial possibilities for effecting solution of copper from ore have been narrowed down to leaching with sulphuric acid and roasting with common salt, even with the "sulphatizing roast" the addition of salt will prove advantageous and insure good results. In every case, the use of reducible salts for solvents, such as ferric sulphate, ferric chloride, cupric chloride, etc., with the idea of precipitating the copper electrolytically and regenerating the solvent, has been disappointing even in the hands of skilled metallurgists. The same may be said of sulphurous acid and ammonia as solvents.

Acid leaching offers the advantages of coarse crushing, rapid percolation, the treatment of raw ore and sometimes the possibilities of electrolytic precipitation with the consequent regeneration of the lixiviant. Many leachable ores however contain more or less copper as sulphide and sometimes appreciable quantities of precious metal, both of which are not recoverable with sulphuric acid solutions alone. In many orebodies, there is also a transition zone between the oxidized and sulphide ores where there is considerable ore containing about equal quantities of oxidized and sulphide mineral. This material would sustain a severe loss from either acid leaching or mechanical concentration alone and probably from both combined, so the preferable method would, no doubt, be roasting with salt, other conditions being favorable.

This brings us to the question of precipitation or recovery of copper from solution. While there is some difference of opinion on this point, it seems to me, it is a question to be decided wholly by the problem involved and not by the relative merits of any method of precipitation.

Electrolysis, at first sight, appears most attractive in spite of its expensive installation, because most of the copper can be recovered in refined condition ready for the market and the lixiviant can be regenerated to a large extent. The two important problems of power cost and insoluble anodes are solvable within commercial limits. Not all ores, however, are of such a character as to yield lixiviums favorable to this method of precipitation. Many of them contain iron which passes into solution as readily as the copper with either weak or strong acid solutions. Appreciable quantities of iron in the electrolyte, as is well known, prohibits the use of this method of precipitation under ordinary conditions. Manganese might act in a similar manner. Arsenic and antimony are also troublesome but, if present, usually occur in very small quantities.

Without going into details, "the only way out" that is feasible in large-scale operations is the use of sulphur dioxide in the electrolyte as a depolarizer. Theoretically this will regenerate 3 lb. of acid for each pound of copper deposited. In experimental practice, 2 lb. has been the maximum obtained owing to difficulties in manipulation. A certain amount of electromotive force is also generated in the direction of the current used which reduces the power consumption. If much iron and alumina pass into solution with the copper, however, these advantages are more apparent than real, for the acid combining with the iron and alumina is not recovered and considerable additional acid will have to be supplied from an acid plant to meet their requirements. This method of rendering the iron in the electrolyte innocuous has not passed the experimental stage. The mechanical difficulties in making the copper lixiviums absorb sufficient SO_2 gas and at the same time keeping such an electrolytic plant habitable for human beings have not been solved and some acid makers do not give much encouragement for its success.

Diaphragms have been tried frequently to overcome the difficulty with iron salts, but the results have been disappointing and when all of the conditions connected with a large leaching plant are considered, their impracticability is at once apparent.

Assuming however, for the sake of argument, that one of these two methods can be made commercially successful, the relatively large quantities of iron and alumina going into solution at each cycle of the lixiviant will make it necessary to discard the entire lixiviant in a short time or a portion of it at each cycle, in which the copper will have to be precipitated by a chemical reagent. This discarded lixivium will either be strongly acid or, if neutralized by fresh ore, will carry its full quota of copper. In all probability, some of the first wash waters will have to be treated in like manner by a chemical reagent to avoid the accumulation of solution.

The only other methods for electrolyzing iron-bearing lixiviums involve the removal of the iron by precipitation or crystallization. It is cheaper to precipitate the copper by similar methods.

In ores of this character, the soluble iron is derived principally from the oxidized pyrite or chalcopyrite, which, owing to the conditions under which it was formed, is similar to an artificial oxide precipitate or a basic salt of iron and is readily soluble in acid, both as ferrous and ferric salts. Alumina is likewise, though less readily, soluble in acid, due to the kaolinization of the gangue.

Prevention is always better than doctoring, therefore it might be better to roast such ores before leaching, even though they contain no sulphide minerals, and thereby render both iron and alumina relatively insoluble in the acid lixiviant, avoid loss of copper by colloid absorption and obtain a solution that could be electrolyzed without

difficulty. This, on the other hand, brings up the danger of forming some insoluble ferrites of copper. Moreover if roasting is done for acid leaching the arithmetical question arises—why not grind the ore to the required fineness, roast with salt, and thus obtain a higher extraction of the copper without the use of acid and recover any small amount of precious metal that may be in the ore?

I have been informed by an engineer who has experimented extensively on electrolytic precipitation, using SO_2 as a depolarizer, that the results obtained from this method on chloride solutions are very unsatisfactory.

Of the chemical reagents available, metallic iron in some form is undoubtedly the most satisfactory from every point of view. Many seem to think there is no iron but scrap iron for copper precipitation, which of course is not available in sufficient quantities for leaching plants as now proposed. The Rio Tinto company has used pig iron for this purpose for years and there are few places in the United States where iron in pig or granulated form cannot be put on the ground at a figure that is not prohibitive. It is entirely feasible also to produce sponge iron, either from iron ore or from the calcines from roasting furnaces at a cost considerably below that of pig iron. This form of iron is an ideal precipitant.

Each ore is therefore a problem in itself and it is just as much a waste of time, money and energy to apply methods that are palpably not adapted to any one ore, simply because the other fellow finds them adapted to his ore, as it is to invent concentrating machines to recover colloid minerals by gravity.

STUART CROASDALE.

Denver, Colo., March 7, 1914.

Records in All-Steel Dredge Construction

In the JOURNAL of Mar. 21, 1914, Lewis H. Eddy, of California, takes exception to my corrections of his statements in the JOURNAL of Dec. 27, 1913, on all-steel dredge construction. In making his claim of a record for construction work, Mr. Eddy should have been more definite, and qualified his statement with the fact that it was only a record for that particular size of dredge.

I gave the names of the firms connected with the subject of my article, merely that he could look up and check the statements I made, as at the time the contracts were let, and for a year following, articles describing this work appeared in most of the mining journals of this country and England. In the JOURNAL of Dec. 17, 1910, is a fully descriptive article in which it was stated that the dredge in question, with its steel hull, was delivered in July, 1910.

Had Mr. Eddy been aware of this, he would have avoided another error in supposing that the Pato or the two Alaskan dredges for the Yukon Gold, were built before the Orsk company's dredge. All of these dredges were built some time after the Orsk company's dredge, which still stands as the first all-steel dredge built in America. Incidentally, it was not only built in record time, but it was also erected in record time for this size and type of dredge.

Mr. Eddy, in his original article of Dec. 27, 1913, states that the total time elapsed between the time of driving the first rivets and the completion of erection, ready to operate, was 4 months 4 days, whereas the Orsk hull, to which my article referred, was 90% assembled before the first rivet was driven, which was 15 days after the laying of the first bottom plates; in other words, my time dated from the beginning of the job to the time dredge started operation.

Furthermore, in connection with the Orsk dredge there was a steam-generating plant and 10-mile transmission line, together with machine shop and other elaborate equipment, which was all erected in the 93 days mentioned by me heretofore.

RUDOLPH E. SCHULZ.

New York, Apr. 10, 1914.

Mortar Foundations

I was interested in reading the article by Algernon Del Mar on mortar foundations, which appeared in the JOURNAL of Mar. 28, in which he illustrates two types of concrete mortar blocks, both of which provide means for the removal and replacement of the anchor bolts in case of breakage.

For some years past I have been referring in a fatherly way to the type presented in Fig. 2, as the "Parral" mortar block, because this type was designed for the Palmilla mill of the Alvarado Mining & Milling Co., at Parral, Mexico, by me in 1910, and I have been under the impression this was its first use. If, however, as Mr. Del Mar believes, this type was recommended by him or built prior to that date, the type has no right to the name I have given it, and someone else should be credited with originating the design.

As a matter of historical interest, I think it is desirable in most cases to confer on any new type of machine or equipment for mill or mine use the name of the mining region where it was first designed and used. The Palmilla mill is a stamp mill and cyanide plant of 400 tons daily capacity; the stamp batteries consisting of sixty 1150-lb. stamps, set in units of 10 stamps each. The mortar block is built as a monolith of concrete extending from end to end of the batteries and having a tunnel 3x3 ft. running longitudinally through the center. Against the roof of this tunnel each of the anchor bolts is washered, with a block of wood between the concrete and the cast washer. The "take up" of the wood reduces the vibration of the bolts to nothing and none had broken in several years of operation. Nor has there been any shrinkage or strain cracks in the block.

Following this installation at Parral, I recommended the same type of mortar block and a battery of 1600-lb. stamps for the Iola mill at Candor, N. C. This latter mill has been in operation a few years and has been a technical and financial success from the start. Since then I have used the type of mortar block in all stamp mills I have designed, and I agree with Mr. Del Mar that it is superior for any weight of stamps to any of the other designs that are used.

However, if it has been used prior to 1910, I will gladly doff my bonnet to the designer and relinquish all my claims to priority of design and use.

BERNARD MACDONALD.

South Pasadena, Calif., Apr. 3, 1914.

Editorials

The Situation in Mexico

As has appeared probable for some time past, the situation in Mexico has developed rapidly into something very like war with the United States, though we are assured by our government that it is not war but only discipline. The action of our government is directed against General Huerta, whose seat of power at present is in the City of Mexico and the adjoining territory. In the belt which he controls Americans have been warned to leave the country and many are doing so; but others seem disposed to stay. Up to this writing the information is that our naval forces have seized the port of Vera Cruz and may also take Tampico. Whether land troops may be called into action depends upon further developments. What action the Huerta forces may take seems still entirely uncertain.

In the northern part of Mexico, where the Constitutionalists, under Carranza and Villa, are practically in control, nothing is being done—at least there is no news. This party is apparently waiting to see what may happen at the capital, and what course American intervention may take.

That intervention has begun seems fairly certain; that it was inevitable has been the belief of many for some time past. What the end of this new phase of the very difficult situation may be it is impossible now to predict.

⁂

General Alarm for Mine Fires

Among the metal-mine accidents of the last few years which were most destructive of human life, we recall one cage accident in India, one explosion of dynamite in the Treadwell group, and a series of mine fires. The mine fire occupies the unpraiseworthy position of being the least expected, the most insidious and the most individually destructive of the many dangers threatening the underground worker. This is not to say that it is the most destructive of life, or even of property, in the long run; there are several other single causes of underground fatalities which are vastly more important. Mine fires are relatively infrequent. When they do come, however, they gather their victims by the score, and usually with attendant circumstances peculiarly tragic.

The lesson of precaution against mine fires is one slowly learned. It seems at times as if every property had to have its own terrible experience of this nature before the strict regulation and minute precautions, necessary to prevent and combat underground conflagrations, can be instituted.

One of the most serious difficulties in fighting such fires is that of removing all the men from the mine before the workings are filled with deadly smoke. Our readers will recall the staggering disaster at the North Mount Lyell mine in Tasmania on Oct. 12, 1913. This fire was the subject of a long and careful investigation, and among the suggestions of the investigators was one that a general alarm might be provided for use in the case of any disaster which should require the prompt removal of the employees from underground, and it was recommended that a signal be adopted for flashing on the underground lighting circuit. We commented approvingly upon this suggestion in our issue of Apr. 19, 1913, and were reminded forcibly thereof by a recent reading of the book of rules issued by the United Verde. One of the rules reads as follows:

> In case of fire, ring nine bells on the electric-cage call signal. The engineer on receiving same will flash all electric lights throughout the mine nine times. This flash will be repeated three times and followed by flashing the station signal on which level the fire is, three different times. Carmen and all others working where there are electric lights will notify those employed in stopes and other places where there are no lights. The trained firemen on the various levels will then take charge of the situation. Their first consideration will be for the safety of the men, and then for the extinguishing of the fire and protection of property.

Too hearty commendation cannot be given to this little rule. It is one which every mining company using electric signaling or lighting underground should include in its set of regulations.

The United Verde, it should be noted, has had a continuous 20-year experience with a mine fire and ought to know something about handling it.

⁂

When Doctors Disagree

When two authorities on any detail of mining, let us say hoisting, write of their subject and come to conclusions divergent from common belief either in direct statement or by implication, what is the lay engineer to do? In the *General Electric Review* for April, K. A. Pauly, hoisting expert of the General Electric Co. and a contributor to the JOURNAL, discusses in a general way the question of electricity versus air or steam for hoisting. In this article he states that practically all electrical hoisting installations are included in one of three systems, the induction motor, the Ward Leonard and the Ilgner modifications of the latter. He does not describe the slip-friction system as used at Ray; the Westinghouse system where the flywheel acts in parallel rather than in series; or the commutator induction motor, which has many characteristics of the direct-current series motor.

Before the Canadian Society of Civil Engineers recently, was read a paper by C. Antony Ablett, engineer for the Siemens companies, covering in some details the various systems of electrical hoisting—an excellent paper in general. Mr. Ablett confines his discussion to the induction-motor system, the Ward Leonard, the Ilgner, and the commutator motor. He does not mention the slip-friction or the Westinghouse. Now, what is the plain engineer to do, follow both doctors in considering the slip-friction and the Westinghouse beneath mention, and follow Mr. Pauly further in paying no attention to the commutator induction motor? We fancy some of our other hoisting doctors will take exception to this.

In a catalog of one of the largest drill manufacturers, dated April, 1911, it is stated, "in hammer-drill work, a

bit with a high center gives the best result." In a catalog of the same machine, dated May, 1912, it is stated, "a bit formed with a flat or slightly concave cutting face . . . . . will drill the rock much faster than one with a raised center." What happened in this year? Did the charaeter of our American rocks alter radically, did the machines behave differently, did the drill steels change their nature, was the doctor mistaken in his diagnosis in 1911, is he right in 1912 and now? When the doctor disagrees with himself, the patient is likely to do as seems best to his own lowly intelligence.

Another case recently came to our notice where a layman attempts to be a geological doctor and overthrow the established theories of geologic medicine—with poor success. Walter Savage Landor is an explorer of note, intrepid, resoureeful and successful. His greatest feat was the penetration of Thibet; he recently completed an arduous and perilous journey through unexplored areas of South America. As quoted in the *Bulletin of the Pan American Union,* his description of this journey contains, with much other matter, a new theory on the formation of the earth. It seems that the older geologists are all wrong, that at some time in its history our planet simply cracked open on the outside like the skin of an overbaked apple and the land surfaces flew apart to form the present continents. The proof of this is easy. Look at a globe and see how neatly the western coast of Africa fits the eastern coast of South America and how the western coast of the Americas joins with the continental lines across the Pacific. As plain as a pikestaff!

This child-like attitude of mind is not incompatible with the characters of great explorers. Possibly "the faith of little children," a blindness to facts, is needed in addition to the other motives that lead such men to endure great suffering and hazard of life in their profession. But we will confess a depreciation of some 99% in our estimation of Mr. Landor, following his disclosure of this ingenuous theory. Are his observations of facts to be strongly relied upon, are his accounts of perils and discoveries quite the last word in accuracy? Is there a little of Dr. Cook in his makeup?

A Silver Episode

The recent marketing of the last of the silver stocks in London and the closing out of the syndieate whieh has been carrying the market for four months past, marks the close of an episode which has affected the silver situation for over three years. The Indian syndicate, to which frequent references have been made in our columns, started in with a view to controlling the market and advaneing prices, and for a time was fairly successful. The attempt was really destined to failure because the production of silver in the world is too large to be handled by any one group of speeulators. Desperate efforts were made, however, to maintain the so called corner. The rush of new supplies, however, and the postponement of coinage purchases by the Indian government were too much for the speculators and a crisis was reached with the failure of the Indian Specie Bank last December, with stocks of between £3,000,000 and £4,000,000 in silver.

To prevent a disastrous break in silver, whieh would probably have had a serious effect on other markets, a syndicate was hastily formed. It was headed by the Hongkong & Shanghai Bank and the Chartered Bank of India, Australia & China, and had, it is understood, assurance of support from the Bank of England. This syndicate took over the stocks of silver and has since been quietly but actively engaged in marketing them. The process was much assisted by a current shortage of supplies, largely due to the troubles in Mexico. It was so conducted that the market has remained nearly at a level, closing a trifle higher than it was when the syndicate took charge.

The silver market is now free from any large speculative interest, and ought to be ruled by ordinary supply and demand. As supplies are short the conditions rather favor a maintenance of prices for the present.

Witwatersrand Amalgamation

The question of a general amalgamation of all the mines on the Witwatersrand, of which there was some talk a few years ago, has been brought up again by Col. Schumacher, George Nathan and other representatives of some of the large companies in their evidence before the South African Commission, now in session at Johannesburg. So far the discussion seems to be theoretical rather than practical, the agreements in favor of consolidation being based on the possible securing of greater economies in operation, the elimination of unprofitable mines and plants and the better handling of the labor question. Some of these arguments remind us strongly of those we used to hear in period of industrial consolidation here, 10 or 12 years ago.

On the other hand, some of the larger interests, like the Rand Mines, Ltd., the Central Mining Corporation, the Robinson group and others, do not believe in the possibility or expediency of a general amalgamation. The adjustments of financial interests would be a complicated and difficult matter, as can readily be seen. The closing of the poorer mines and concentration of labor on the richer ones would involve local upheavals and probably serious labor troubles. There are many other points which could be suggested as practical obstacles to the project.

Attractive as it may seem in some ways, it is probably a long time before the Witwatersrand mines will be ready to come under one head. The formation of a gigantic corporation to take them all over is a long way in the future. If it ever comes about, it will come as the result of a number of minor consolidations, and it must be remembered that some of those already made have not had altogether satisfactory results.

The evidence of a number of engineers before the commission points to the probability that the possible or probable ore reserves of the Witwatersrand are at least twice as great as the quantity already mined. How much of this untouched ore is payable, or can be mined at a profit, is another question.

At the recent annual meeting of the Bethlehem Steel Co., Charles M. Schwab spoke rather pessimistically on the conditions in the steel trade. Nevertheless the belief seemed to be that these conditions are only temporary, for the stockholders approved the expenditure of $6,000,000 in extensions and new additions to the plant, and it was announced that shipments of Chilean ore were to be expected at an early date.

BY THE WAY

A close proposition in mining is defined by a manager as one that depends so much upon the maximum efficiency of every man that if a shift boss eats two pieces of pie at dinner and has indigestion, the mine loses money.

⁂

At the Chicago convention of the American Chemical Society, a chemist announced that sulphuric-acid fumes have been found effective in the treatment for tuberculosis. "Smoke farmers" take notice. Abandon law suits and build sanitariums. Furnace men look to your jobs. Soon a clamoring crowd may be outside the gates bidding premiums for "rustling tickets"; feed-floor space may bring high rental.

⁂

The General Electric Co. has been steadily increasing the percentage of mazda lamps which it makes and cutting down the percentage of carbon lamps until today carbons form less than 25% of the total. If carbons could be discontinued altogether it would save the General Electric Co. the large expense of trying to combine these two different types of production. Incidentally it would be a long step toward standardization.

⁂

The way of the fake promoter is hard, and getting harder. L. B. Adams, of New York, was sentenced to six months' imprisonment on Blackwell's Island and a fine of $250. His offense was the use of the mails in a scheme to defraud. He offered to promote and underwrite the sale of securities, claiming to have an extensive sales organization, and a large clientele of investors, but did practically nothing in return for fees collected.

⁂

An extraordinary fatal accident occurred at the Morning mine in the Coeur d' Alenes, as noted by state mine inspector, Robert N. Bell, in his report for 1913. One J. R. Jones was hammering an ore chute that was hung up two floors above. It is customary to cut vent holes in these chutes at every floor but the vents at this point had got choked with muck. When the heavy mass of wet ore let go, therefore, it acted as a great piston, compressing the air below it in the chute and blowing off a plank. The plank struck the man hammering the chute and crushed his head against the ladder, killing him.

⁂

The baiting of presidents, general managers, and rich men is now a favorite pastime in Congress. The Committee on Mines and Mining is now "studying" the Colorado coal strike, in which the Colorado Fuel & Iron Co. is involved, a large interest in that company being owned by John D. Rockefeller. The committee had Mr. Rockefeller, Jr., on the stand, the other day. The son of "the richest man in the world" proved an interesting witness, said the *Sun*. He was prompt in replies to all questions and maintained his self-possession even in the face of obvious attempts to floor him. There must have been times in the proceedings when Mr. Rockefeller wondered if he was sitting in a blast-furnace room of the Colorado Fuel & Iron Co. With that democratic simplicity that marks all Congressional hearings, everybody was smoking cigars furiously and continuously. Chairman Foster sat close to Mr. Rockefeller. Mr. Foster's cigars are famous around the House. They are well known throughout the land as fivers of quality. The witness dodged and ducked from time to time to find a rift in the big clouds blown in his direction by the chief examiner. Questions put to Mr. Rockefeller seemed to indicate that the committee believes that Mr. Rockefeller and other stockholders in the Colorado Fuel & Iron Co. are morally responsible for labor conditions in Colorado.

⁂

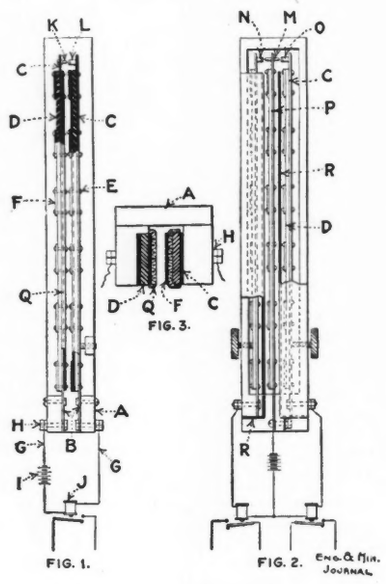
It is interesting to note the attitude of the employees of the U. S. Steel Corporation on the conditions of employment, a subject that was brought into the limelight several years ago by Charles M. Cabot, of Boston. As a result of much agitation, the public has had a misconception of the work that the Steel Corporation was gradually accomplishing in improving the conditions of its employees. A rather extraordinary thing happened at the annual meeting at Hoboken this week, when stockholding workmen expressed their opinions of the way the Steel Corporation was treating them. There were present about 150 stockholders, among whom was an important representation of stockholding employees, led by Samuel Wilkinson, a pattern maker employed by the Shelby Seamless Tube Co., who put in proxies for 1322 shares owned by workmen of the Corporation. The report of the committee on employment conditions stated that for several reasons, such as foreign competition and the attitude of the men themselves, a change from the 12-hr. to an 8-hr. day in certain departments was not advisable at present. The total expenditure in 1913 for improving the condition of the workmen was $7,240,699. Judge Gary, in discussing working conditions, said that the Corporation had been paying its men 2½c. more per hour than its largest competitor, and that the men themselves would object to a reduction of working hours, which would be bound to reduce wages correspondingly. Mr. Cabot, who caused the investigation of employment conditions several years ago, was present and expressed his approval of the work of the Corporation on behalf of its employees. Judge Gary said that Mr. Cabot did not have more interest in the welfare of the Corporation's workmen than had its directors and officers. Mr. Cabot added that he thought the directors had proved their interest in the welfare of the workmen. After this mutual exchange of cordialities, Samuel Wilkinson said that he was not present as an agitator, but as an educator. He described the conditions at the mills as excellent, complimented the Corporation on its safety and sanitation work, and suggested that a plan be devised for bringing out of the workmen what he described as their "hidden talents." Judge Gary said that this question of developing the ideas of workmen had been taken up by a committee during the last year. Then another stockholder-employee, S. R. Maitland, a boiler tender at the Carnegie Steel Co.'s plant, at Newcastle, Penn., declared that he had spoken to many of his fellow workers and that they had always told him that they got a "square deal" from the Steel Corporation. "The Corporation," Mr. Maitland said, "is doing more for humanity than is the United States Government. This company keeps its men from being paupers." Maitland closed his talk in a manner entirely novel to the customary proceedings at annual meetings, i.e., with a prayer for the corporation's officers and workers, in which he asked all present to join.

Impulse Thermostat for Abnormal Changes in Temperature

By George A. James*

The invention illustrated by the accompanying drawings relates to a device which will indicate, by a change in electric circuit or otherwise, a rapid change of temperature while unaffected by a slower change.

Existing thermostats are constructed so as to indicate when a certain temperature is reached, but they are unaffected by the rapidity of the change in temperature before arriving at the point of indication. They comprise a single compound member of two strips bound together and composed of materials having unequal expansion coefficients, so that a part thereof may be caused, by a change in shape due to a change in the temperature, to make or break electrical contact with a fixed point. The faults of this construction are many. Suppose that the fixed point is adjusted to complete an electrical circuit at a temperature of 130°, then evidently, the nearer the temperature reaches 130°, the closer the contact points approach. Slight jars are then likely to cause a false alarm. Therefore, on a warm day, a comparatively slight variation of temperature is sufficient to cause an alarm, on cold days a fire must bring the temperature of the surrounding atmosphere through a wide range before an alarm is given. Again, a thermostat of this construction is greatly strained by the movable compound member being strongly pressed against a fixed point when subjected to excessive temperatures.



James' Thermostat

The object of my invention of the impulse thermostat is to provide a device that will be free from these objections, and indicate an abnormally rapid change of temperature. Figure 1 of the accompanying drawings is a broken side view of one form of my device; Fig. 2 is a similar view of another form thereof; Fig. 3 is a similar view of still another form thereof.

A indicates a suitable support to which are secured, as shown at *B*, the ends of two thermostatic members extending parallel to one another at normal temperature and precisely alike, each comprising a brass strip *C*, and a strip *D* of vulcanite secured to the strip *C* by rivets *E* passing through the brass strip *C*, the vulcanite strip *D*, and separate short pieces *F* of sheet brass on the side of the vulcanite strip remote from the brass strip.

In Fig. 2, the thermostatic members are arranged in substantially the same plane as in Fig. 1. In Fig. 3, I show three thermostatic members, all parallel to one another at normal temperature.

It is evident that these thermostatic members, being precisely alike, will bend equally if maintained at the same temperature one with another. But, if one of these thermostatic members be protected more than another from the influences of sudden changes of temperature of the surrounding air, then on a sudden change in temperature, the former would not bend so quickly as the latter, and consequently an electric circuit may be closed or broken thereby. Such circuit is here indicated in Fig. 1 by the wires *G*, connected to the binding screws *H*, leading through an electric battery *I* and an electromagnet *J*, which may be used for the purpose of signaling, or otherwise. Also in Fig. 1 contact points *K* and *L*, directed toward one another, are secured on the opposing sides of the free ends of said thermostatic members.

In Fig. 2 a contact point *N* extending from this member and a double contact *M* extending from either side of the member *P*, meet under impulse to complete the circuit on that side when the central member *P* moves in that direction. A similar contact point *O* is placed to meet the contact point *M*, under an impulse causing the member *P* to move in that direction. This in turn can be made to control different signals to indicate either heat or cold. The temporary protection against change in temperature given to one or more of the members may be afforded in several ways.

This impulse thermostat may be variously employed: In fire-alarm systems, especially where a wide range of temperature exists under normal circumstances; in a dynamite manufactory; in the chemical laboratory; in controlling the temperature of buildings; in protection against fire and the approach of water in underground mines; in stamp mills and other metallurgical plants.

*George A. James Co., assayers and chemists, 28-32 Belden Place, San Francisco, Calif.

Victoria Copper Co.

As shown in the annual report of the Victoria Copper Mining Co., Victoria, Mich., the production for 1913 amounted to 1,428,693 lb. of refined copper, the largest in the history of the mine. Receipts and expenditures follow:

Received from sale of copper		$215,995
Received from miscellaneous earnings		12,340
Total receipts		$228,335
Expenditures:		
Working expenses at the mine	$210,358	
Smelting, freight, marketing, office	25,472	
Interest paid	2,273	
Construction	3,193	
Development of water power	3,412	
Legal expenses	565	
Total	$245,273	
Expenditures over receipts		$16,938

The company has spent $2,901,634 since date of organization, of which $1,380,551 came from copper sales. Balance of quick assets over liabilities amounted to $10,685. A summary of the year's work shows that 159,565 tons of ore were hoisted, of which 22,402 tons were discarded and 137,163 tons stamped, producing 2,273,890 lb. of mineral. Owing to the scarcity of labor, work at No. 6 shaft was suspended and had not been resumed at the end of the year. Negotiations are pending for more water storage on Lake Gogebic.

PERSONALS

Stover & Hall have removed their offices to No. 27 William St., New York.

Louis L. Davis, of Elgin, Ill., is in Colorado on several mining matters.

Henry A. Bomberger, of Philadelphia, has been in Colorado looking after various mining interests.

Charles A. Mentsel left New York, on Apr. 19, for a professional examination of Elk Lake, Ontario.

Philip L. Foster, representing the Exploration Co., Ltd., of London, has removed to No. 62 Broadway, New York.

George A. Laird is no longer connected with the Great Cobar Copper Co., but has opened an office in Sydney, N. S. W., to carry on a general consulting practice.

H. H. Harpham has returned to New York from Ecuador, where he has been for the past two years, at the mines of the South American Development Company.

Oscar Lachmund, general manager of the British Columbia Copper Co., returned to Greenwood, B. C., on Apr. 18, after a short stay in New York on company matters.

Harry Cecil, with other members of a British syndicate, have been looking over the Teck-Hughes mine, at Kirkland Lake, Ontario, with the view of acquiring another option.

W. G. Earle, of London, England, who has large mining interests in California and South Africa has been on a trip of inspection to the Cobalt, Porcupine and Swastika camps in Ontario.

M. Dannenfelser, of the Peirce-Smith Converter Co., arrived in Chile early in April, to assist the Catemou and Naltagua companies in the application of the basic converting of their copper matte.

Arthur G. McKee, Cleveland, Ohio, engineer and general contractor for power plants, coal storage and handling plants, etc., has opened a branch office in New York at 52 Broadway, in charge of P. M. Stewart.

J. Howard Evans, of the Peirce-Smith Converter Co., will sail on May 5 from New York to assist the Cape Copper Co. in the introduction of the basic-converting process at Briton Ferry, Glamorganshire, Wales.

H. J. Kruse has resigned his position as superintendent of the Rogers, Brown Ore Co. after six years' service with the company. Mr. Kruse did the pioneer development work for the company on the Cuyuna range, in Minnesota.

Carlton R. Rose, for 10 years past superintendent of the United States Zinc smelting works, at Pueblo, Colo., has resigned and will become a member of the firm of Smith, Emory & Co., of Los Angeles and San Francisco. J. Thomas, formerly of Kansas City, succeeds Mr. Rose, at Pueblo.

A prospecting party comprising Frank E. O'Near, Morgan C. Milne, Harvey E. Nold, and W. P. O'Neal, experienced prospectors, is organizing an expedition in search of gold and silver to the Omenica country lying north of the main line of the Grand Trunk Pacific Railway, in British Columbia.

H. F. E. Gamm has just completed an examination of the Black Rock District, Arizona, and will now spend several months in Routt County, Colorado, and northern California on business matters. Mr. Gamm has severed all connection with the Oil Furnace Engineering Co., of New York, and will devote his time to mining and engineering work in general.

Samuel S. Arentz returned to Salt Lake City for a few days last week, after a week spent on mine examinations south of Golconda and in the Yerington district, Nevada. For the next two weeks he will be in eastern Utah on professional work connected with the U. S. Bureau of Mines experiment station, at the University of Utah, investigating the low-grade ores of Utah.

OBITUARY

Barney Keer, one of the pioneers of the Black Hawk mining district, died in Silver City, N. M., April 8. He was a native of Ulster, Ireland, and had lived 30 years in New Mexico. New Mexico.

Frank Dillingham died in Denver, Colo., April 16, aged 68 years. He went to Colorado from the East in 1876 and settled in Central City, where he took an active part in developing mines in Gilpin County. Some years later he went to Denver, where be established the firm of Chamberlain & Dillingham, ore buyers. About two years ago he retired from active business.

Andrew Jackson Dull died at his home in Harrisburg, Penn., April 8, aged 84 years. He was born at McVeytown, Mifflin County, Penn., and was educated at Tuscarora and Strasburg academies and Princeton, graduating from the latter in 1852. For years he was identified with the construction of various public works, notably the aqueduct at Washington, and the Chicago water works. In 1863 he assisted in forming the firm of Reese, Graff & Dull, which erected rolling mills in Pittsburgh. It rolled plates used as armor for monitors for the United States Navy during the last years of the Civil War. With Robinson, Rea & Co. this firm formed the Graffton Iron Co., which built and operated furnaces at Leetonia, Ohio. In 1871, having retired from the Pittsburgh firm, Mr. Dull became general manager of the Lochiel Rolling Mills, Harrisburg, and was also identified with the Lochiel Furnace Co., of the same city. He was interested in other companies and took an active part in local affairs.

SOCIETIES

American Institute of Mining Engineers—Dr. R. B. Moore and Dr. Karl L. Kithil, of the U. S. Bureau of Mines, have kindly consented to deliver a series of lectures before the Colorado Local Section upon the subject of radium and its occurrence in the ores of Colorado. The first meeting of this series was a lantern lecture by Dr. Moore on the evening of Apr. 23, subject: "Radium and Radioactivity." The meeting was held in the lecture room of the Colorado Scientific Society.

Institute of Metals—Professor E. Heyn, of Berlin, one of the most famous scientists in Germany, is this year to deliver the annual May Lecture before the Institute of Metals. Professor Heyn, who has made a life-long study of the subject, has given the title of his discourse as "Internal Strains in Cold Wrought Metals, and some Troubles Caused Thereby." Professor Heyn's discourse will be given in the building of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S. W., London on Tuesday, May 12, next.

American Institute of Mining Engineers—At the meeting of the New York Section on Apr. 22, the subject was "Sanitation in Mining and Metallurgical Operations." Illustrated papers were presented by: Dr. J. W. Luther, surgeon-in-chief for the New Jersey Zinc Co., on the "Organization, Equipment and Results Accomplished at Palmerton, Penn.," Dwight E. Woodbridge, consulting engineer of the Bureau of Mines, on "Sanitation in Mining Camps in the South," C. L. Close, "Sanitation in the Plants of the U. S. Steel Corporation." The papers were discussed by several of the members present.

Montana Society of Engineers—The 27th annual meeting was held Apr. 9, 10 and 11 in Great Falls, Mont. The first day was devoted by the local members to receiving and welcoming the arriving outside members. On the second day a visit was paid to the hydro-electric plants of the Montana Power Co. at Rainbow and Great Falls of the Missouri river and to the reduction works of the Boston & Montana Co. In the evening the visitors were entertained by a display of moving pictures, illustrating developed and undeveloped power plants of the Montana Power Co. This was followed by a smoker at the Rainbow Hotel. All of the third day was taken up by the regular business of electing officers for the ensuing year, reading of papers, an illustrated lecture on the work of the U. S. Reclamation Service in Montana and a discussion of such papers. The meeting closed with a banquet at the Rainbow Hotel.

American Institute of Mining Engineers—A meeting of the Utah members of the Institute was held in Salt Lake City, Apr. 4, for the purpose of organizing a local section. The movement was started by R. C. Gemmel, of the Utah Copper Co., who presided. A petition to the executive board was drawn up, asking for a charter. Members of the Institute in Nevada have been invited to join with the Utah members, and if they accept the section will be known as the Utah-Nevada section, with headquarters at Salt Lake. Twenty members of the Institute were present, and signed the petition. The early organization of a local section is of importance, as the American Institute is to meet in Salt Lake Aug. 10-14, and it is desirable to begin preparations for the entertainment. The mining and smelting companies of the state are contributing $10,000 toward an entertainment fund.

Colorado Metal Mining Association—Membership is steadily increasing through the organization of subsidiary or county associations. Already such branches have been created in nearly half the mining counties of the state and the remaining counties are takng steps to start similar bodies. Members of these subsidiary associations are principally operators or owners, but many employees of mines and mills are also enrolling. John M. O'Connell, secretary of the parent body, believes that there will be a membership of about 12,000 when all counties are fully rounded up. The annual membership dues are $1. The directors of the Teller County (Cripple Creek district) Metal Mining Association are: E. P. Arthur, Jr., Luke Shepard and A. J. Campbell, of Cripple Creek; Rufus T. Windsor, of Elkton; Philip H. Argall, Jr., Frank Smale and G. L. McCarthy, of Victor; O. P. Nagel, of Independence; James H. Hore, of Goldfield. The directors of the Boulder County Association are: Eugene Stevens, president, E. J. Temple, vice-president, M. B. Tomblin, secretary, E. B. Hill, treasurer, J. W. Valentine, R. H. B. Little, J. R. Wolff, Ralph Cotton and L. A. Ewing.

INDUSTRIAL NEWS

Asbestos Protected Metal Co., of Beaver Falls, Penn., announces the removal of its New York office at 52 Broadway.

The New York Leather Belting Co., 51 Beekman St., New York, advises that it is tripling the capacity of its works at Easton, Penn.

The Mountain Copper Co. is going to install two 8 ft. by 36 in. cyl. herringbone-gear driven Hardinge mills in its new concentrator, at Keswick, Shasta County, California.

The Ingersoll-Rand Co. announces the opening of a new branch office and warehouse in Los Angeles, Calif., 1036 Union Oil Bldg. Also the opening of a branch in Juneau, Alaska.

The General Chemical Co. reports that it is installing three 21 ft. 6 in., seven-hearth furnaces, at the plant of the Davison Chemical Co., Baltimore, Md. The foundations are in and the work is expected to be completed by Aug. 1. These are the latest type of Herreshoff air-cooled pressure furnace, and will be equipped with temperature control and movable arms. A 16-ft. furnace, embodying these new featuures, has been in operation for two months at the A. S. & R. plant at Perth Amboy, New Jersey.

The C. G. Buchanan Co., 1115 West St. Bldg., New York City, has within the last few months sold the following crushing equipment: A 42x48-in., all steel crusher to the Alaska-Treadwell mines; two 30x42-in., all steel crushers to the American Cyanide Co., at Niagara Falls, N. Y., making a total of 10 Buchanan crushers at this plant now; a 36x42-in. crusher to the Gastineau mines, Alaska. The company has also supplied the General Smelting Co., Chestnut Hill, Penn., with a 10x16-in. crusher, 30-in. rolls, elevators, transmission machinery, 50-hp. motive power installation, and a 24-in. magnetic separator. The Boyd-Smith mines, Louisa County, Virginia, has also recently purchased from this company a 12x20-in. crusher and 30x14-in. rolls. Crushing machinery including 30-in. rolls has also been shipped to the Philippine Islands, for the Government, and the Buchanan company is now building 36-in. rolls for the Arstemia Chemical Co., in Louisa County, Virginia.

TRADE CATALOGS

English Iron Works Co., Kansas City, Mo. Catalog D. Hoists. 34 pp., Illus., 9x12 inches.

E. R. Watts & Son, 123 Camberwell Road, London, Eng. Catalog. Mining Transit Theodolite. 4 pp. Illus, 6x4½ inches.

Central Foundry Co., 90 West St., New York, N. Y. Booklet. Valve Service and Roadway Boxes. 24 pp. Illus. 6¼x3½ inches.

Deister Machine Co., East Wayne St., Fort Wayne, Ind. Loose Leaf Catalog. Concentrating machinery. Illustrated, 8x10½ inches.

Keystone-Hindley Gear Co., Pennsylvania Bldg., Philadelphia, Penn. Loose Leaf Catalog. Keystone-Hindley worm gears. Illus, 7½x10 inches.

NEW PATENTS

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

ALUMINUM—Flux for Purifying Aluminum and Its Alloys. Grenville Mellen, East Orange, N. J., assignor of one-half to United Aluminum Ingot Co. (U. S. No. 1,092,935; Apr. 14, 1914.)

ALUMINUM—Process for Purifying Aluminum and Its Alloys. Grenville Mellen, East Orange, N. J., assignor of one-half to United Aluminum Ingot Co. (U. S. No. 1,092,936; Apr. 14, 1914.)

ALUMINUM—Soldering and Welding Materials. Auguste Cornand and Henri Van de Cruys, Brussels, Belgium. (U. S. No. 1,092,340; Apr. 7, 1914.)

AMMONIA—Process of Producing Ammonia. Samuel Peacock, Chicago, Ill., assignor to International Agricultural Corporation, New York, N. Y. (U. S. No. 1,092,167; Apr. 7, 1914.)

CATHODE FOR ELECTROLYTIC FURNACES. George O. Seward, East Orange, N. J., and Franz von Kügelgen, Holcombs Rock, Va., assignors to Virginia Laboratory Co., New York, N. Y. (U. S. No. 1,092,178; Apr. 7, 1914.)

CEMENT-MANUFACTURING APPARATUS. Fritz Worn, La Salle, Ill., assignor to German-American Portland Cement Works, La Salle, Ill. (U. S. No. 1,092,551; Apr. 7, 1914.)

CONCENTRATING—Improvements in Concentrating and Separating Machines for Ores or the Like. W. W. Richardson, St. Austell, Cornwall, Eng. (Brit. No. 9048 of 1913.)

CONCRETE—Waterproof Concrete and Process of Making the Same. Richard K. Meade, Roland Park, Md. (U. S. No. 1,092,933; Apr. 14, 1914.)

COPPER EXTRACTION—A New or Improved Electrolytic Process for Extracting Copper from Ores. N. V. Hybinette, Christiania, Norway. (Brit. No. 22,745 of 1913.)

CRUSHING—Improvements in or Relating to Machines for Crushing Stones, Ore and the Like. T. G. Rennerfelt, Stockholm, Sweden. (Brit. No. 12,810 of 1913.)

CUPOLA FURNACE. Michael Zippler, Jr., Pittsburgh, Penn. (U. S. No. 1,092,623; Apr. 7, 1914.)

CUPOLA FURNACES—Improvements Relating to a Method of and Means for Preventing the Formation of Carbon Monoxide in Cupola Furnaces. E. Schurmann, Kotzschenbroda, Dresden, Germany. (Brit. No. 11,073 of 1913.)

CYANIDING—Filter Press. Charles W. Merrill, Berkeley, Calif. (U. S. No. 1,093,345; Apr. 14, 1914.)

DRILL—Rock Drill. Dudley T. Fisher, Columbus, Ohio, assignor to the Jeffrey Manufacturing Co. (U. S. No. 1,093,120; Apr. 14, 1914.)

DRILL CYLINDER. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,093,408; Apr. 14, 1914.)

DRILLING—Apparatus for Rock Drilling. Charles H. Locher, Glasgow, Va. (U. S. No. 1,092,583; Apr. 7, 1914.)

DRILLING—Post for Drilling Machines. Abdon F. Deruy, Pittsburg, Kan. (U. S. No. 1,092,980; Apr. 14, 1914.)

DRILLS—Improvements in Pneumatic Percussive Tools. J. Arthur Dalton, Northumberland, Eng. (Brit. No. 6244 of 1913.)

ELECTRIC FURNACE. John W. Brown, Lakewood, Ohio, assignor to National Carbon Co., Cleveland, Ohio. (U. S. No. 1,093,382; Apr. 14, 1914.)

ELECTRIC FURNACE for Medium Temperatures, Particularly for Melting Copper and Its Alloys. Ernesto Stassano, Turin, Italy, and Napoleon Petinot, Niagara Falls, N. Y. (U. S. No. 1,093,494; Apr. 14, 1914.)

ELECTRIC INDUCTION HEATER OR FURNACE. Alois Helfenstein, Vienna, Austria-Hungary. (U. S. No. 1,093,328; Apr. 14, 1914.)

FLOTATION PROCESS—Method and Apparatus for Ore Concentration. Edward Hoit Nutter, New York, N. Y., and Theodore Jesse Hoover, London, England, assignors to Minerals Separation, Ltd., London, England. (U. S. No. 1,093,463; Apr. 14, 1914.)

FURNACE VALVES—Improvements in Reversing Valves for Furnaces. J. Ollg, Westerwald, Germany. (Brit. No. 16,440 of 1913.)

HOISTING APPARATUS FOR OPERATING GRAB BUCKETS. Augustus Smith, Roselle, N J., assignor to Bergen Point Iron Works, Bayonne, N. J. (U. S. No. 1,092,669; Apr. 7, 1914.)

METALLIC OXIDES—Improvements in or Relating to the Manufacture of Metallic Oxides or Compounds. C. White, London, Eng. (Brit. 4082 of 1913.)

STEEL—Improved Process for the Manufacture of Steel and Apparatus Therefor. Rombacher Hüttenwerke and J. I. Brown, Rombach, Germany. (Brit. No. 29,051 of 1912.)

TREATING METALS To Render Them Inoxidizable. Emery G. Gilson, Schenectady, N. Y., assignor to General Electric Co. (U. S. No. 1,091,057; Mar. 24, 1914.)

WASHING—Apparatus for Washing Minerals. Joseph Dodds, Rutherglen, Glasgow, Scotland. (U. S. No. 1,091,047; Mar. 24, 1914.)

WELDING PROCESS. Worthy C. Bucknam, Jersey City, N. J., assignor to Davis-Bournonville Co., New York, N. Y. (U. S. No. 1,091,479; Mar. 31, 1914.)

ZINC—Improvements in or Relating to Plant for the Recovery of Zinc from Zinc Ores. A. Roitzhelm, Duisburg-Ruhrort, Germany. (Brit. No. 6771 of 1913.)

Editorial Correspondence

SAN FRANCISCO—Apr. 15

Industrial Accident Insurance Commission in its campaign of mine inspection has selected the southern California mining districts as the second region to be visited by H. M. Wolflin, inspector of mines for the State of California and the U. S. Bureau of Mines. The commission does not give out the reasons for its selection of this or any other region or section of the state to be visited at a particular or set time. But it is plain that, whatever the reason, the result will be to provide the commission with information regarding the southern districts that is wholly dissimilar from that gained in the Mother Lode region in Amador and Calaveras Counties. Comparison of conditions in a deep-mining district, where the mines form an almost unbroken chain of developed claims, with a region of scattered mines of shallow depth should furnish a substantial basis upon which to build the framework of a set of rules for guarding the safety of miners that will be satisfactory to both operators and employees and executed without friction. So far as Wolflin has progressed in the work of inspection he has been well received and the consensus among mine operators is that only good results will follow. The itinerary of the second in the series of visits, now in progress, embraces Kern, San Bernardino, Inyo and Imperial Counties. The mines at Randsburg, Johannesburg and Atolia, which are in a general way included in what is known as the Randsburg district, but which in fact form three distinct districts, will provide the largest share of the work mapped out. The Randsburg district has within the last year largely adopted electric power, which places the operators on a surer footing and will enable them to extend the development of the mines to greater depths as long as they can do so profitably. The appliances for safety already in use at the deep mines of the Mother Lode, when made known to the operators of the shallow mines of the south, should furnish suggestions of great value, and a comparison of the requirements of one district with those of another will result in benefit to both. While it has not been announced by the commission or the inspector what method will be adopted in applying the information and the data gathered to the needs of the operators and the miners, nor what special results are anticipated, there is a disposition among mining men to assume that it is possible to use the vast fund of information to be acquired in the way of suggesting some modification of the workmen's compensation act as applied to the mining industry. The law as it now stands is well known to be in some respects entirely too drastic respecting the operation of deep mines; and the mine operators now feel that they have some chance for presenting their side without encountering the political obstacles that have heretofore been placed in their path. The commission has shown its purpose to deal fairly with the mining men by the selection of Wolflin and by the manner of going about the work of mine inspection. So the evils complained of are likely to be cured in a simple but practical way.

BUTTE—Apr. 16

Montana Mining Exhibit at the Panama-Pacific Exposition at San Francisco will be in charge of E. P. Mathewson, general manager for the Anaconda Copper Mining Co. The commission in charge of the Montana exhibit has announced the appointment.

SALT LAKE CITY—Apr. 16

Utah Copper Steam-Shovel Operations are furnishing the ore required for the mills, 22,000 to 23,000 tons daily, and on Apr. 1 underground mining was abandoned, probably permanently. There are 20 steam shovels at work, some being operated two shifts of 10 hours each, and others working one shift. On the Boston Consolidated section of the property stripping operations have revealed ore of higher grade than the company has heretofore developed. During March over 11,000,000 lb. copper were produced.

DENVER—Apr. 16

Haywood's Reply to John D. Rockefeller, Jr., was made in Denver recently after Rockefeller's testimony at the Congressional inquiry in Washington, showing his attitude regarding unionism. Haywood said: "It remains for labor organizations to follow the lessons given by Mr. Rockefeller and his associates. Not only must labor cope with these gigantic corporations in the everyday struggle for better wages and shorter hours, but with the end in view of ultimately having a voice in their control and operation to the elimination of such men as Mr. Rockefeller, who contributes nothing to the management or labor of the great concerns in which he is financially interested. . . . . The people are beginning to realize that it is a fallacy to vest the right and power in an individual or group of individuals to own land, coal mines, oil fields or any of the other things essential to society. . . . If the United Mine Workers of America should determine on united action and declare a general strike throughout the nation, it would compel a recognition of Mr. Rockefeller's responsibilities to the nation as a whole."

CALUMET—Apr. 18

Result of the Referendum Vote by the local unions of the Western Federation of Miners cast Sunday, Apr. 12, was to call off the strike by a large majority. Hundreds of former strikers have turned in their union cards and made application to the various companies for work. A majority of these men will be given employment as soon as vacancies occur, for the companies will give these men preference in filling vacancies. The last few days have seen the exodus of many professional strikers and petty agitators who have infested the district since the beginning of the strike. Moyer, Mahoney and the rest will probably return to the district, but under different circumstances than their previous visits, as the circuit court refused to annul the indictment against them for conspiracy and they are to stand trial. The calling off of the strike has resulted in a feeling of much relief. Although the mines have been operating at normal capacity for several weeks, this feeling of uncertainty has prevailed and conditions have been unsettled. The Hancock company is shipping 200 tons of rock to the mill daily. More men will be employed and additional ground opened, so that in a short time this company will be able to maintain an increased production. Work has been resumed at the Oneco, which is under the same management as the New Arcadian company. Results at both properties have recently been promising.

HOUGHTON—Apr. 16

Michigan Strike Has Been Declared Off nine months after it started. As soon as the strikers themselves had a chance to vote on it they declared themselves in favor of returning to work. Now the situation that confronts the mines of the district is to find places for the men. There is an oversupply of workingmen. In addition to the money that the strike cost the strikers in loss of wages, the maintenance of the strike has required $1,000,000. Most of this money came from the American Federation of Labor and from honest workingmen who were led into liberal contributions to the cause of the strike by the misrepresentations of paid orators who did the collecting for the strike. The representatives of the American Federation of Labor who were in charge of the strike at intervals never believed it could win. Neither did the American Federation of Labor countenance the strike. When the strike started the Western Federation of Miners had but $75,000 in the treasury. That money went rapidly. Then a loan of $100,000 was secured from the United Mine Workers of Illinois. That was framed up between Moyer and Walker, the same Walker who openly advocated murder on the platform at the Indianapolis meeting of the American Federation. Another loan of $25,000 was secured from a brewery union in Cincinnati. In actual cash contributions through the regular channels the American Federation of Labor sent by far the largest sums, $250,000 in all, and over $200,000, it is estimated, came from various local unions, from locals affiliated with the American Federation of Labor. The strike cost the Butte union of the Western Federation more than any other organization, for that union is rich and pays regularly. The average cost per member in Butte was $25. In one month, through the regular assessment of one day's wages and by various other contributions, the Butte contribution to the strike is said to have been $80,000. The experience has been costly for the mining companies and more costly for the strikers. It has taught them not to believe agitators. The fact, too, is generally acknowledged, that President Gompers, of the Ameri-

can Federation of Labor, did not favor a Congressional investigation and refused, at first, to favor such a step. But Moyer and Walker by their conduct and attacks on Gompers, at the Indianapolis convention, put Gompers in such a position that he had to do their bidding in this regard and when he asked at Washington that the Congressional committee investigate the strike, action was secured without delay. The committee has not yet reported. The strikers believed the agitators when the strike started, but promise after promise was broken. Before the strike started the men were led to believe that $1 per day benefits would be paid. Perhaps the most insidious lie that was circulated referred to Government ownership. The men were told that the Government would take over the mines and employ none but Federation workingmen. When Secretary Wilson made his speech at Seattle, advocating Government ownership, this was utilized for the purpose of proving the claims of the agitators. Then it was promised that Wilson himself would come and take charge of the mines. That was held out for weeks as a bait. Then when the Congressional committee arrived and spent a month here, the very presence of the Congressmen was used by the strike leaders as evidence of Federal assumption of mine management, and the politicians all seemed willing and anxious to participate in this misrepresentation of the situation. Officially declaring the strike off, while it has, practically, been off, in effect, for some months, is a good thing and will clear the atmosphere. It means a more prosperous copper country. It means a larger working force at all of the mines than ever before in the history of the district. It means higher wages for all of the men; greater efficiency in every way.

IRON RIVER—Apr. 18

Loading Ore for Shipment to the docks was begun by some Lake Superior mines as early as Apr. 1. The season is, nevertheless, one of unusual backwardness. There has as yet been no general movement of ore to the lake ports, and only conjectures are offered as to when shipping will start in earnest. Mining men compare this season with that of 1908, when, they say, there were no sales of ore until May. There have been no sales so far this spring, and comparatively few inquiries. The furnace men who look to the open market for their ore are holding off and displaying little interest in the situation. They are playing for a lower price than they paid last year, and it is said that a reduction of 50c. per ton would about meet their ideas of what is right.

Much of the ore business is transacted on the basis of continuing contracts, however, and it is not necessary to wait for the close of the season's contracts between the independent ore interests and the independent miners before the movement begins. But the backwardness of the selling period means that the shipping season will open sluggishly, and that it will be some days after the formal opening of navigation before the movement will be on a normal basis. Predictions on the year's outgo are not made with any great certainty, for it is felt that the general business situation has many disturbing factors that will have to be cleared up before it is to be seen what can be expected. It is expected, however, that the movement will closely approximate that of last season, 50,000,000 tons. D. G. Kerr, of New York, vice-president of the U. S. Steel Corporation, who with a party of other officials has been in the mining region, stated that his visit was purely one of inspection and had nothing whatever to do with the fixing of prices of ore for the season. Kerr said: "As far as I know now no sales have been made and no price will be fixed until after the first sale."

JOPLIN—Apr. 18

New Mining Territory in the Miami Camp in Oklahoma is being brought in, in spite of the depressed condition in zinc and lead prospecting operations. Miami is 35 miles southwest of Joplin. There is more prospecting activity in this camp than in all the other camps of the district. It might be added that there is less falling off in mining activity of every kind in this camp than anywhere else in the field. One development of special interest lies in the opening of a shallow run of ore in the territory in the north end of the Hattenville area along Tar Creek. Here, while doing some prospect drilling, Barnes & McConnell, of Miami, have discovered a promising run of lead ore at 40 to 60 ft. which compares with the first discoveries in the Hattenville camp. Since the discovery holes were sunk others have been drilling adjacent territory with excellent results which seems to indicate the coming of another shallow mining area in that field. The drilling of the Picher Lead Co. on its recently acquired leases, aggregating 2000 acres, has been progressing with exceptionally good results. Some of the holes are reported to be as good as any so far drilled in that field. The campaign, while really only begun, is reported to have been gratifying to the company. The Cornfield Mining Co., another Joplin concern, is also developing a lease in new territory in the Miami camp. While the ore occurs at 105 ft., the water has been difficult to handle and the development work has been slow. One feature of this camp which is attracting attention is the number of companies that are planning to erect mills during the coming summer or by autumn. No less than 19 companies are figuring on mills according to one mill builder who is interested in building in that camp. Such activity cannot be found anywhere else in the district. The old South Carthage camp is being revived after long idleness. The work is being done by Mrs. Henrietta Glenn, who started two years ago to drill out the tract and make a thorough prospecting campaign before attempting to do any actual mining. A large number of drill holes were put down which not only developed the fact that there was a large area of shallow deposits to be mined yet but that in addition there was a deeper run of importance. After a convincing campaign, Mrs. Glenn undertook the sinking of development shafs. Following this a mill is now under construction. This mill will be of modern design. It will be the first mill of importance in the camp, although in early days it had a few small plants. The large output from this camp came principally from the shallow shafts and the ore was cleaned upon hand jigs. The camp has had a number of bonanza mines producing zinc blende, calamine and lead. Due to the loss by fire of a common pumping plant 10 years ago, the camp became deserted until Mrs. Glenn purchased the land covering the site of the entire camp and considerable adjoining territory. Its revival now with adequate capital and with modern mining and milling methods promises an even larger output than in the early days. Mrs. Glenn is a Joplin woman and personally supervises her mining operations.

GUADALAJARA, MEXICO—Apr. 2

Suspension of Operations has been made by the Cia. Minera Dos Estrellas y Anexas at Tlalpujahua in the state of Michoacan and it is reported that 1200 men have been thrown out of employment. Lower-grade ore, coupled with extraordinary expenses resulting from the present situation in Mexico, caused the step, it is said. For years Dos Estrellas held the production record in Mexico, and dividends of 6,000,000 pesos per year were paid. Due to continued rebel activity in that part of the state of Puebla, the Teziutlan Copper Co. has stopped work at its mines and smelting plant in Teziutlan district. The branch railroad from San Marcos, on the Interoceanic, to Teziutlan was cut repeatedly. A financial hitch between the Huerta government and the Sociedad Afinadora de Metales, the French refining concern of Mexico City, stopped the arrangement made a short time ago for the delivery to the government for coinage of all the silver bullion received by the Sociedad Afinadora. Under the arrangement the mining concerns supplying the silver were to receive 85,000 pesos weekly in 50-centavo pieces, but only two shipments of coin were made. Many mining companies still are forced to pay a premium for the silver needed for payrolls. At the new Cinco Minas reduction plant in the Hostotipaquillo district of Jalisco, which was the last plant designed by the late Godfrey D. Doveton, an excellent showing is being made. In February the plant handled 7653 tons of ore at a cost of 2.888 pesos per ton. The mining cost was 2.933 pesos, general expense, 67 centavos, and shipping and selling cost, including taxes, etc., 2.536 pesos, making a total cost of 9.027 pesos per ton. The ore handled in March amounted to 8881 tons, and it is expected soon to handle an average of at least 300 tons daily. The Amparo Mining Co., of the Etzatlan district of Jalisco, has increased its dividend rate from 4 to 5% per quarter, making the yearly disbursement $400,000. La Blanca y Anexas, of Pachuca, reports a production in February of 369,910 pesos from 13,500 tons of ore, and a net profit of 155,521 pesos. The San Vicente is the only mining company operating at present in Sinaloa. Two properties, San Luis, a Hearst holding, and Mexican Candelaria, are still operating in Durango. The San Vicente is mining silver-sulphide ore and dropping 22 stamps. The average extraction has been raised from 82% to over 92% under the management of George B. Dillingham, the present general manager, who is the only American left at the San Vicente property. Of the three properties operating in this district, San Luis is the largest producer, San Vicente averaging about half the former and slightly more than Mexican Candelaria. In February, however, the respective productions as shown by shipments were: San Vicente, over $180,000; San Luis, $100,000, and Mexican Candelaria, $60,000.

The Mining News

ALASKA

A PLACER STRIKE ON LOWER YUKON is reported to have been made 125 miles above Andreafsky.

HOUSTON DREDGING CO.—Company has purchased a new dredge and hydraulic plant for property at Mile 26.

CENTER STAR (Fairbanks)—Doctor Overgard, owner, has purchased a small one-stamp mill, which will be erected this season.

CAMERON-JOHNSON—Company is taking 300 tons of freight to mine, including a new mill, tramway, three engines and other equipment.

PORTLAND (Tiekhell)—A consignment of freight and supplies has been sent to this property, which is to be developed. A mill may be built.

MOTHER LODE (Cordova)—This company is installing an 80-hp. boiler with which to drive compressor. Expect to ship 40 tons of ore per day by July 15.

AMERICAN DREDGING CO.—Company will operate first combination tin and gold dredge to be used in Alaska. Boat will have a capacity of 1000 cu.yd. per day, and will be installed on Anacovick River.

ALASKA GASTINEAU (Sheep Creek)—Sheep Creek tunnel was holed through at 3 a.m., Apr. 2. When drill struck through, crews of both sides grabbed it and there was a "tug-of-war" for its possession, "Paddy" O'Neil's crew finally regaining possession of the drill. Distance driven since Nov. 1, 1912, to Apr. 1, 1914, is 10,497 ft.; cut is 8x10 ft. Crews worked in six-hour shifts, each shift consisting of one shift boss, eight machine men, six muckers, one car man, one motor man, one brakeman and three men on air and ventilating pipes on ditch and floor. Tunnel was driven mostly along strike of formation, mostly in greenstone and hard metagabbro. An average speed of 550 ft. per month was maintained, greatest distance being driven in November, 661 ft. Little timbering was necessary. Four machines were used in breast, two on top bar and two on bottom bar. For half the distance 7-in. casing pipe was used for air and other half 6-in. standard-gage pipe. Pressure at face was 105 lb. Cars used were 1½-ton side dump, roller bearing, and were hauled by a Jeffrey storage-battery locomotive; 50-lb. rails were used throughout tunnel, and gage of track was 54-in. No switches were used in main tunnel, but stations at intervals were made by laying iron slick sheets beside track and empty cars were transferred to these. A short track, 25 ft. long, was placed over end of rails as needed, so that car to be loaded could be kept at muck pile at all times.

ARIZONA

Gila County

INTERNATIONAL SMELTING & REFINING CO. (Miami)—Excavations for power plant are completed and foundations for buildings and stack are to be started soon. Foundations for machine-shop tools are in place and several carloads of equipment are now on ground and will be erected as soon as possible so as to allow laying of cement floors. Forms for receiving bins are ready for pouring of concrete.

BARNEY COPPER CO. (Miami)—Orders have been given to begin grading a wagon road from present highway to a point 500 ft. northwest of Shaft No. 2 of Inspiration Consolidated, where Barney shaft will be sunk. Barney group's owners recently won a contest involving right to receive mineral patent to their claims, U. S. Land Office holding that its geological aspect was sufficient to warrant possibility of ore deposits. Barney property, which has ben drilled by Lewisohn interests, has not thus far been thoroughly explored, and fact that Gila conglomerate is underlain at considerable depth by mineralized schist makes property an interesting possibility. It is announced that shaft will be sunk to a depth of 1200 ft. First hole drilled by Lewisohns entered schist at a depth of 1100 feet.

INSPIRATION (Miami)—Concreting of main east shaft is now well under way, forms for first sections and conduits for handling concrete being in place. This work is being started at 400 level, it being impossible to begin at bottom as some details of underground hins have not yet been definitely decided upon. Riveting and painting continues on crushing plant and headframes and work of placing corrugated siding and windows will start as soon as this work on storage bin is completed. Steel for compressor and hoist house is being erected as fast as received so that it should be housed in a few weeks. This will allow erection of hoisting and compressor machinery, a large portion of which is already on ground. Steel on second terrace of concentrator is now all in place and that on fifth is fast being swung. Two-boom traveler is being moved to fourth terrace, where it will be ahle to serve third and fourth. About 80 tons of steel per day is being erected with a force of 30 men. A Layne 3-stage well pump is soon to he installed at company's well on Wogg ranch for purpose of testing water-supply. Two more wells are to he put down between this well and Kiser pumping station, source of present supply. Derricks are already in place and drilling probably will be begun within a few days.

OLD DOMINION (Globe)—Two furnaces are in blast and a third one will probably be started before end of month. Basic converter, which is handling all matte from furnaces, has made over 23,000,000 lb. of copper without any lining repairs, and it is still in good condition. Concentrator is milling up to full capacity. In the construction department work on two concrete slime-thickening tanks has been completed and Dorr thickener installed. Work is now proceeding on steelwork above concrete tanks. Inside concentrator, concrete foundations are being poured for sand tables, and other equipment installation work is being done. In mine development work and ore extraction continue normal. Pump station on 18th level, which will house two new 1200-gal. Aldrich quintuplex electric pumps, is being cut. When pumps are installed a drift will be driven around under "A" shaft and shaft connected to 18th level. At present, all waste from that level is being handled up pump winze. Good headway is being made with winze in west end, and when 17th level is reached a station will be cut to allow prospecting and development work being done on that level. Work is continuing on two-compartment skip pocket north of shaft on 16th level, but completion of this job is not expected until latter part of year. On 12th level, motor haulage installation is about complete. Heavy rails and trolley lines have been laid east and west from "A" shaft, and when new three-ton locomotive arrives this month motor haulage will take place of mule tramming on that level. A fan has been put in Buffalo crosscut to improve ventilation in that part of mine. In Gray mine of United Globe mines new change house is now in use; new hoist and motor are on foundations and will soon be in commission. An additional tank for storing slimes has just been completed east of Miami road, and one more will soon be started on Hamm Homestead ground.

Maricopa County

SUNFLOWER CINNABAR MINING CO. (Phoenix)—Company has under consideration construction of a wagon road from Sears ranch on Verde River to camp in Mazatzal Mountains near head of Sycamore Creek.

MONTEZUMA (Morristown)—This old lead mine was once a producing property. Many tons of silver ore were once freighted across desert to Ehrenburg on Colorado River and sent to various smelters. It is thought that good ore remains in the mine which will now be mined and shipped to smelters by rail.

Mohave County

SWASTIKA (Yucca)—J. T. Anderson, W. H. Smith, L. Hoffman and Mr. Stebbins, inventor of the Stebbins dry concentrator, are going to build a 75-ton mill, using Stebbins process, on Swastika group. Stebbins is at present making tests on ores from Whale mine, in Copper Cañon.

Yavapai County

CONSOLIDATED ARIZONA SMELTING CO. (Humboldt)—Suit of Charles S. Hinchman, of Philadelphia, against company to recover $900,000 alleged to be due on purchase price of Blue Bell mines has been dismissed by U. S. court of appeals.

COLORADO

Clear Creek County

AMERICUS (Empire)—Lessee H. C. Merrick has opened a streak of smelting ore in this property on Covode Mountain.

CROWN PRINCE CONSOLIDATED MINING CO. (Empire)—Lower workings of Mint mine are being unwatered preparatory to resumption of development work.

HECLA TUNNEL (Empire)—This property is being cleaned out and placed in order preparatory to resumption of development. Main crosscut will be advanced into Covode Mountain.

CALUMET-CORBIN MINING CO. (Idaho Springs)—Concentration tests are being made on copper-lead ore of this property by R. H. Toll, who is metallurgist for company. Manager B. H. Hall contemplates remodeling New Era mill for treatment of this ore

SEVEN-THIRTY (Georgetown)—Lessees are repairing old workings and preparing to supply new Edison mill that is almost completed, at mouth of Burleigh tunnel. Garrett lease has, for months, been shipping regularly from a vein 6 to 14 in. thick, rich in silver and lead.

Lake County

CLEVELAND (Leadville)—Bona lease is shipping 200 tons per month.

SILENT FRIEND (Leadville)—Gildea & Campbell have opened zinc-carbonate in this Big Evans gulch mine.

LOUISVILLE (Leadville)—Hanifen & Reynolds are shipping low-grade ore through Yak tunnel. Oreshoot said to be of great extent.

STAR CONSOLIDATED (Leadville)—Cramer & Co., leasing No. 5 Star shaft, on Carbonate Hill, are making repairs to surface plant and adding shops. Underground workings are being prepared for large output of iron ore.

San Juan County

HIGHLAND MARY (Silverton)—Although making shipments is difficult at this time of year, a carload of ore was packed down on animals recently and shipped to Durango.

Teller County

EL PASO (Cripple Creek)—A strike of ore of good grade has been made on tunnel level, in Fuller crosscut to C. K. & N. vein.

FREE COINAGE (Cripple Creek)—Mill near Altman, has resumed operations and is treating about 50 tons of low-grade ore per day.

MICHIGAN

Iron

DRILLING NEAR ESCANABA—It has long been thought by some that there is an extension of the Menominee range formation near Escanaba, which is on Lake Michigan, and so drilling has been started on a piece of land five miles from city. There has been much guesswork regarding iron ore near Lake Michigan; this drilling will probably reveal the truth. Years ago, some mining work was carried on at Hermansville, not a great distance from the lake, and it was here that one of the first Menominee range properties was opened. Cleveland-Cliffs Iron Co. did some drilling at Hermansville several years ago but results were not announced.

TILDEN (Bessemer)—A new shaft, which will be lined with concrete and steel, is planned for this property, present one being considered in bad shape. It is also intention to erect a new coal dock, trestle, boiler and engine house.

CASCADE MINING CO. (Palmer)—Shaft has been sunk to a depth of 800 ft. and will have to be sunk 100 ft. more before it will be bottomed. Drifting and crosscutting will then be started and it is certain that some ore will be shipped this year. Shaft is lined with concrete and steel. A contract for a large hoist will be awarded.

PRESQUE ISLE (Wakefield)—Ore is now being hoisted from this exploration to east of Wakefield near Whiteside property. Ore is coming from a depth of 250 ft. at a distance of 500 ft. from shaft in foot-wall side. Drills also showed ore from 700 to 1000 ft. and it is likely that shaft will be sunk deeper after drifting and crosscutting is completed on 250-ft. level. Little work has been done in this territory in a mining way and it is believed that success at Presque Isle will lead others to that virgin field between Wakefield and eastern end of Gogebic County.

LAKE ANGELINE (Ishpeming)—Some miners were laid off last week because mine is about played out and it will not be long before it will be necessary to suspend operations for all time. Property has been one of the most famous in Lake Superior country as it mined richest ore in district. East end part is now closed and few men remaining are employed taking out ore that lies under hill to south. This ore has been known to exist for some time but management did not desire to mine it because of tracks and houses on surface above. Many men who have been discharged have worked at Lake Angeline for over 30 years and they are now seeking work at other mines on range.

MINNESOTA

Cuyuna Range

BRAINERD-CUYUNA (Brainerd)—Company's second shaft is now down 40 ft. in surface material.

ROGERS-BROWN ORE CO. (Crosby)—Armour No. 2 and Kennedy mines have begun shipping direct from shafts. Loading from stockpile has not started yet. No successor has been named for Superintendent H. J. Kruse, recently resigned.

IRON MOUNTAIN (Ironton)—Operations in shaft have ceased at 117 ft., being 47 ft. into formation of manganiferous ore. Property was then boarded up and left in charge of watchman. Officials state this is for purpose of economy while negotiations are being carried on for disposal of property.

AMERICAN MANGANESE MANUFACTURING CO.—Stockholders of Cuyuna-Mille Lacs Iron Co. indorsed consolidation of that company with Cuyuna-Duluth Iron Co. and Dunbar Furnace Co. to form the American company, Apr. 9. By terms of the consolidation, each of the iron companies will have two representatives on board of directors, and furnace company remaining five members. Shareholders of Cuyuna-Mille Lacs stock will receive, for each 100 shares held, 500 shares of preferred and 650 shares of common, each of par value of $50. It is proposed to complete exchange of stock prior to May 1. Furnace plant of Dunbar Furnace Co., Dunbar, Penn., 60 miles east of Pittsburgh, has a capacity of 500 tons daily. Enough tonnage has been booked, it is stated, to insure operation throughout year. In list is an order for manganiferous pig-iron from an Eastern railroad company, to be used in manufacture of steel rails.

Mesabi Range

STATE HAS BEEN TAXING ROYALTIES due to individuals or corporations from leased iron-ore lands. To this, a number of Mesabi range fee owners have objected, and have asked state tax commission for an abatement of assessments. To make a test case in courts, this request has been refused. In St. Louis County alone, where greater part of Mesabi range is located, this tax nets state $20,000 per annum. Action in matter will be started immediately.

SHIPMENTS HAVE BEGUN, but not with quite the vim experienced in former years. Great Northern Ry. announces that, from indications, it will haul 15,000,000 tons this season. Shenango Furnace Co., which usually inaugurates activities on range, has started at all its properties. Oliver Iron Mining Co. has 62 drills at work exploring on lands of Higgins estate, which it is under contract to buy at a stipulated rate per ton of ore developed. Lands are in vicinity of Biwabik. Quinn Mining Co.'s property near Naskwauk, now stripped, will ship heavily during season. Company contemplates erection of a washing plant. Big forces have also started at Crosby and Hawkins mines, near Nashwauk. Latter property has in late years been premier shipper in that vicinity. Pearson mine has closed down, for unstated reasons. At La Rue, activities are largely confined to building a new concentrator. Usual activity prevails around Keewatin. Great Northern officials recently inspected Mississippi, and tracks are now being completed to stockpile. Bray mine, it is stated, will resume before May 1. At Virginia, Lincoln mine was flooded out Apr. 6, due to overflowing of a stream that ran near shaft. Drainage is now in progress.

BANGOR (Virginia)—Labor troubles have caused closing down of mine, 100 men having walked out. Dissatisfaction is due to changing method of paying men from contract system to a day rate. Pickands-Mather & Co. are operators. No trouble has arisen, and deputies are in charge.

MISSOURI-KANSAS-OKLAHOMA

Joplin District

G. L. COLE HAS RETURNED TO NECK CITY and will develop Calumet, Penn Zinc and Hudson leases. Eight holes put down are said to have shown good zinc-ore runs. Calumet drilling reached 225-ft. level.

JAMES BARNES HAS MADE STRIKE ON TAR CREEK, at Miami, Okla. Hole put down to 200-ft. level, with last 10 ft. showing good run of zinc ore. McConnell & Barnes also have developed good strike in Miami field.

CHAMBERLAIN & CO. (Carterville, Mo.)—Old Yale mine has been drained to 200-ft. level and extensive operations will be conducted in sheet ground.

LONE STAR LEASE (Carthage, Mo.)—Mining operations for calamine on this tract unearthed good run of lead ore. Pocket was found at 12-ft. level.

COATS & ORTT (Webb City, Mo.)—These operators have opened good lead prospect on Baker land. Have entered old shaft and cut drift at 70-ft. level.

CENTURY (Neck City, Mo.)—This mine is a comparatively new one. In 10 weeks it has produced 1230 tons of blende valued at approximately $50,000.

NAPOLEON (Thoms Station, Mo.)—Aërial cable tram will be used to connect new shaft to concentrator. Operators will sink to 173-ft. level to reach ore.

DURSTON MINING CO. (Galena, Kan.)—New concentrator is now running. Mine is on lease of McElroy-Luscombe tract. Good orebody developed from 60 to 90 feet.

GRASS ROOTS (Cave Springs, Mo.)—A second shaft has encountered even a better run of ore that first one sunk. At 45-ft. level, 25-ft. face of zinc ore is worked.

TEN O'CLOCK LEASE (Carterville, Mo.)—Good zinc ore strike has been made by S. D. Eurit, Alfred Vick and George W. Crowder on undeveloped portion of this tract.

SYCAMORE (Seneca, Mo.)—This property, opened eight years ago, has been taken over by William Caruth, of Joplin, Mo., and placed in operation. New machinery has been installed.

WEEKS & BRIGGLE (Carl Junction, Mo.)—This company soon will start large concentrator and resume operations on Anderson land. Weaver mine, on same tract, also will be started up.

SALOME (Klondike, Kan.)—Development work at this mine has revealed some new ore-bearing ground that appears promising. Ore found from 75-ft. level down to 90-ft. Mine is near Yellow Pup.

MAGOON MINING CO. (Lawton—via Weir, Kan.)—This company soon will begin work on concentrator, which will make fifth plant for Lawton camp. Two other plants will probably be built soon.

MAGGIE TAYLOR TRACT (Galena, Kan.)—S. R. Ping & Co. have entered good orebody with drill at depth of 118 ft. and will sink shaft. Company recently purchased 30 acres from T. W. Bayne. Land formerly produced well but was idle long.

AMBOY (Galena, Kan.)—Concentrator has been purchased by four Galena men to be used as custom plant and for company's ore from shaft on Southside tract. Concentrator is on Cornwall land, formerly owned by Playter Mining Co. Amboy shaft to be sunk deeper.

MONTANA

Beaverhead County

PROSPECTING FOR OIL in Big Muddy and Sheep Creek Basin, 17 miles west of Dillon, has been so promising that more than 500 acres of oil land have been located, while other lands are being staked out daily. Expert oil drillers are in field making preparations for drilling.

Deer Lodge County

WASHOE SMELTING WORKS (Anaconda)—A contract was let Apr. 8 to Clifton-Applegate Co., of Spokane, for excavation work of first 2000-ton unit of new leaching plant. Two sulphuric acid experts, C. S. Rogers and W. H. Dederick, of Philadelphia, are in consultation with E. P. Mathewson, relative to installing a sulphuric-acid plant at Washoe works to supply company's leaching plant as well as other plants now in course of construction in other parts of state.

ELK MINING CO. (Deer Lodge)—A new stage has been reached in litigation between this company and Tim Buckley who five years ago homesteaded a tract of land which was afterwards located as Elk mining claim. Elk company contested Buckley's homestead entry and made application for patent which was refused. A number of samples of ore, alleged to have come from mine were introduced as testimony but were likewise refused. Company finally pumped out mine to permit a representative of U. S. Land Office to make a personal inspection of mine, which will be made soon.

Fergus County

BARNES-KING DEVELOPMENT CO. (Kendall)—Suit originally brought by Arthur P. Heinze against this company was dismissed Apr. 1 in New York courts. By this action $90,000 of company's money that had been tied up through attachment proceedings was released and forwarded to Daly Bank & Trust Co., of Butte. Suit was instituted by Heinze to recover $97,000, claiming that he had been defrauded by a prospectus issued by W. H. A. Fisher, a member of syndicate selling stock in New York. Case after having been tried in various courts was set for final hearing last December and had since been pending. Order of dismissal was directed against Assets Collecting Co., which succeeded Heinze to title.

Granite County

TWO PER CENT (Tower)—Mine is being reworked by Earl & Patten, who have recently struck a new shoot of silver ore, all of which is of shipping grade.

MIDNIGHT (Tower)—Old workings are being reopened by O. A. Johnson, C. E. Nerling and W. J. Thomas and shaft is being retimbered. A vein of silver ore has been found.

Lewis & Clark County

VALLEY FORGE (Rimini)—In course of development work carried on during last few months a strong vein, 24 ft. wide was encountered, carrying silver, gold and lead; 5 ft. of this is high-grade ore. Strike was made 500 ft. below surface and work will be hastened on lower levels to intersect this vein. Strike is said to be most important one made in region near Helena in many years.

Powell County

IN THE SNOWSHOE AND CARPENTER CREEK DISTRICTS, north of Elliston, development on various claims during winter has been encouraging in that it uncovered extensive bodies of low-grade copper ore. Most of it is too low grade to stand cost of a 10-mile haul to railroad and will be treated at the mines. It is expected that some companies operating in district will erect plants for concentrating ore and others for leaching it by processes which proved successful in leaching Butte copper ores.

Silver Bow County

BUTTE DULUTH (Butte)—A shipment of copper was made Apr. 9 aggregating 75,000 or 80,000 lb. This is output of plant for 30 days. New crusher plant will be completed in 30 days.

TIMBER BUTTE (Butte)—Operations in this plant will begin by June 1. Present unit will have a capacity of 350 tons per day and will treat zinc ores from Elm Orlu mine, which contains 20% zinc with gold and silver equal to that of ore of adjoining Butte & Superior mine.

BUTTE & ZENITH CITY (Nissler)—Work of installing new electric pump on 460-ft. level has been completed and at present pump handles between 200 and 250 gal. of water per min. Crosscutting is going steadily forward north and south of station, and development work so far has been promising.

NORTH BUTTE (Butte)—Sinking has been going on steadily in Granite Mountain shaft which is to become main working shaft of company in future. It is now below 3000-ft. level and connection with 2800 level of Speculator mine has been completed. New electric hoist is expected to arrive by July 1.

ANACONDA (Butte)—Work was resumed at Mountain Consolidated mine after a shutdown of several months. This, it is expected, will bring Anaconda output once more up to capacity of smelting works. West Stewart, Diamond, Belmont, Silver Bow and Never Sweat shafts are not in operation at present, repairs being made at all of them which is chief reason for decreased output during last month. West Stewart will be ready to resume operation by end of month.

BUTTE & LONDON COPPER DEVELOPMENT CO. (Butte)—New compressor which arrived a few days ago, is being put in place by a large force of men. Unwatering of shaft is progressing rapidly and it is expected that by time compressor is installed, all water will have been pumped out so that sinking below 1100-ft. level can be started. At this station an electric pump will be installed which is now on its way from Duluth; 500 ft. of shaft sinking from the 1100- to 1600-ft. level has been contracted for with Rainbow Development Co.

BUTTE MAIN RANGE (Butte)—At a meeting of directors, Apr. 8, plans were discussed to resume operations on company's properties at an early date. It was proposed to sink a shaft midway between Spread-Delight and Rory O'Moore claims. Shaft will be 600 ft. from Tropic shaft being sunk by Anaconda company to west of Butte Main Range. When new shaft is down to 700-ft. level, it will be connected with two old shafts on extreme northwest and south ends of company's claims. Money for this work is to be raised by sale of 150,000 shares of treasury stock at par value of $1 per share.

NEVADA

Elko County

ELKO PRINCE (Gold Circle)—Montana men who held option have forfeited it, and Savage estate, it is reported, will resume operations on a large scale.

ALPHA (Jarbidge)—Mill is now treating $30 ore. Other mines operating in district are Success, Bluster, Flaxie, Pick and Shovel, Little Devil and Long Hike.

Esmeralda County

KEWANAS MINING CO. (Goldfield)—Operations will soon be resumed by reorganized company. Stock of old company has been accepted for that of new by payment of bonus of 1½c. per share.

C. O. D. CONSOLIDATED MINING CO. (Goldfield)—Shipping will commence in near future, and ore will be treated in Bonnie Clare mill of Jumbo Extension Co. This mill is also treating Jumbo Extension ore.

SILVER PICK CONSOLIDATED (Goldfield)—Air compressor and 40-hp. motor have been installed, and 2½-in. piston drills have replaced hand drilling. Pump, with capacity of 120 gal. per min., has been installed on 500-ft. level. Crosscutting on this level is being done.

ATLANTA MINES CO (Goldfield)—Vein recently cut in crosscut on 1750-ft. level in St. Ives shaft of Goldfield Merger Mines Co., is 22 ft. wide; of this, 6 ft. is good-grade ore. Crosscut, at depth of 200 ft. from Jumbo No. 2 workings of Goldfield Consolidated, into Atlanta ground, has cut vein 11 ft. wide, with pay streak assaying $12 in gold.

Eureka County

PEARL (Eureka)—New strike of high-grade ore has been made by lessee. Sinking is being done and better ore is found at depth. Ore is being sacked for shipment.

Humboldt County

PLACER MINING AT PANAMA, near Rochester, is now being done. Bedrock is covered by only two or three feet of sand and gravel; upper half is removed by plows and scrapers and other half hauled in wagons to water.

BUCKSKIN NATIONAL GOLD MINING CO. (National)—Mine has been leased and extensive work will be done this year. Construction of new road with easier grade has been started.

DANBY ORE REDUCTION CO. (Seven Troughs)—This English company, leasing Badger Hills property, has recently discovered high-grade ore. Test shipment to Selby smelting plant has been made.

ANTELOPE SPRINGS (Imlay)—Vein has been cut 840 ft. from portal and 165-ft. drift has opened oreshoots of mixed carbonates and suiphides. Ore assays in gold, silver, lead, copper and zinc, and occurs in stringers in vein except at oreshoots, which are 12 to 20 ft. wide.

Lander County

LYNN BIG SIX (Austin)—Mill will be built this spring. South drift on east vein has opened oreshoot assaying over $100 per ton in gold.

RAVENSWOOD (Ravenswood)—Extensive development work will be done this summer. New headframe will be built at shaft which is now 256 ft. deep, and sinking to water level will be done. Vein system will then be crosscut. Ore developed to date is worth $17.50 per ton in silver, lead and copper. Many claims in this district will be developed this summer.

Lincoln County

YUBA (Pioche)—Hoisting plant of No. 3 shaft has been placed in commission. Much development work is under way and shipments will begin in near future.

GOLD CHIEF (Pioche)—Milling plant, building and equipment, has been purchased, and is being moved to company's property in Chief district, where it will be put into operation.

PRINCE CONSOLIDATED (Pioche)—Shipments will be increased by 50 tons per day, 30 cars per week being shipped at present. Shipments from Bullionville tailings dump will begin in a few days.

DAY-BRISTOL CONSOLIDATED MINING CO. (Pioche)—Suit to regain title to Inman claim has been lost in lower court; case has been appealed to supreme court of state. Inman claim is considered of value and is near principal workings of company. Title was lost by failure to do annual assessment.

Mineral County

BLACK EAGLE (Rawhide)—Force at mine and mill has been increased and mill is now treating 60 tons daily.

NEVADA NEW MINES CO. (Rawhide)—High-grade streak 3 in. wide and said to yield some specimen ore assaying $3 per lb. has been struck in shaft sunk by lesses. Company is driving crosscut between old and new shafts. Production is now between 50 and 60 tons per day and is being treated in company's mill below town. Night shift will be put on and production increased.

Nye County

JIM BUTLER (Tonopah)—Temporary injunction to restrain West End company from working ground under dispute has ben granted. Injunction is embraced in suit to recover $500,000 damages.

GOLDEN ARROW DEVELOPMENT CO. (Tonopah)—A 3-ft. vein was cut on 400-ft. level and inrush of water was so great that mine pump of 200,000 gal. daily capacity, could not handle it, and mine was flooded. There was time, however, to clear mine of all tools. Mill will be built in near future, and this flow of water will be of value.

SUNSET MINING & DEVELOPMENT CO. (Bullfrog)—Capacity of mill will be increased to 70 tons daily and complete cyanide plant will be added. New equipment will consist of 5x18-ft. tube mill, Akins classifier, Dorr thickener, Pachuca agitating tanks and Portland continuous filter. Work has started under direction of R. P. Akins, of Colorado Iron Works Co., and plant is expected to be in operation by Aug. 1, 1914. In mine, development work has been done continuously for past year and two-years supply of ore is blocked out. Oreshoots are opened to vertical depth of 700 ft. by tunnels.

Ormsby County

PROSPECTING IN CARSON RIVER below Empire will be done by means of caissons. After tests have been made as to best method of saving gold, dredging on large scale will be done.

White Pine County

ELY CALUMET (Ely)—Drifting on 300-ft. level of Gladys shaft to Grand Deposit vein is being done.

CONSOLIDATED COPPER MINES CO. (Ely)—Development is being done on Emma, Nevada and Watson claims adjoining Liberty pit of Nevada Consolidated. Five churn drills are working, holes being drilled 500 to 700 ft. deep. Some deep holes will be sunk and 12- and 14-in. bits have been ordered for this purpose.

NEW MEXICO

Grant County

McKENNA & GERHART (Hanover)—Lessees have started work on copper property near Fierro.

CHINO COPPER CO. (Hurley)—Flume from No. 2 dam to concentrator is nearing completion. Two dams are to be constructed below present series, south of Hurley.

STAUBER, BELL & WRIGHT (Pinos Altos)—A lease has been secured by these men on all Pinos Altos property of Savannah Copper Co., which includes Pacific, Hearst, Atlantic, Gillette, Mina Grande and others.

AMERICAN TURQUOISE CO. (Silver City)—Commissioner's sale on foreclosure of mortgage will be held at court house Apr. 20. Company has four claims in Eureka mining district, Grant County. Frederic N. Gilbert is plaintiff.

Taos County

FRANK GALLUP (Rinconda)—Five tons of tungsten ore were shipped for treatment from Hubnerite No. 1 shaft on Copper Mountain, Taos County. Ore taken out at a depth of 45 to 60 ft. Pay streak is 1 ft. wide and ore is said to contain 25% tungstic acid. Operators contemplate making regular shipments by the end of summer.

OREGON

Jackson County

STERLING PLACER (Medford)—Bullis company, of New York, owners of this old mine, will soon set off a blast of 15,000 cases of powder to loosen a ledge. Mine is oldest and richest in Jackson County.

Josephine County

ALTHOUSE PLACER MINING CO. (Holland)—Arnold Becker, of New York, president and organizer of this company, which has just installed a complete excavating plant at the mines, recently committed suicide. Plant installed by him was a success. Injunction proceedings were instituted against company preventing use of water from a creek that it wished to use and this is thought to be cause of his act.

SOUTH DAKOTA

Lawrence County

GOLDEN REWARD (Deadwood)—Company will spend $15,000 in improvements to its cyanide plant this summer, directors having appropriated that amount at a recent meeting in New York. Principal improvements will be a tube mill.

RATTLESNAKE JACK (Galena)—President C. B. Harris and M. E. Hiltner, who is designing plant, are in Nevada investigating Trent system of cyaniding, prior to making final determination as to equipment of mill, which is now under construction.

DEADWOOD-STANDARD (Ragged Top)—Hodges, Nicholls & Burkett have leased this property at Ragged Top. Property is equipped with a dry-crushing cyanide mill, which will be put in commission. Lessees are all miners of Terry, S. D.

TITANIC (Carbonate)—Work is practically suspended owing to impassable condition of wagon roads between Trojan and Carbonate, some three miles, over which coal supply must be hauled. Recent developments have been highly encouraging, following a stringer assaying as high as 140 oz. silver per ton.

HEIDELBERG (Two Bit)—Working tunnel, following ore vertical, has intercepted porphyry sheet, believed to be roof of ore. It dips with formation, about 5° to east, from horizontal. Porphyry is mineralized and carries $3 to $6 in gold, per ton. Fourth shipment of ore has been made to Golden Reward mill, at Deadwood, and shows about same assays, viz., $17 per ton.

ORO HONDO (Lead)—With water all out of shaft to bottom, 1050 ft., it has been found boiler plant is inadequate to run hoist compressor and pumps. New and longer smokestacks are being installed in hopes of getting additional power. If this fails it is probable electric pumps will be installed, power to be secured from near-by transmission line. Concrete bulkheads have been put in crosscuts on 1000-ft. level to shut off water coming to shaft, drills have been received and everything is in readiness to start sinking.

Pennington County

PLACER GROUND ALONG SPRING CREEK, near Hill City, covering several miles of stream, has been optioned by Denver men and investigation of dredging possibilities will be undertaken.

DAKOTA CONTINENTAL COPPER (Hill City)—Cutting station at 825-ft. level, preparatory to starting lateral work, is in progress. New piston drills are being used.

UTAH

Beaver County

CAVE (Milford)—Good ore has recently been opened; and mining and shipments will soon be started as soon as a new hoist can be installed.

Emery County

RADIUM COMPANY OF AMERICA (Green River)—Carnotite ore is being hauled from this company's properties, 12 miles west of Green River. There is stated to be 100 tons of this material, which will be shipped to company's reduction plant, near Philadelphia, for treatment.

Juab County

TINTIC SHIPMENTS for week Apr. 10, were 131 cars.

TINTIC ZINC (Eureka)—These claims contain extension of Scranton vein, and drifting is being done with a view to prospecting this vein at depth.

CROWN POINT (Silver City)—Operations have been resumed at this property, with funds provided by an assessment of ½c. per share, recently levied. Main shaft is 550 ft. deep, from which depth a winze has been sunk 100 ft. In all 5000 ft. of development work has been done.

IRON BLOSSOM (Silver City)—Regular quarterly dividend of 10c. per share, or $100,000, has been declared, payable Apr. 25. This brings total for 1914 thus far up to $200,000. There is stated to be a good reserve in treasury. Shipments for first quarter of 1914 amounted in round numbers to 10,000 tons. Between 3500 and 4000 tons a month are being produced at present.

Salt Lake County

UTAH APEX (Bingham)—This company has received a preliminary allowance of $2274 from county commissioners on its claim for $6000 for material and labor furnished during hunt for murderer Lopez. It is understood that a further allowance will be made by county.

UTAH CONSOLIDATED (Bingham)—During 1913 there were produced 7,710,668 lb. of copper, and 19,208,063 lb. of lead, as compared to 8,734,063 lb. of lead in 1912. Earnings were $2.12 per share, largest in five years, increase being due to larger lead production. Copper-ore reserves were 287,083 tons, averaging 1.9% copper, and lead reserves 51,409 tons, carrying 15.3% lead. Lead reserves have been more than doubled over those of 1912. Development in 1913 was 20,500 ft., as compared with 12,320 for year preceding; $1.50 per share was paid in dividends.

Tooele County

GETHIN LEROY (Wendover)—High-grade ore, running well in silver and copper, with some lead and a little gold, has been opened in a tunnel, which is being driven on main vein to cut its intersection with LeRoy vein. Ore was cut near shaft, from which shipments are now being made. A 2000-ft. tram is proposed to bring ore down east side of mountain, so that it can be readily loaded for hauling.

WASHINGTON

Ferry County

LAKESIDE—This mine, recently bonded by Stewart Brothers, of Spokane, has opened a new vein of shipping ore, showing high values in copper. Vein is 8 in. in width.

WASHINGTON—This property, near Curlew Lake, which is owned by A. C. Cook and G. J. Thomkins, has been bonded by Granby company, which is equipping it with diamond drills.

SAN POIL (Republic)—This mine and mill have been purchased by Hope and Knob Hill companies for a consideration of $170,000. Purchasers have contracted to produce not less than 50 tons daily.

Okonogan County

AN ORE-SAMPLING WORKS IN OROVILLE may be built for treatment of ores of some of the mines in that vicinity.

Stevens County

COPPER KING (Chewelah)—The 100-ton oil smelter being installed at this property is well under way, and will be finished in about 90 days.

CANADA

British Columbia

RAMBLER-CARIBOO (Three Forks)—Work is being resumed on this property, which has been shut down for several weeks, owing to shortage of water.

JEWEL (Eholt)—Vein was found to have faulted between 300- and 400-ft. levels, but was located after some difficulty on 400-ft. level, where it was 3 ft. wide and assayed much higher than on any other level.

SILVER HOARD (Ainsworth)—Ore has been struck in west drift of 200-ft. level and work has been continued in shape of a crosscut, which, at 30 ft. in, had not reached opposite wall. Ore is of good milling grade, assaying from 10 to 30 oz. in silver. Another drift is being driven toward a cave where a large body of carbonate ore was found.

ROCHER de BOULE (Hazelton)—Machinery is installed, electrical equipment working and everything is ready for operations to begin as soon as ground tram is finished from camp to workings; 50 men will be employed in development. Two months will be required to drive tunnel, by which time tram line will be completed and bunkers at railway will be ready to receive ore.

Ontario

ORE SHIPMENTS FROM COBALT in March were as follows: City of Cobalt, 40.35 tons; Cobalt Lake, 96.15; Cobalt Townsite, 153.98; Coniagas, 128.19; Crown Reserve, 20, by Dominion Reduction Co., 75.43, or a total of 95.43; Hudson Bay, 74.65; Kerr Lake, 29.42, by Dominion Reduction Co., 56.91, or a total of 66.33; La Rose, 129.27; McKinley-Darragh, 215.53; Nipissing, 57.99; O'Brien, 42.88; Peterson Lake (Gould), 30.65, Peterson Lake (Seneca Superior), 34.31, or a total of 64.96; Penn Canadian, 52.32; Right of Way, 41.56; Timiskaming, 32.23; Trethewey, 12.31; a total of 1354.03 tons.

GOULD (Cobalt)—Company has struck vein on 280-ft. level.

COCHRANE (Cobalt)—Arrangements have been made to treat some low-grade ore in Timiskaming mill.

THREE NATIONS (South Porcupine)—Mine is now under option to a Montreal syndicate and is being thoroughly developed.

GOLDEN FLEECE—This gold mine, in eastern Ontario, has been leased and will be operated this summer. The property has a five-stamp mill.

DOME (South Porcupine)—March report shows a recovery of $87,657 from 14,970 tons of ore, having an average value of $5.85 per ton. New section of mill will be in operation in May.

REA (South Porcupine)—A new deal for amalgamation of a leasing company and original Rea Mining Co. is under way. New concern, in which interests are practically same as in leasing company, will provide $20,000 cash for working capital. If these negotiations are consummated, original Rea shareholders will get practically nothing.

MEXICO

Sonora

CANANEA CONSOLIDATED—A strike was called at Cananea, Apr. 13, because a number of miner's leaders were deported as sympathizers with Huerta. Cananea is under rebel control. Strikers declared they would refuse to work in mine unless officials compelled Constitutionalists to allow their leaders to return. Officers of mining company say that they do not expect any serious trouble and that relief men will take place of strikers.

MINES CO. OF AMERICA—Report for year ended Dec. 31, 1913, shows total receipts of $1,734,626, expenditures $1,238,639, operating profit $495,987. Profit after interest, general expenses and taxes was $467,232. Consolidated balance sheet of company shows current assets of $1,539,378, accounts and drafts payable and suspense account $392,065. Considering difficulties under which company was forced to operate, owing to disturbed conditions in Mexico, company made a satisfactory showing. Although there was extracted during year from four properties, Dolores, El Rayo, Creston-Colorada and La Dura, 207,085 tons, assaying $2,017,057, value of ore reserves increased largely during year and at close amounted to 485,261 tons, assaying $4,888,605, compared with 334,876 tons, assaying $3,612,010 at the close of the preceding year.

The Market Report

METAL MARKETS

NEW YORK—Apr. 22

The metal markets show no marked increase in demand from consumers, and have been inclined to weakness, though without any great changes.

Copper, Tin, Lead and Zinc

Copper—The market during the past week has been exceedingly dull and has manifested some further weakness. Sales were small both for domestic and foreign delivery and prices were reduced, as offers to sell developed from day to day without, however, bringing out any great demand. Sales were made as low as 14¼c., delivered for foreign account. These were chiefly from second hands. Even at the prices which were offered domestic buyers do not seem to be in any hurry to come forward. Without affecting business one way or the other, the Mexican trouble has for the time halted trading and everybody is inclined to wait for further developments. Moreover domestic consumers seem to have made up their minds that 14c. copper is in sight and are holding back for that price.

The average of our weekly quotations for electrolytic copper is 14.092 cents.

Lake copper continues largely nominal, sales being limited to small quantities with very little change in price.

The standard market has been weak. On Thursday, April 16, spot was quoted £64 16s. 3d.; three months £64 18s. 9d. The market declined steadily, closing on Apr. 22 at £64 6s. 3d. for spot and £64 5s. for three months.

Base price of copper sheets is now 19¾c. per lb. for hot rolled and 20¾c. for cold rolled. The usual extras are charged and higher prices for small quantities. Copper wire is 15@15½c. per lb., carload lots at mill.

Copper exports from New York for the week were 9371 long tons. Our special correspondent reports exports from Baltimore for the week at 3449 tons.

Visible Supplies of Copper in Europe on Apr. 15 are reported as follows: Great Britain, 10,590; France, 2140; Rotterdam, 3100; Hamburg, 4180; Bremen, 1090; other ports, 750; total, 21,850 long tons, or 48,944,000 lb. This is an increase of 1120 tons over Mar. 31. In addition to the stocks above, 1900 tons are reported afloat from Chile and 4200 from Australia, making a total of 27,950 tons.

Tin—There was considerable buying by consumers in this country the second half of last week. The lower level made for confidence and large future business was placed. The activity in our market, however, did not stimulate the London market, where bears seem to be at war with the continental bull interests. Large sales were made on the London Metal Exchange and quotations broke severely. The market closes steady at £161 5s. for spot and £163 5s. for three months; and about 35½c. for April-May tin here.

Messrs. Robertson & Bense write us that receipts of tin ore and concentrates at Hamburg during March were: Bolivia, 2594; Southwest Africa, 22; South Africa, 30; total, 2646 tons.

Exports from Baltimore for the week included 470,751 lb. scrap tin to London.

Tin shipments from the Straits in April are estimated at 5000 tons. For the four months ended April 30, the total shipments were 19,730 tons in 1913, and 19,972 in 1914; increase, 242 tons.

Lead—The market is quiet and a trifle lower. The metal is freely offered and the demand has been slack. At the close New York is quoted 3.75@3.80c., and St. Louis, 3.62½@3.65 cents.

The London market for Spanish lead is quiet at £18; English lead 10s. higher.

Spelter—This market, too, is weak. There has been little demand and considerable pressure to sell at lower prices. At the close St. Louis is quoted 4.87½@4.90; New York, 5.02½@5.05 cents.

The London market is quiet. Good ordinaries are quoted £21 15s.; specials £22 per ton.

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

Limitation of production it is understood will be considered by the German Syndicate—which is a member of the International Spelter Convention—at a meeting to be held next week. It is said that stocks carried by the producers now exceed the point which the spelter convention fixed as a limit.

Other Metals

Aluminum—The market is a little better and some selling has been noted. Prices remain fairly steady, 18@18½c. per lb. being asked for No. 1 ingots, New York delivery.

DAILY PRICES OF METALS

NEW YORK

Apr.	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.
16	4.8685	58¼	*14½	14.10 @14.20	36¼	3.75 @3.80	3.62½ @3.65	5.05 @5.10	4.90 @4.95
17	4.8690	58¼	*14½	14.10 @14.20	36¼	3.75 @3.80	3.62½ @3.65	5.05 @5.10	4.90 @4.95
18	4.8690	58¼	*14½	14.05 @14.15	36¼	3.75 @3.80	3.62½ @3.65	5.05 @5.10	4.90 @4.95
20	4.8690	58¼	*14½	14.00 @14.10	36	3.75 @3.80	3.62½ @3.65	5.02½ @5.05	4.87½ @4.90
21	4.8700	58½	*14½	14.00 @14.10	35½	3.75 @3.80	3.62½ @3.65	5.02½ @5.05	4.87½ @4.90
22	4.8705	58½	*14½	14.00 @14.10	35½	3.75 @3.80	3.62½ @3.65	5.02½ @5.05	4.87½ @4.90

*Nominal.

The quotations herein given are our appraisal of the markets for copper, lead spelter and tin based on wholesale contracts; and represent, to the best of our judgment, the prevailing values of the metals specified as indicated by sales by producers and agencies, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.15c. apart. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic; of casting copper 0.15 to 0.25c. below. The quotations for lead represent wholesale transactions in the open market for good ordinary brands; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

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

LONDON

Apr.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
16	26 13/16	64 3/4	14 08	64 1/8	69 1/4	164 1/2	166 1/2	18	3 91	21 1/8	4 70
17	26 13/16	64 11/16	14 05	64 1/8	69 1/4	166 1/4	168 1/4	18 1/4	3.94	21 1/8	4 70
18	26 13/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	26 7/8	64 3/4	13 99	64 1/8	69 1/4	164 1/4	166 1/4	18	3.91	21 1/8	4 70
21	26 13/16	64 5/16	13 97	64 5/16	69	161 1/2	163 1/2	18 1/8	3.94	21 1/8	4 73
22	26 13/16	64 5/16	13 97	64 1/4	69	161 1/4	163 1/4	18	3 91	21 1/8	4 73

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Antimony—No buying demand for this metal has developed and business through the week has been rather of a retail order. Prices are a little weak with considerable spread according to quantity and other considerations. Cookson's is quoted at 7.20@7.50c. per lb.; Hallett's, at 6.90@7.15c., while 5.85@6.25c. is asked for Chinese, Hungarian and other outside brands.

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

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

The production of cadmium in Upper Silesia in the year 1913 was 37,192 kg., a decrease of 5565 kg. from the preceding year.

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

Exports from Baltimore for the week included 2491 lb. selenium to Hamburg, Germany.

Foreign Trade of Great Britain in Metals other than iron and steel, two months ended Feb. 28, in long tons:

	Imports		Exports	
Metals:	1913	1914	1913	1914
Copper	19,332	29,021	12,989	11,330
Tin	8,771	8,502	8,023	7,506
Lead	32,943	34,794	9,432	11,157
Zinc	23,217	24,863	1,265	1,659
Quicksilver	382	400	204	114
Minor metals	1,342	1,459	5,051	4,795
Ores:				
Tin ore and concentrates	5,510	6,076	.....	.....
Pyrites	170,373	150,225	.....	.....

Copper includes metallic contents of ore and matte. Exports include reëxports of foreign material.

Gold, Silver and Platinum

Gold—The demand for Russia and France was so strong that ½d. premium was paid, making the price on the open market in London 77s. 9½d. per oz. The surplus supplies went to Russia.

Iridium—The market is quiet and prices unchanged, $75@78 per oz. being quoted.

Platinum—The market is quiet, but no further weakness has developed, and prices are unchanged. Dealers ask $43@44 per oz. for refined platinum and $46@49 for hard meatl. The foreign market is steady and firmer.

Gold and Silver Movement in the United States, three months ended Mar. 31, as reported by the Bureau of Foreign and Domestic Commerce:

	Gold		Silver	
	1913	1914	1913	1914
Exports	$47,687,632	$18,624,883	$17,288,480	$11,483,600
Imports	15,947,824	21,494,995	9,865,791	6,799,568
Excess	E.$31,739 808	I. $2,870,112	E.$7,422,689	E.$4,684,032

Exports of merchandise this year were valued at $565,307,032; imports, $484,717,738; excess of exports, $80,589,294. Adding the gold and silver gives $82,403,214 as the total export balance.

Silver—The market shows a tendency to slight improvement in prices. Silver sold Apr. 21 close to 27d., and though the market is quoted today as limited, the fact must also be taken into account that the supplies are materially contracted, owing to the Mexican situation.

Shipments of silver from London to the East, Jan. 1 to Apr. 8, as reported by Messrs. Pixley & Abell:

	1913	1914	Changes
India	£2,501,300	£1,916,000	D. £585,300
China	166,000	40,000	D. 126,000
Total	£2,667,300	£1,956,000	D. £711,300

The total imports of silver into Great Britain for the three months ended Mar. 31, were 22,449,048 oz., against 33,634,311 oz. in the first quarter of 1913, and 34,474,199 oz. in 1912. The decrease was largely due to conditions in Mexico.

Imports of silver into France, two months ended Feb. 28, were 52,924,000 fr.; exports, 67,516,000 fr.; excess of exports, 14,592,000 fr., against 7,656,000 fr. last year.

Imports of silver into Great Britain, three months ended Mar. 31, were valued at £2,776,658; exports, £3,894,471; excess of exports, £1,117,813, which compares with an excess of imports of £596,150 last year.

Imports of gold into France, two months ended Feb. 28, were 138,559,000 fr.; exports, 15,676,000 fr.; excess of imports, 122,883,000 fr., against 84,840,000 fr. last year.

Zinc and Lead Ore Markets

JOPLIN, MO.—April 18

Blende sold as high as $43, the assay base ranging from $37 to $40.50 and the metal base from $35 to $37 per ton of 60% zinc. Calamine sold at $19@23 per ton of 40% zinc. The average price of all grades of zinc is $38.18 per ton. Lead sold up to $47 on a base of $45 per ton of 80% metal contents, and the average of all grades is $44.98 per ton.

At least one lot of high grade blende sold a half dollar above last week's market, while a few other lots sold at $1 less base price. Metal base prices were generally reduced on all grades, $1 to $2 per ton. The peculiar trend of the market is the unusually stiff demand for calamine ores, the average of which was advanced $2.66 per ton, while the blende average declined 30c. A year ago when blende was $41@44 base calamine was $19@20 base.

SHIPMENTS WEEK ENDED APR. 18

	Blende	Calamine	Lead	Value
Totals this week...	10,353,110	973,990	1,339,340	$235,050
Totals 16 weeks...	165,645,850	10,187,430	28,099,790	$4,095,405

Blende value, the week, $193,750; 16 weeks, $3,285,580.
Calamine value, the week, $11,180; 16 weeks, $115,740.
Lead value, the week, $30,120; 16 weeks, $694,080.

PLATTEVILLE, WIS.—Apr. 18, 1914

The base price paid this week for 60% zinc ore was $39@40 per ton. Lead sold at the low base price of $46@48 per ton for 80% ore. Shipments were a litle heavier than last week.

SHIPMENTS, WEEK ENDED APR. 18, 1914

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	2,390,140	66,680	983,900
Year to date	44,358,380	1,371,870	14,590,530

Shipped during week to separating plants, 2,873,720 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—April 22

Little or no change is reported in general conditions, and the markets remain quiet. Order are slow, but specifications are reported better.

From some accounts a better tone is developing, and ironmakers are more inclined to look at the expectation of good crops than at the absence of railroad buying and slowness of orders. Structural steel is again the most active section of the market and more large contracts are in sight.

The pig-iron market is dull and inactive. Buying is on a small scale; though more consumers are in evidence, it is only for their immediate needs.

The rumors of an agreement or deal, between the Republic Iron & Steel and the Sloss-Sheffield Iron & Steel companies, have been revived; but there is nothing so far to prove that there is any solid basis for the reports.

Export trade is understood to be better. A sale is reported of 10,000 tons of steel plates to go to Russia. The tariff on steel in that country has been temporarily suspended on account of a shortage of material there. Orders are under negotiation for 7500 tons of rails for Brazil and 30,000 tons for Australia.

PITTSBURGH—Apr. 21

The production of steel has not dropped off as much as has been claimed in some quarters. Taking the country as a whole the output is at the rate of between 60 and 70% of capacity, while the Pittsburgh district is operating at approximately 70%. The flow of orders is at a lower rate than this, perhaps at not over 50%, and production and shipments therefore promise to decrease further unless there is an early improvement in buying. It is noted that the number of orders being booked is very large, while the average tonnage per order is small and this is held to indicate that stocks in buyers' hands are very low. Prices are so low that they can decline little if any and it is argued that buyers will soon take hold more freely.

The sentiment among independent steel makers in favor of reducing wages seems to have been toned down and it is not probable that anything will be done within the next few months at any rate.

Under date of Apr. 20 the National Tube Co. issued new discounts on steel pipe, making a reduction of one-half point or about $1 a ton. This restores the market to the basis

which prevailed from Oct. 27 to Feb. 2, when a half point advance was made. Bars, plates and shapes are on the basis of 1.15c. for attractive orders, while sheets are at about 1.90c., and not firm at that figure.

Orders from the regular railroads for this year now total somewhat over 600,000 tons. The Bessemer road of the Steel Corporation has ordered 2500 cars while one of the corporation's Minnesota roads has ordered 1000, bringing orders thus far this year up to fully 40,000 cars, not altogether a bad showing.

Pig Iron—The pig-iron market continues almost absolutely stagnant. A recent purchase of 1500 tons of bessemer by a Cleveland consumer, for second-quarter delivery, showed that the market was steady at the price of $14 which has lately been quoted. Basic appears equally firm at $13, while malleable is $13@13.25 and No. 2 foundry, $13.25, all at Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—It is rumored that some Pittsburgh interests propose getting control of Dunbar furnace, idle for some time on account of the financial embarassment of the owners, and making ferromanganese from some Cuyuna range ore. The market is quiet at $38@39 for prompt or forward English or German, at Baltimore, with $2.16 freight to Pittsburgh.

Steel—The market continues so quiet that prices usually named as the market, $21 for billets and $22 for sheet bars, are purely nominal. The fact that no inquiry appears from sheet mills, while the mills have been running almost full, indicates that they bought more heavily three or four months ago than was generally reported. Rods are $26, Pittsburgh.

FOREIGN IRON NOTES

Foreign Trade of Germany in Iron and Steel, two months ended Feb. 28, in metric tons:

	Exports	Imports	Excess
Iron and steel	1,053,672	76,562	Exp. 977,11
Machinery	82,214	15,320	Exp. 66,89
Total	1,135,886	91,882	Exp. 1,044,004
Total, 1913	1,083,670	117,281	Exp. 966,389

There was some increase in exports this year, but a considerable decrease in the imports.

IRON ORE

The first freighters to leave Buffalo for the season were three, which started Apr 16. Lake Superior is reported clear, but there is still ice at the Sault.

It is announced that with the completion of the new piers at Providence, vessels carrying Nova Scotia ore for Eastern points will unload at that port.

Imports of Iron Ore in Great Britain, three months ended Mar. 31, were 2,041,904 tons in 1913, and 1,557,320 in 1914; decrease, 484,584 tons. Imports of manganese ore were 165,877 tons in 1913, and 128,775 in 1914; decrease, 37,102 tons.

Imports at Baltimore for the past week included 5100 tons of manganese ore from Batum, Russia.

COKE

Coke production in the Connellsville region last week is reported by the "Courier" at 354,725 tons; shipments, 348,411 tons. The production in the Greensburg and Upper Connellsville districts was 46,560 tons.

Exports of Fuel from Great Britain, three months ended Mar. 31, in long tons:

	1913	1914	Changes
Coal	17,239,009	17,430,369	I. 191,360
Coke	282,190	301,749	I. 19,559
Briquettes	507,202	502,181	D. 5,021
Steamer coal	4,951,231	5,035,448	I. 84,217
Total	22,979,632	23,269,747	I. 290,115

Imports of coal are insignificant, being only 11,894 tons in 1913, and 5707 this year.

CHEMICALS

NEW YORK—Apr. 22

The general markets are still rather quiet, but the tone seems better, and it is believed that more activity is in sight.

Arsenic—Business is still moderate and supplies are good. The price still seems fixed at $3 per 100 lb. for white arsenic.

Copper Sulphate—Business is fair and prices unchanged. The current quotation is $4.80 per 100 lb. for carload lots and $5.05 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is rather quiet, but prices are about the same as last week. Spot is quoted 2.25c. per lb., while 2.22½c. is asked for May, 2.20c. for June and 2.17½c. for July delivery.

OTHER ORES

Manganese Ore is quoted as follows in England, c.i.f. United Kingdom ports: Indian or Brazilian, 50%, 19½@20c. per unit; 48%, 18½@19c.; 45%, 18@18½c. Caucasian, 50% manganese, 17@17½c.; 48%, 16½@17c. per unit.

PETROLEUM

The pipe lines have again reduced the price paid for Oklahoma oil at wells by 5c., bringing it down to 85c. per bbl. This is the lowest price for a long time.

The prices paid for Pennsylvania crude oil of different grades have also been reduced 5 to 10c. per bbl., according to grade.

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.

	November	December	January	February	March
Alaska shipments	3,391,300	3,104,155	2,701,258	1,803,579	2,069,960
Anaconda	25,250,000	25,100,000	24,400,000	21,300,000	.....
Arizona, Ltd	2,800,000	2,920,000	3,474,000	3,062,000	3,286,000
Copper Queen	7,115,991	9,033,459	8,796,358	6,987,366	7,637,042
Calumet & Ariz	4,600,000	5,230,000	5,975,000	5,596,850	5,875,000
Chino	4,270,821	4,390,018	6,488,220	5,642,426	.....
Detroit	1,922,352	2,021,034	1,590,681	1,814,214	1,973,725
East Butte	1,002,190	1,324,560	1,256,000	1,193,960	1,546,180
Giroux	250,000	197,649	148,411	90,017	287,980
Mason Valley	1,174,000	1,372 000	944.000	1,254,000	.....
Mammoth	1,700,000	1,400,000	1,625,000	1,400,000	1,800,000
Nevada Con	5,445,647	5,343,862	5,791,122	4,588,243	5,218,257
Ohio	772,120	722,940	700,728	582,000	.....
Old Dominion	2,450,000	2,613,039	2,797,000	3,066,000	2,997,000
Ray	4,753,964	5,075,202	5,705,000	5,432,000	.....
Shannon	1,110,000	1,078,000	937,432	903,761	1,082,000
South Utah	225,072	242,362	275,569	333.874	406,381
Tennessee	1,666 753	1,700,000	1,474,890	1,232,812	.....
United Verde*	3,000,000	3,000,000	3,000,000	2,700,000	.....
Utah Copper Co	10,787,426	10,306,646	10,329,564	.....	.....
Lake Superior*	6,600,000	5,600,000	7,400,000	8.500,000	11,000,000
Non-rep. mines*	6,000,000	6,250,000	6,200,000	5 600,000	.....
Total prod	96,285,636	98,024,926	102,100,233	.....	.....
Imp., bars, etc	21,796,866	23,578,938	24,504,249	19,918,448	.....
Total blister	118,082,502	121,603,864	126,604,482	.....	.....
Imp. ore & matte	8,980,186	12,205,187	10,893,969	9,713,164	.....
Total Amer	127,062,688	133,809,053	137,498,451	.....	.....
Miami†	3,230,000	3,210,000	3,258,950	3,316,482	3,361,100
Shattuck-Arizona	995,429	1,050,781	1,276,636	1,134,480	1,136,458
Brit. Col. Cos.:					
British Col. Cop	655,637	795,004	607,930	.....	.....
Granby	1,944,145	1,605,382	1,793,840	1,661,212	.....
Mexican Cos.:					
Boleo†	2,315,040	2,315,040	2,369,920	1,984,080	.....
Cananea	3,800,000	3,646,000	3,460,000	2,688,000	4,260,000
Moctezuma	3,517,800	3,139,613	3,024,556	2,642,543	2,882,884
Other Foreign:					
Braden, Chile	1,592,000	2,122,000	2,430,000	2,362,000	1,810,000
Cape Cop., S. Af.	649,600	683,200	519,680	459,200	.....
Kyshtim, Russia	1,624,000	1,742,720	1,559,040	1,534,400	.....
Spassky, Russia	904,960	900,480	902,720	902,720	.....
Exports from					
Chile	7,616,000	10,640,000	5,488,000	6,720,000	6,944,000
Australia	11,200,000	6,720,000	,712,000	7,952,000	8,176,000
Arrivals–Europe‡	9,107,840	13,787,200	8,599,360	18,354,560	17,572,800

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

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

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
Year. 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
IV, '13.	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII	138,074.602	58,904,192	78,480,071	52,814,606	77,904,000	124,808,606
VIII	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI	134,087,708	48,656,858	70,067,803	32,566,382	48,787,200	81,353,582
XII	138,990,421	21,938,570	73,542,413	47,929,429	46,592,000	94,521,429
Yr., '13	1,622,450,829	767,261,760	869,062,784	.....	.....	.....
I, 1914.	131,770.274	47.956,955	87.955.501	91,438,867	53,916.800	145,355,667
II	122,561.007	47,586.657	83,899,183	87,296.685	50.108.800	137,405,485
III	145,651,982	69,852,349	89,562,166	78,371,852	47,376.000	125,747,852
IV	.....	.....	.....	64,609,319	46,435,200	111,044,519

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

Assessments

Company	Delinq.	Sale	Amt.
Advance, Ida.	Apr. 15	May 15	$0.003
Alta Cons., Utah			0.05
Bullion, Ida.	Apr. 11	May 11	0.005
Caledonia, Nev.	Apr. 7	Apr. 29	0.10
Confidence, Nev.	Apr. 21	May 11	0.10
Consolidated Virginia, Nev.	Apr. 10	May 1	0.10
Contact, Mich.		Apr. 27	0.50
Diamond Black Butte, Mont.	Apr. 10	May 14	0.005
Emerald Tintic, Utah	Apr. 15	May 9	0.0033
Empire, Ida., postponed		May 1	0.005
Florence, Ida.	Apr. 19	May 11	0.001
Great Western, Nev.	Apr. 6	Apr. 28	0.01
Hypotheek, Ida.	Apr. 9	May 11	0.01
Iron Mask, Ida.		May 26	0.002
Mass Cons., Mich.	Apr. 7		1.00
Nevada Silver Reed, Utah	Apr. 6	Apr. 27	0.001
New York, Nev.	Apr. 6	Apr. 27	0.05
Ophir, Nev.	Apr. 7	Apr. 29	0.10
Royal, (formerly Penn.), Ida.	Apr. 23	May 18	0.0015
Samson, Ida.	Mar. 28	Apr. 28	0.002
Savage, Nev.	Apr. 16	May 7	0.10
Southern Swansea, Utah	Apr. 18	May 6	0.0003
Tintic-Central, Utah	Apr. 11	Apr. 29	0.005
Tonopah-Gypsy Queen, Nev.	Mar. 25	Apr. 29	0.01
Torino, Ida.	Apr. 16	May 16	0.001
Verda, Utah.	Apr. 15	May 5	0.001
Victoria, Mich.	Apr. 15	May 24	1.00
Wasatch-Utah, Utah	Apr. 6	May 11	0.01
Wisconsin, Utah	Apr. 3	May 5	0.003

Monthly Average Prices of Metals

SILVER

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

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

COPPER

Month	New York				London Standard	
	Electrolytic		Lake			
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	16.767	14.772	71.741	64.304
February	14.971	14.491	15.253	14.946	65.519	65.259
March	14.713	14.131	14.930	14.625	65.329	64.276
April	15.291	.....	15.565	.....	68.111	.....
May	15.436	.....	15.738	.....	68.807	.....
June	14.672	.....	14.871	.....	67.140	.....
July	14.190	.....	14.563	.....	64.166	.....
August	15.400	.....	15.904	.....	69.200	.....
September	16.328	.....	16.799	.....	73.125	.....
October	16.337	.....	16.913	.....	73.383	.....
November	15.182	.....	16.022	.....	68.275	.....
December	14.224	.....	14.904	.....	65.223	.....
Year	15.269	.....	15.686	.....	68.335	.....

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

TIN

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

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

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19 606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	.....	4.242	.....	17.597	.....
May	4.342	.....	4.226	.....	18.923	.....
June	4.325	.....	4.190	.....	20.226	.....
July	4.353	.....	4.223	.....	20.038	.....
August	4.624	.....	4.550	.....	20.406	.....
September	4.698	.....	4.579	.....	20.648	.....
October	4.402	.....	4.253	.....	20.302	.....
November	4.293	.....	4.146	.....	19.334	.....
December	4.047	.....	3.929	.....	17.798	.....
Year	4.370	.....	4.238	.....	18.743	.....

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

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.583
February	6.239	5.377	6.089	5.227	25.338	21 413
March	6.078	5.250	5.926	5 100	24.605	21.460
April	5.641	.....	5.491	.....	25.313	.....
May	5.406	.....	5.256	.....	24.583	.....
June	5.124	.....	4.974	.....	22.143	.....
July	5.278	.....	5.128	.....	20.592	.....
August	5.658	.....	5.508	.....	20.706	.....
September	5.694	.....	5.444	.....	21.148	.....
October	5.340	.....	5.188	.....	20.614	.....
November	5.229	.....	5.083	.....	20.581	.....
December	5.156	.....	5.004	.....	21.214	.....
Year	5.648	.....	5.504	.....	22.746	.....

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

PIG IRON IN PITTSBURGH

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

STOCK QUOTATIONS

COLO. SPRINGS Apr. 21

Name of Comp.	Bid.
Acacia	‡.02½
Cripple Cr'k Con.	‡.007½
C. K. & N.	‡.07½
Doctor Jack Pot	.05½
Elkton Con.	.45½
El Paso	2.00
Findlay	.01
Gold Dollar	.04
Gold Sovereign	‡.02½
Golden Cycle	‡1.50
Isabella	.12¾
Jack Pot	.06
Jennie Sample	‡.05
Jerry Johnson	‡.03½
Lexington	‡.003
Old Gold	.01
Mary McKinney	.54
Pharmacist	‡.01
Portland	1.07
Vindicator	.93

SALT LAKE Apr. 21

Name of Comp.	Bid.
Beck Tunnel	.03¼
Black Jack	.06
Cedar Tallsman	.00¾
Colorado Mining	.11
Crown Point	.21½
Daly-Judge	5.00
Gold Chain	.10
Grand Central	.50
Iron Blossom	1.15
Little Bell	.15
Lower Mammoth	.01¾
Mason Valley	3.00
May Day	.06½
Nevada Hills	.25
Prince Con.	.20½
Silver King Coal'n.	3.05
Silver King Cons.	2.07½
Sioux Con.	.03
Uncle Sam	.03
Yankee	.02

TORONTO Apr. 21

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.03	Foley O'Brien	.20
Coniagas	7.35	Hollinger	16.00
Peterson Lake	.37½	Imperial	.01½
Right of Way	.03¾	Jupiter	.11
T. & Hudson Bay	73.00	Pearl Lake	.07
Timiskaming	.14	Porcu. Gold	.09
Wettlaufer-Lor.	.04¾	Preston E. D.	.02
Big Dome	8.15	Rea	.20
Crown Chartered	.00¾	Swastika	.01½
Dome Exten.	.08½	West Dome	.11

SAN FRANCISCO Apr. 20

Name of Comp.	Bid.	Name of Comp.	Bid.
Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡.00½	Belmont	7.60
Belcher	.30	Jim Butler	.92
Best & Belcher	.04	MacNamara	.06
Caledonia	.60	Midway	.34
Challenge Con.	.05	Mont.-Tonopah	.87
Chollar	‡.01	North Star	.28
Confidence	.36	West End Con.	.81
Con. Virginia	.18	Atlanta	.23
Crown Point	.28	Booth	.05
Gould & Curry	.01	C.O.D. Con.	.04
Hale & Norcross	.03	Comb. Frac.	.07
Mexican	‡1.10	Jumbo Extension	.24
Occidental	.70	Pitts.-Silver Peak	.34
Ophir	.29	Round Mountain	.25
Overman	.18	Sandstorm Kendall	.11
Potosi	.01	Silver Pick	.06
Savage	.10	Argonaut	2.50
Sierra Nevada	.11	Bunker Hill	‡1.90
Union Con.	.09	Central Eureka	.58
Yellow Jacket	.28	So. Eureka	1.50

N. Y. EXCH. Apr. 21

Name of Comp.	Clg.
Amalgamated	73⅛
Am.Sm.&Ref.,com	64⅛
Am. Sm. & Ref., pf.	101⅛
Am. Sm. Sec., pf. B.	80
Anaconda	33⅛
Batopilas Min.	⅛
Bethlehem Steel, pf.	83
Chino	40
Colo. Fuel & Iron.	29
Federal M. & S., pf.	33
Great Nor., ore., ctf	32⅛
Guggen. Exp.	53
Homestake	113½
Inspiration Con.	16⅛
Miami Copper	23
Nat'l Lead, com.	43⅛
National Lead, pf.	107⅛
Nev. Consol.	14⅛
Phelps Dodge	179
Pittsburg Coal, pf.	87⅛
Quicksilver, pf.	2
Ray Con.	20⅛
Republic I&S, com.	22
Republic I&S, pf.	83
SlossSheffi'd, com.	26⅛
Sloss Sheffield, pf.	86
Tennessee Copper	33⅛
Utah Copper	54⅛
U. S. Steel, con.	58⅛
U. S. Steel, pf.	108⅛

BOSTON EXCH Apr. 21

Name of Comp.	Clg.
Adventure	1
Ahmeek	280
Alaska Gold M.	26⅛
Algomah	1
Allouez	38
Am. Zinc	16⅛
Ariz. Com., ctfs.	4⅛
Bonanza	.51
Butte & Balak.	2⅛
Calumet & Ariz.	64
Calumet & Hecla	416
Centennial	15
Cliff	1
Copper Range	.37
Daly West	2
East Butte	10⅛
Franklin	5
Granby	78⅛
Hancock	13⅛
Hedley Gold	30
Helvetia	30
Indiana	3⅛
Island Cr'k, com.	47
Island Cr'k, pfd.	85
Isle Royale	18
Keweenaw	3
Lake	6
La Salle	4
Mass	3⅛
Michigan	.75
Mohawk	41
New Arcadian	4⅛
New Idria Quick	3⅛
North Butte	25⅛
North Lake	1⅛
Ojibway	1⅛
Old Dominion	48⅛
Osceola	73
Quincy	57
Shannon	5⅛
Shattuck-Ariz.	22
Superior	27⅛
Superior & Bost.	‡1 11/16
Tamarack	31
Trinity	3⅛
Tuolumne	.50
U. S. Smelting	36⅛
U. S. Smelt'g, pf.	46⅛
Utah Apex	1⅛
Utah Con.	10
Victoria	1⅛
Winona	3⅛
Wolverine	40
Wyandot	.60

N. Y. CURB Apr. 21

Name of Comp.	Clg.
Ariz. Belmont	‡.03⅛
Barnes King	‡1⅛
Beaver Con.	.28⅛
Big Four	.08
Boston Montana	8⅛
Braden Copper	8
B. C. Copper	1⅛
Buffalo Mines	1⅛
Can. Cop. Corpn.	1⅛
Can. G. & S.	.08
Caribou	.70
Con. Ariz. Sm.	.50
Coppermines Cons	1⅛
Davis-Daly	9/16
Diam'field-Daisy	.05⅛
Ely Con.	.03⅛
Florence	.52
Gold Hill Con	1⅛
Goldfield Con.	1 7/16
Greene Cananea	30⅛
Greenwater	.06⅛
Internat. S. & R.	‡106
Kerr Lake	4⅛
La Rose	1⅛
McKinley-Dar-Sa.	.65
Mines of Am.	2⅛
New Utah Bingham	.68
Nipissing Mines	6⅛
Ohio Copper	⅛
Oro	.12
Puebla S. & R.	2⅛
Stand'd Oil of N.J.	397
Stand'd Silver Lead	1 1/16
Stewart	1 3/16
Tonopah	6⅛
Tonopah Ex.	‡2
Tonopah Merger	.58
Tri-Bullion	‡⅛
Tularosa	7/16
West End Ex.	.04
Yukon Gold	2⅛

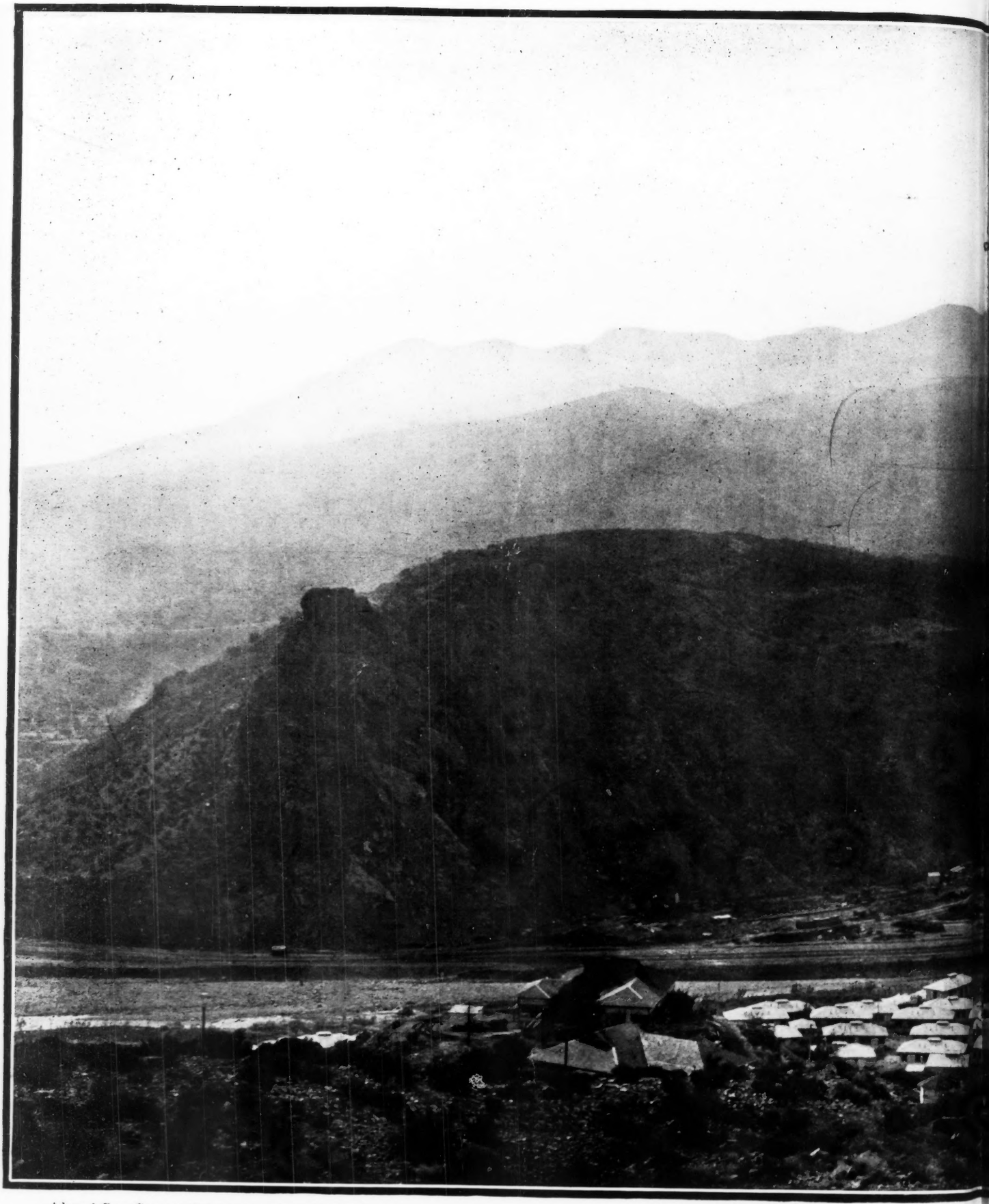
BOSTON CURB Apr. 21

Name of Comp.	Bid.
Bingham Mines	.05
Boston & Corbin	.28
Boston Ely	.30
Butte & Lon'n Dev.	.40
Cactus	.01
Calaveras	1⅛
Chief Cons.	.68
Contact Copper	.06
Corbin	.25
Cortez	.25
Crown Reserve	1⅛
Eagle & Blue Bell	1
First Nat. Cop.	1⅛
Houghton Copper	1⅛
Majestic	.20
Mexican Metals	.12
Moneta Porc	‡.02
Nevada-Douglas	.93
New Baltic	1⅛
Oneco	1⅛
Raven Copper	.14
Smokey Dev.	.25
So. Lake	3
S. W. Miami	1⅛
Tonopah Victor	.32
Trethewey	.23
United Verde Ext.	.78

LONDON Apr. 9

Name of Comp.	Clg.
Camp Bird	£0 12s 0d
El Oro	0 14 3
Esperanza	0 17 6
Mexico Mines	5 2 6
Oroville	0 13 0
Santa Gert'dis.	0 16 9
Stratton's	‡0 0 6
Tomboy	1 2 6

‡Last Quotation.

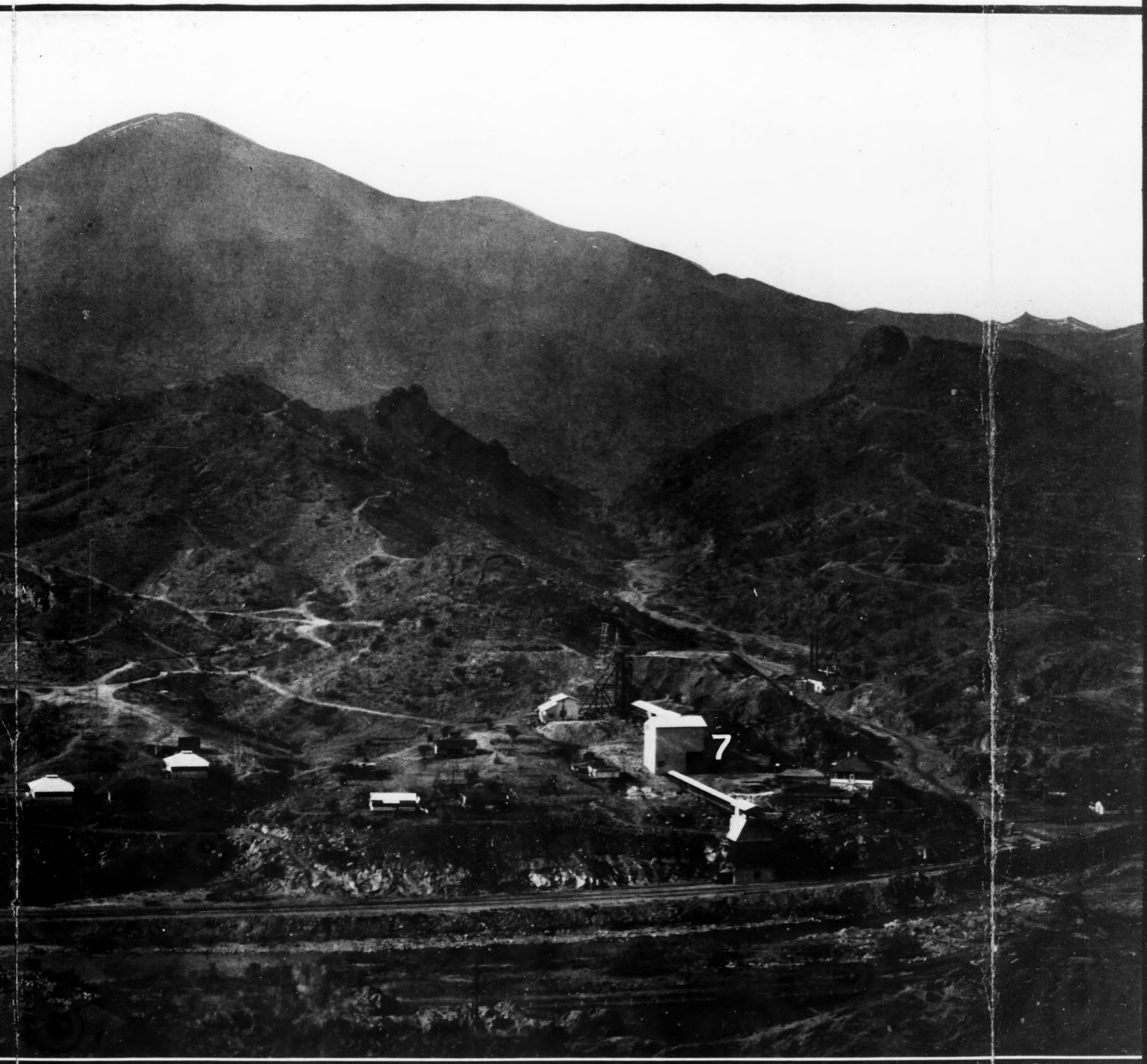


Adams & Grace Company, Designers and Printers, New York.

1. Office and Employes' Quarters 2. Machine Shop 3. Storehouse 4. Compressor plant 5. No. 1 Shaft, Hoisting and Crushing

GENERAL VIEW OF THE RAY CONSOLIDATED COPPER COMPANY'S MINES AND

7. Hoisting and Crushing Plants and Ore Bins 6. Sonora Town—Mexican Settlement 7. No. 3 Shaft, Hoist, Crushin



ND THEIR SURFACE IMPROVEMENTS AT RAY, ARIZONA—LOOKING WESTERLY.

RUSHING PLANT AND LOADING BIN 8. BUSINESS HOUSES IN TOWN OF RAY 9. AMERICAN SETTLEMENT OF EMPLOYES WORKING AT NO. 2 SHAFT—HOSPI

NT OF EMPLOYES WORKING AT NO. 2 SHAFT—HOSPITAL IN FOREGROUND

10. NO. 2 SHAFT, CRUSHING PLANT AND LOADING BINS

11. RA

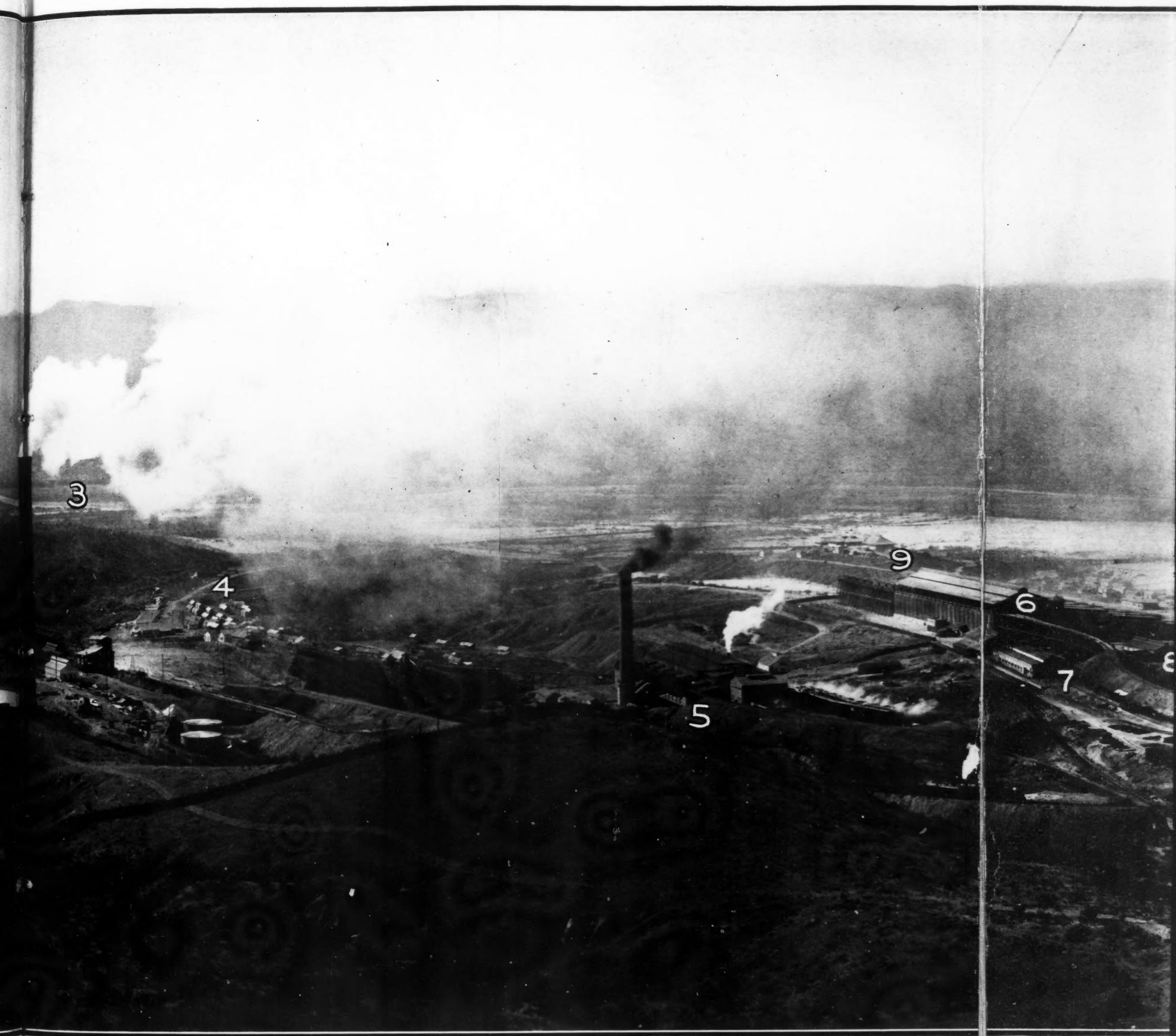
1. Ray & Gila Valley Railroad Station and Terminal

SUPPLEMENT TO
THE ENGINEERING AND MINING JOURNAL,
By Courtesy of The Ray Consolidated Copper Company.

Adams & Grace Company, Designers and Printers, New York.

GENERAL VIEW OF RAY CO

1 and 2. SMELTING PLANT; REVERBERATORY AND ROASTER DEPARTMENTS 3. JUNCTION OF THE GILA AND SAN PED



AY CONSOLIDATED COPPER COMPANY'S MILL, AND OF THE AMERICAN SMELTING AND REFINING COMPAN S SMELTER, AT HA

N PEDRO RIVERS 4. SETTLEMENT OF SMELTER EMPLOYES 5. RAY CONSOLIDATED COPPER COMPANY'S POWER PLANT 6. CONCENTRATOR 7. MACHINE OP AND WAREHOUSE 8.

S SMELTER, AT HAYDEN, ARIZONA—LOOKING SOUTHWESTERLY ACROSS THE VALLEYS OF THE GILA AN

IOP AND WAREHOUSE 8. WOODWORKING SHOP 9. GENERAL OFFICES AND OFFICERS' DORMITORIES 10. TOWN OF HAYDEN—EMPLOYES' SETTLEMENT

AND SAN PEDRO RIVERS.

SUPPLEMENT TO
THE ENGINEERING AND MINING JOURNAL,
By Courtesy of The Ray Consolidated Copper Company.

MENT 11. TOWN OF SAN PEDRO—MEXICAN EMPLOYES' SETTLEMENT 12. STORAGE RESERVOIR—MILL WATER SUPPLY