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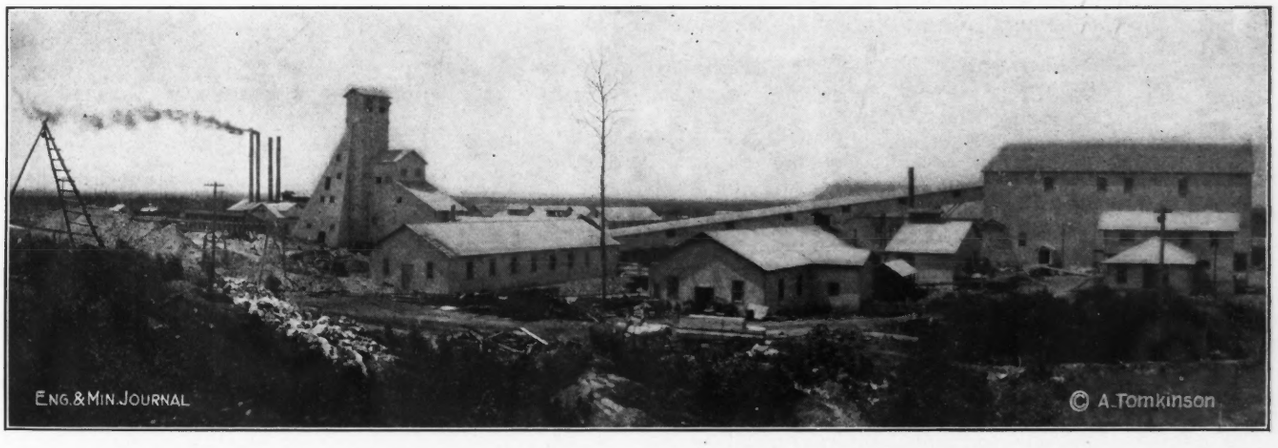
Development of Continuous Counter Current Decantation--I*

By Herbert A. Megraw

SYNOPSIS—Decantation is making headway in displacing or supplementing the filter. Primarily the system is designed to provide economical means for separation of dissolved metals from solids. A secondary advantage is that some additional metal is usually dissolved in passage through the system. Forms of the process are in operation at the Hollinger mill, the McIntyre, Vipond and Porcupine Crown mills, and these are discussed.

The process of continuous decanting in slime treatment, to replace or supplement the filter, is making notable headway. New mills are being constructed to use it, and old ones are being rearranged to take advantage of its economies. There is no new principle involved in its application to present-day metallurgy, and while there are new mechanical devices designed to make the most of the conditions which exist, it is still possible to use the older type of apparatus and to get acceptable results. The latter may, however, involve much more trouble and perhaps somewhat more cost than the newer machines.



The Hollinger Mine and Mill, Timmins, Ontario

Preparation of the Ore

Preparation of an ore for treatment by continuous decantation process is a matter of importance, just as it is with any other process. The ore must be properly prepared to take advantage of the highest efficiency obtainable through the methods applied. Perhaps the most important preparation for the ore is to see that it is to the greatest possible extent in the same condition throughout; that is, a pulp which contains a slight percentage of coarse sand is not capable of giving best results by counter-current decantation, not because of the actual size of the sand, but because the larger, heavier grains sink more rapidly through the solution, and have less contact with it than the lighter, slimey portions, and are likely to get through the circuit without very much treatment. Slimes, on the contrary, settle more slowly through solution and is in contact with it for a much greater length of time.

At this point it will be of interest to enlarge upon pulp condition, because there are factors which will modify the statements made in the preceding paragraph. It must be carefully borne in mind that continuous counter-current decantation was not designed to provide means for dissolution of precious metal, but to provide a method for the simple and economical separation of the dissolved metals from the solids. Clearly, for the satisfactory accomplishment of this function, the size of the pulp particle need not be considered. For the best working

*This is the fifteenth of a second series of articles by Mr. Megraw. It deals with the comparative details of cyanide practice, discussing points of possible improvements. Preceding articles of this series appeared in the issues of Sept. 6, Oct. 4, Nov. 1, Nov. 15, Dec. 20, 1913; Jan. 31, Mar. 7, Mar. 21, Apr. 25, May 23, June 20, July 25, Aug. 29 and Sept. 12, 1914. The next article will deal with "Development or the Counter-Current Decantation Process—II," and will appear in the issue of Oct. 31, 1914.

of counter-current decantation, the pulp under treatment should receive its agitation treatment, the amount calculated to dissolve the economical maximum of precious metal, before going to the decantation system at all. It cannot be too strongly emphasized that counter-current decantation is not designed as an extraction process.

Notwithstanding the facts just mentioned, it will be found almost impossible to pass a pulp, whatever its previous agitation, through a continuous counter-current decantation system without accomplishing some additional dissolution of metal, small though it may be. This is so true that some operators, who are concerned in the treatment of clean, free-gold ores of low value, have believed that the decantation system was all that was necessary to dissolve the economically maximum portion of gold. Most of these have discovered that agitation was beneficial after all, but it is still true that the changes of solution incident to continuous decantation tend strongly toward the dissolution of further quantities of metal. To take advantage of this secondary function to the fullest possible extent, it is clearly desirable that the pulp should be of even size, the essential for maximum dissolution in continuous agitation systems.

Sulphide ores may, and usually do, require previous concentration, but it is nevertheless true that by grinding a sulphide fine enough, its values are very likely to be given up in about the same time required in the ordinary slimes treatments. To do this, however, sulphide slimes should be reground until they are in an exceedingly fine state of subdivision. In such case they may go through counter-current decantation treatment along with ordinary slime and have their values satisfactorily extracted. Sulphides are, of course, governed by the same general laws as ores, so that what has already been said as to dissolution in the decantation circuit applies to them as well.

Principle of the Process

The basis for the process is exceedingly simple. It is the fact that slimes may be dewatered by allowing them to settle quietly through the solution, and to decant off the solution. The settled slime is not, of course, thoroughly or entirely dewatered, but retains a percentage of its original solution, the amount depending upon several factors, among which may be mentioned the specific gravity of the slime itself, the specific gravity of the solution from which it is settled, size of the slime particles, temperature, and the acidity or alkalinity of the solution. These factors vary, and their effects upon settlement vary with the different slimes and solutions handled, so that no general rules can be laid down for operation. A slime thus settled may be reduced to some point from 30 to 50% of moisture. When the original pulp contains 4 or 5 tons of solution to one of solids, and is thickened to $\frac{1}{3}$ ton of solution to 1 of solids, it will be seen that the removal of solution has been considerable. If the thickened slime be then mixed with other solution up to the point of original dilution, or less in many cases, the character of the solution is changed, the new solution being affected slightly by the small percentage remaining in the thickened slimes. If this process should be repeated, it will readily be seen that the small quantity of solution remaining in the thickened portion will be quite different from that remaining in the original thickened portion, having been increased or decreased in value, cyanide or whatever the solution may contain, accordingly as the newly added solution differed from the original. If the newly added solution is water, then the solution in the mixture will be of low value. If water were added not only once as a diluent, but two or three times, it may be easily seen that the value of the solution remaining in the finally thickened pulp would approximate nothing, and for practical purposes could be considered as such. Then this pulp could be thrown away without any reference to its contained value, since it is small enough to be disregarded.

Amount of Water Limited in Practice

In practice it is quite evident, in considering this subject, that it would be impracticable to use water dilution as many times as would be necessary to reduce the value of the solution to an inconsiderable figure, since it would increase the solution in the plant to such an extent that much of it would have to be thrown away. This difficulty is surmounted by using the same solution a number of times, and precipitating it midway of the circuit if desirable. For instance, the water is mixed in previous to a thickening process at the final step, and the decanted solution from that final step is sent to the next step before, thus making use of a weak solution instead of water. The weak solution decanted from the next last step is used in the step previous to that, and so on until it has accumulated sufficient value or cyanide to be used elsewhere. It may then be sent to the precipitation department, or it may be sent to the head of the mill to be used as battery solution, and precipitated after that. Barren solutions and water are thus so manipulated that only in the final step is water received into the system, and even then only in such quantities as can be naturally equalized by the discard at the final end, and such small quantities of the precipitated solution, containing extremely small quantities of cyanide, as may be discarded without danger.

Advent of Continuous Decanting Machines

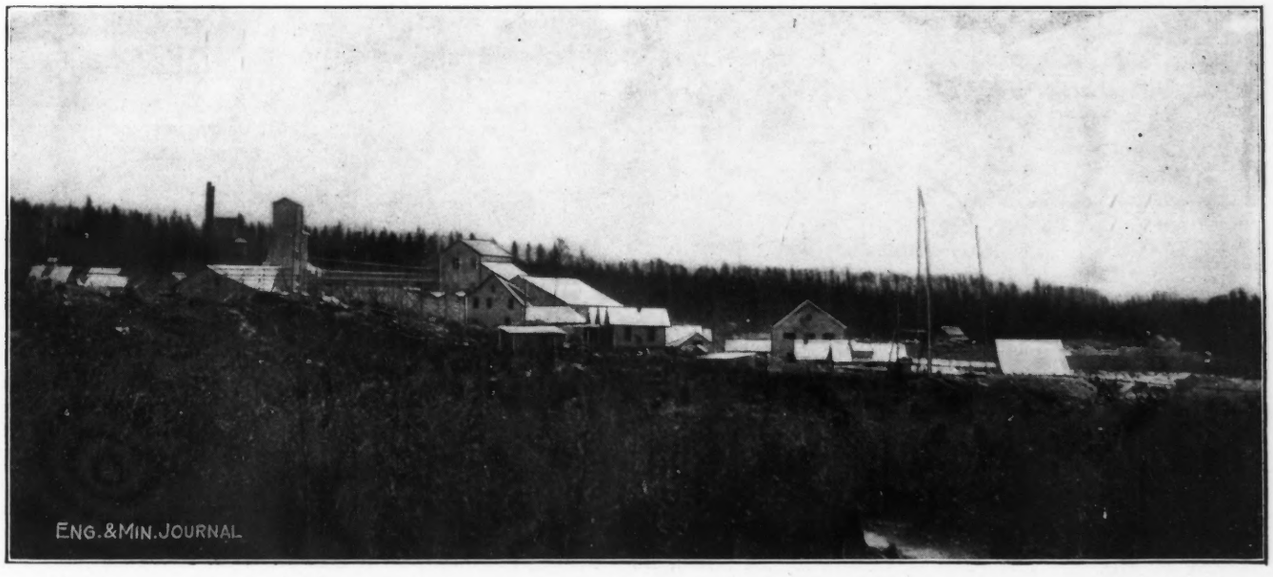
The advent of continuous decanting machines, in which decantation may be carried on without interruptions of any kind, has assisted to improve the efficiency of the process, and consequently they have been adopted in well designed mills. The Dorr thickener is the machine which has done most to bring about successful treatment, and it is the one most generally used in the new installations. The machine is well known and needs no description here, its characteristics being the receiving of pulp in various stages of dilution, and the discharge of an overflow of clear solution and an underflow of thickened slime, which may contain 30 to 40% of moisture, and which will, in most ordinary cases, give a 30 to 35% product with ease. In any event, it is only necessary to deliver the pulp under treatment, or after agitation treatment, into a series of thickeners, the number depending upon the strength of solution used, its value and upon the amount of barren solution to be produced for washing purposes, in comparison with the material dissolved per ton of ore treated, decanting off the clear solution and discharging the thickened slime to another thickener. The final thickener of the series receives the pulp which has just been mixed with fresh water, the overflow from this passing back to the next thickener in the line, its overflow going back to the next, etc., until the whole series of thickeners have been traversed.

Agitation of slimes to recover the gold or silver, or

both, may be performed entirely before the counter-current decantation process is instituted, or it may be a part of the process, or agitation may be omitted altogether, as it is in some mills, depending upon the contact between the slimes and the solution in passing through the thickener series to recover the maximum amount of metal. The latter system is sometimes employed with clean siliceous gold ores, in which the metal is fine, rather readily dissolved in cyanide, and where the solution is not required to be of great strength. In treating silver ores, the solution must be of much higher strength and requires a considerable length of time to accomplish dissolution, consequently an agitation system is usually resorted to before beginning the continuous counter-current decantation series. In many cases this series has to be assisted by a dewatering filter after the decantation has been completed, since the cyanide in the final decantation-thickened product retains sufficient value to be worth saving through a simple filtering process. In this case, of course, the filter need not be an elaborate one, nor one susceptible of washing, a simple dewatering being the only requirement. In non-washing filters, the moisture-reducing efficiency is highly developed, and with them the moisture content may easily be reduced to from 10 to 20%, and often closely approximates the former figure.

reground in tube mills. The all-slime pulp is received in small primary thickeners, and the thickened slime then passed over concentrating tables. The remaining slime pulp is then thickened in the system, which treats it for recovering the remaining gold by cyanide.

The pulp is distributed, through a distributing box, into four 30x15-ft. Dorr thickeners. Here the solids settle through cyanide solution of such strength that the gold will be readily dissolved. The thickened slime pulp then is mixed with a low-value cyanide solution and goes to a second set of Dorr thickeners, identical in size with the first. On this trip, through the distributing boxes and in the thickeners themselves, there is an efficient agitation treatment, and much of the gold is effectually dissolved. As a matter of fact, it will be seen that there is absolutely no agitation, as such, in the circuit. The only agitation with cyanide solution that the pulp gets is incidental and is obtained in passage through the batteries, tube mills, classifiers, concentrators, distributing boxes and thickeners. Of course, though it is not called agitation, the pulp does get a good deal of stirring and, as a matter of fact, gives up its gold readily to the cyanide solution. The operators at this mill consider, however, that a further amount of agitation would be advantageous to their extraction, and have consequently arranged to in-



THE PORCUPINE CROWN MILL, NEAR TIMMINS, ONTARIO

When filters are used in connection with counter-current decantation, a much more rudimentary plant may serve, for the reasons already mentioned. The sole object is to save the cyanide contained in the water, and the water itself where it is scarce and expensive.

SYSTEM IN USE AT THE HOLLINGER

At the present time examples of continuous counter-current decantation in practice are not lacking. One example of its partial use in a plant which was not built to take advantage of it may be cited at the Hollinger Gold Mines, Ltd., at Porcupine, Ont. Theirs is a mill for treating gold ores, the process in general having already been described rather completely. Crushing is by stamps, in cyanide solution, from which the pulp is taken to classifiers, the slime separated and the sand

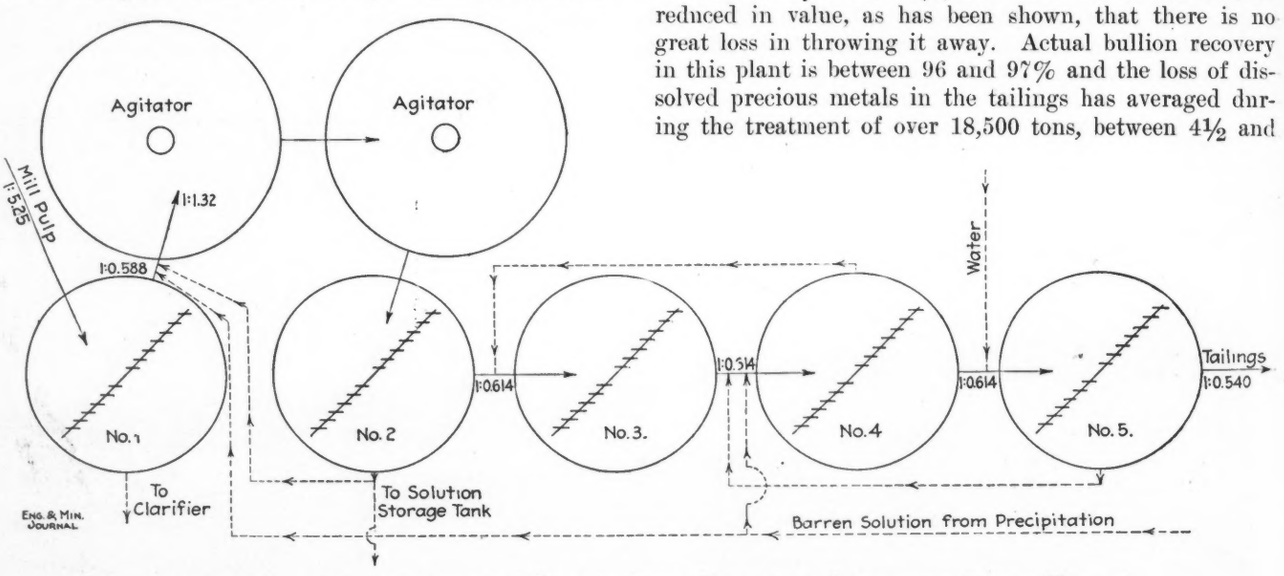
terpolate an agitation series consisting of one or two agitating tanks. This may be placed after the first decantation and before the second. The fact that a filter is available makes this location appear preferable. The fact that a Moore filter was originally installed at the Hollinger mill, and is giving satisfactory results, will probably preclude, for the present at least, the adoption of continuous counter-current decantation in its entirety, but its partial use has cut down the dissolved losses to a fraction of what they were before, and requires only a small percentage of the values to be passed through the filters, whereas all of it had to pass when the operations of both washing and dewatering were thrown entirely upon the filter.

Another mill in the Porcupine district, which will probably make use of counter-current decantation in some

form in the not very distant future, is the McIntyre. Some study is being given to the question there, and, while the mill has not been designed primarily for the process, it will probably be adapted in one form or another. The new Vipond mill, the cyanide addition of which is now in operation, is taking advantage of continuous counter-current decantation without a filter.

Porcupine Crown System

The most interesting example of counter-current decantation is afforded by the Porcupine Crown mill, near Timmins, Ont. This is an example of a mill, rare at the present time, which has been designed primarily to take advantage of counter-current decantation and for which all facilities have been provided. The cyanide plant consists of five 30x12-ft. Dorr thickeners, working in series, and two 16x16-ft. Dorr agitators. The pulp is delivered to the first thickener at a dilution rate of 5.25 to 1. Overflow from this thickener is taken to precipitation and is the regular pregnant solution, the gold having been taken in solution in the crushing, amalgamating the tube-milling processes which have preceded it. Barren solution from precipitation is led to the first agitator and thickener No. 4. The pulp is, of course, all slime, no sands being treated by leaching. The arrangement is such that not all of the so called pregnant solution must be precipitated, only the amount necessary for keeping down the solution grades being sent to the precipitation system. The rest is sent to the battery storage tanks. whence it goes through the circuit again.



Continuous Counter-Current Decantation System at Porcupine Crown Hill

The thickened pulp from the first Dorr thickener is taken to the first agitation tank and then to the second, in series, the solution meanwhile being built up to the proper strength with cyanide. The greater part of the gold extraction is during agitation. From the second agitator, pulp is taken to No. 2 Dorr thickener, the overflow from which is led to a storage-solution tank, and then is pumped back to dilute the thickened product of the No. 1 thickener going into the first agitation tank. The underflow from No. 2 thickener is taken to the third thickener, which receives, with the thickened pulp from No. 2 thickener, the overflow from No. 4 thickener. Thickener No. 4 receives the thickened underflow from thickener No. 3, and the overflow from thickener No. 5, which later receives, together with the thickened pulp from No. 4, a dilution of water. This is the only water entrance into the plant, and it may be seen that it is applied at the most efficient point, diluting the inflow into the last thickener, reducing the solution value, both in cyanide and in precious metal, and permitting a thickened underflow to go out of the plant which may be discarded without appreciable loss.

The thickened pulp from thickener No. 1 contains only about 35% moisture. As it goes into the agitator, the addition of barren solution is at such a rate that the moisture is brought up to about 60%. About a third of the cyanide is added at this point, the rest of it having been added at the tube-mill feed entrance. The water enters thickener No. 5 about equal in amount to the solution discharged with the thickened pulp as tailings, thus maintaining a constant volume in the solution circuit. The discharge from thickener No. 5 is so arranged that careful control may be given at all times. Its average moisture content is only about 30%, and this solution has been so reduced in value, as has been shown, that there is no great loss in throwing it away. Actual bullion recovery in this plant is between 96 and 97% and the loss of dissolved precious metals in the tailings has averaged during the treatment of over 18,500 tons, between 4½ and 5c. per ton. More recent work has had the effect of reducing the dissolved loss to 3.6c. per ton. The consumption of cyanide in the mill is 0.74 lb. of KCN per ton milled, showing plainly that the loss of cyanide is not high and that, on the whole, the work done by the counter-current decantation system in this example, is at least equal to the best that could be accomplished by the use of a filter.

The study of overflow solutions from the various thickeners is interesting, since it shows the drop in solution grade and the consequent washing out of the pulp as it progresses toward the end of the thickener series. From No. 1 thickener the overflow, which is precipitated, contains $3.17 in dissolved gold; No. 2 thickener, $0.82; No. 3 thickener, $0.26; No. 4 thickener, $0.14; No. 5 thickener, the discharge solution, $0.10. Since the moisture percentage in the discharge is low, the loss in dissolved gold is low, the figure given for April, 1914, being $0.043 per ton of ore milled.

(To be continued)

Modern American Rock Drills--I

By L. O. Kellogg

SYNOPSIS—Scope of article. Trend of design. Methods of manufacture; testing; materials. Definitions and classification. The parts of the piston drill. Types of valves.

Within a few years there have been so many changes, both in general design and in details, of the air-actuated machine drills used in mining, that many operators and engineers may have lost track of development and become somewhat confused as to the characteristics of the many machines offered for their use. This series of articles is designed to describe some of the more important examples, especially those drills which embody interesting improvements. Particular attention is paid to their mechanism, and no attempt is made to give figures on performance or to draw irritating and useless comparisons between the products of various companies. The heavier types of machines, which are in general unsuitable for underground use, electric drills of every type, and machines used principally in foreign countries, are not included.

The trend of latter-day design in rock drills has been toward the hammer type of machine rather than the piston. Only one important change in piston-drill design has been made, namely, the introduction by the Sullivan company of hollow steel for conducting water and air to the bottom of the hole which is being drilled, on the principle made familiar in the Leyner machine. The application by various companies of automatic rotation to plugger machines, and to some extent to stopers, represents on the other hand a change of hammer-drill design of a most radical nature. There have been at the same time a multitude of small improvements made in both types of machine, the effect of which has been to produce lighter, stronger, longer wearing, more convenient, faster drilling and more economical rock drills.

The Manufacture and Testing of Drills

An astonishing degree of care is taken in the manufacturing of machine drills of all types, and by practically all makers. This involves the most careful selection of materials in the first place, skillful handling in the shop, and continual testing of both raw stock and finished products.

The heat treatment of all the important parts is conducted with elaborate precision. The fact that many new alloyed steels have been developed in recent years, and the fact that they are skillfully prepared for the drill user, has contributed as much as any other single thing to the longer life of the modern machine.

It is not widely realized how much testing of drills is carried out by the best factories. It begins with tests on purchased stock material, and includes tests on various finished individual parts, especially after heat treatment has taken place; further tests to destruction on finished machines by subjecting them to hard service, and finally tests on performance in mines or quarries belonging to the factories.

There is in progress an increasing tendency to use drop forgings instead of castings for all but the largest pieces. The shells and cylinders of piston drills are still cast; all other important parts may be made of drop forgings, although they are not always so made. This, of course, excepts parts that can be made from standard stock, such as tubing, pipe fittings, etc. There is also an increasing tendency to use steels of various compositions and eliminate cast iron.

Let the difference between the piston and the hammer drill be well understood. The former consists essentially of a reciprocating piston, to which the bit which drills the hole is firmly attached so as to reciprocate with it. The latter consists of a more rapidly reciprocating piston, which strikes the top or shank end of the drill bit directly or indirectly, while the latter presses always on the bottom of the hole or remains near it. The former is always mounted in a guide shell and adjusted for position by a hand-actuated screw; the latter, except for the Leyner type, is never so mounted or set. The former may be considered to correspond to the old hand-actuated churn drill, whose marks may yet be seen in Mexican tunnels, while the latter corresponds to the modern hammer-and-steel system of hand drilling. As the hammer-and-steel supplanted the churn drill, the modern hammer machine-drill seems destined to supplant the piston,

Something in the way of definition may not be out of place. "Rock drill" and "machine drill" are the terms usually used to denote a drilling machine for putting holes in rocks which are to be subsequently blasted. Any complete designation must differentiate such a machine from the churn or well drill, the core drill, the hand drill and the various tools and machines used for drilling in wood and metals in the shop. Obviously, neither "machine drill," nor the "rock drill" is at all definite in this respect, but the term "rock drill" is most commonly used, and will be here so used as including both hammer and piston machines.

"Hammer drill" is about the only term applied to that type of machine, while the other type is variously known as "rock drill," "reciprocating drill" and "piston drill." Why it should be designated as a rock drill is not at all clear. The term "reciprocating drill" is equally applicable to both types, since both involve reciprocating motion. A somewhat similar objection might be taken to the use of the term "piston drill," but in the type to which we shall limit the term here, the piston rod projecting through the front head bears more resemblance to the piston of an engine than does the free-floating hammer. Rock drills may then be classed either as piston drills or hammer drills.

Hammer drills are further divided into pluggers, stopers and Leyners. The first is held in the hand and fed by the operator; the second has a telescopic air feed; the Leyner has a screw feed and uses hollow steel with water and air to clean the hole.

For convenience, the end of the machine toward the drilling bit will be known as the front in the case of all drills, and also as the top in the case of the stoper, and the bottom in the case of the plugger, while the other end will be similarly known as the back, bottom or top.

Essential Parts of Piston Drill

The piston drill consists of a cylinder in which a piston reciprocates. A rod projects through the front of the piston and passes through an airtight end of the cylinder, called the front-head. The end of this rod

outside the cylinder is enlarged and bored to hold the shank or head end of the drill steel or bit. This shank is held in by friction against either rotation or longitudinal motion. The hole in which it fits is lined with a removable and replaceable bushing, usually open on the top; through this opening in the top a key is pressed against the shank by the means of a U-bolt, which is tightened either by screwing up the threaded end, or by a wedge between the key and the bolt; such a wedge is usually self-tightening, as it is inserted with its thin end toward the front of the machine, and the forward stroke of the machine with the sudden stopping tends to urge the wedge forward more strongly than the return stroke urges it backward.

Various methods are used to make the front head of the cylinder tight, and at the same time permit the reciprocation of the piston rod. The cylinder has various openings into it to permit the entrance and exhaust of the actuating air. The back of the cylinder is closed by a back-head, and this with the front-head is held to the cylinder by two through-bolts on the sides, the holding nuts working against a spring so as to permit the absorption of a blow delivered by the piston on the front-head, and thus avoid breaking some part of the machine.

The piston is hollow for part or all of its length, and sometimes the piston rod next to the piston is also hollow. In this bore there is inserted a nut with inclined flutes on the inside, known as the rifle nut. This nut in the reciprocation of the piston works on a rifle bar fluted to correspond to the fluting of the nut. The bar is so held at the back end by a system of ratchets and pawls in the back-head that it is free to turn in one direction and not in the other. Thus, on the forward stroke, the rifle bar turns, and the piston and the bit, which is rigidly connected to it, do not turn; on the return stroke, the rifle bar is held against turning, and the nut having to follow the twisted fluting of the bar, turns also the piston and bit a certain amount.

The fact that the piston of the piston drill is rigidly connected to the drill bit subjects the piston to a good deal of side bending. It is therefore necessary to keep it tight in the cylinder by the use of piston rings. These may be of one or several pieces, and may be held out by their own spring or by separate springs, and finally may be one or two in number on the piston.

Frequently, the piston is spooled out for part of its central length, sometimes for the sake of getting certain air connections and throwing either the valve or the piston itself, but usually to get the shoulders, which will strike and move the tappets, when tappets are used.

The cylinder with piston and bit, that is, the engine proper, is moved back and forth, closer or farther from the bottom of the hole, in a shell containing runways or guides in which projecting side lugs at the bottom of the cylinder can slide. The shell may be cast in one piece, or the guides may be so constructed as to be adjustable. Wear is bound to take place, and if the top or gib of the guide is made separate and bolted to the rest of the shell, the space in which the cylinder lugs slide can be made smaller or larger in either direction by removing or inserting fillers or shims between the gib and the shell. This adjustment is also possible with a shell cast as one piece.

The position of the cylinder in the shell is adjusted by means of a feed screw. This extends the length of the shell and turns in a bearing thereon. Its thread engages a nut attached to the bottom of the cylinder. There is a crank at the end of the screw, and the counter-clockwise rotation of the crank forces the cylinder forward, while the clockwise rotation withdraws it. The shell has on the bottom a lug called by various names, such as "saucer" or "standard," which is in effect a thick bevel-edged disk. This is gripped in a clamping device, which is itself bolted to the column bar or tripod upon which the machine is mounted. This standard can be rotated in its clamp when the clamping bolt is released, and thus the direction in which the machine points can be varied in one plane, while other arrangements of saddle and arm permit shifting of the drill and varying its direction in other planes.

Types of Valves

The reciprocation of the piston in the cylinder is controlled by a valve of some sort. The valve may control both live air and exhaust, or live air only. It is usually seated above the cylinder and communicates with the latter through long ports cast in the cylinder shell. Piston drills are most easily classified on the basis of the type of valve which is used. This may be of the tappet type, wherein the valve is thrown mechanically from one of its positions to the other, and the air thus directed into either one or the other end of the cylinder; the blow is struck against the tappets by shoulders on the piston itself; the tappets are in mechanical connection with the valve; the latter is most commonly of the "D" or slide-valve type, but is not necessarily so.

The second type of valve is that which is altogether air thrown; in this case the piston itself acts frequently as a valve and may be considered a large spool valve. Such air-thrown valves may be of the spool, butterfly or ball type, the spool valve being by far the most common. The spool valve is essentially a slide valve. It consists of alternating cylindrical portions of small and large diameter. The small diameter portions register with two ports in the seat, connect them and permit air to flow from one to the other. The large portions fit close in the cylindrical casing and are called the spools. They may be all of the same diameter, or one may be larger than the other; they may be three or four in number.

The third type of valve is the auxiliary. This consists of a smaller intermediate valve mechanically moved by the piston through tappets and arranged to operate in connection with small ports so as to change the air pressures on the main or the spool valve and thus throw it.

Examples of the different types of drills have been selected for presentation here with particular regard to what is new, to what is the principal product of the various manufacturers, and to illustrate certain departures from ordinary practice. It is obviously impossible to describe every machine upon the market without going to unwarranted length. The tappet valve is rapidly becoming extinct, and only one is described here.

It will be noted that several well known makes of machines are not represented in this series of articles. This is because of the fact that the manufacturers thereof declined to furnish the necessary material to make possible an adequate treatment. The descriptions which are included could not have been written without the hearty coöperation and assistance of the manufacturers concerned, to whom acknowledgment is herewith made.

(To be continued)

Mine Stores and What Mines Use--III

SYNOPSIS—Continuation of list of supplies consumed at Nevada Con., Miami, New Jersey Zinc and Hollinger, including drill supplies, electrical supplies, leather and rubber goods, chemicals, rope, wire and miscellaneous materials.

In Parts I and II of this article, a list of fuels, lumber, explosives, oils and greases, iron and steel, pipe and fittings, tools, tramming and haulage supplies, building material, general hardware and machinery and parts used at the Nevada Consolidated Copper Co., Ely, Nev.; Miami Copper Co., Miami, Ariz.; New Jersey Zinc Co., Franklin Furnace, N. J.; and the Hollinger Gold Mines, Porcupine, Can., was given. The following list completes the supplies used at these mines during the same period covered by previous articles. The list of the Miami Copper Co. was not furnished in quite as much detail as furnished by the other mines, some articles were lumped and only their cost given. During the period covered by the Miami list, $449,989 was actually charged out to operation and construction. Structural steel, and 823 lockers for change house, amounting to $21,597, were not included in the list published. The consumption of supplies at Miami amounts to about $83,000 a month and it carries about $315,000 total stock which is turned over once about every four months.

NEVADA CONSOLIDATED COPPER CO.

Mine Supplies for 10 Months in Steam-shovel Mining; 2,376,966 Dry Tons Ore and 2,480,962 Cu.yd. of Waste Mined

Churn Drills and Fittings

No. 5 Keystone, complete	1	Chain-sprocket locks.	6
Casing, 7⅝-in., ft.	3281	Socket-holder plates.	5
Boiler flues	410	Keystone special blowers	9
Crosshead and crank end brasses	104	Intermediate shaft	1
Casing, 4¼-in., ft.	15	Sand-reel female frictions	6
Fluted rock bits, 5⅝-in.	39	Sand-reel male frictions	2
Spudding sheaves	11	Center grate	1
Eccentric straps	14	Drive pinions	6
Crossheads	15	Drive shoes	5
Sand-reel bearing cups	2	30-in. front wheels	5
Crankshafts	3	8x8-in. cylinders	2
Sand-reel gear	1	Sprockets	7
Intermediate pinions.	4	Worm gear	1
Stub shaft	1	Rear-axle caps	3
Sand-line sheaves	3	Crank gears	2
Pitman bearings	2	Sand reels	8
Slip tongs, pair	1	Horn for drill circle	1
Drill-stem box ends	9	Differential gear	1
Drill-stem pins	4	Rope sockets	3
Engine beds	1	Eccentric sheaves	3
Exhaust ell	1	Wrist pin	1
Bull gear	1	Bolster plate	1
Muffler	1	Tread wheels	8
Flywheels	1	Drill jars, set	1
Cannon speed pins	8		

Electrical Supplies

Electric light globes.	2,531	Capitol tape, lb.	83
Electric carbons	572	Lamp coloring, qt.	2
R. C. wire, No. 10, 12 and 14, ft.	29,481	Carbolineum, gal.	20
Lamp cord, ft.	6,425	W. P. sockets	357
Flexible wire, No. 2, ft.	36	Key sockets	281
Cap wire, ft.	1,000	Extension plugs	33
Bare copper wire, lb.	7,145	Porcelain knobs	1,605
Bare wire, No. 6, lb.	785	Ceiling rosettes	148
Twisted telephone wire, ft.	500	Wood brackets	49
W. P. wire, ft.	1,146	Brass wall brackets	26
Guy wire, ft.	100	Light fixtures	24
Annunciator wire, lb.	144	Shade holders	38
Listed fuse wire, lb.	26	New Gourd globes	12
30-amp. fuse blocks	24	Lamp changer	1
Transformer fuse blocks	3	Stage lights	4
30-60-amp. 600-v. fuses	184	10-amp. snap switches	50
Desk phone sets	3	Knife switches	22
Telephone protectors.	12	10-amp. panel switches	1
Mouth pieces	12	Receptacles	19
Telephone poles	23	40,000-volt transmission insulators	150
Transmitter arm	1	Lamp guards	92
Inside arc globes	67	Insulator tops and bottoms	188
Climbers, pair	1	Oak pins	138
Tin circuit panel cutout	1	Socket bushings	400
Electric radiators	2	Plug cutouts	10
Transformers	1	Red fiber, sheets	16
Motor starters	3	Porcelain tubes	551
10-hp. potential starter	1	Attachable plugs	70
Cord adjusters	12	Glass insulators	253
Holophane shades	66	Side-cut pliers, pairs.	3
High tension cross-arms	63	Milanite tacks	1,000
Soldering irons	7	Portable lamp	1
Solder paste, lb.	2	Electric disk stove	1
		Electric plate	1
		No. 6 Columbia dry cells	100
		Transil oil, gal.	5

Belting, Hose, Packing, Etc.

Belting, all kinds, ft.	817	Gaskets	60
Steel belt lacing, in.	2517	Water hose, 1-in., ft.	150
Leather belt lacing, ft.	1007	Cotton fire hose, 1½-in., ft.	890
Cling surface belt lacing, lb.	30	Suction hose, 4-in., ft.	15
Composition wire, ft.	100	Hose nozzles	6
Sundry packings, lb.	1824	Hose plugs	1
Sight-feed gaskets	144	Hose clamps	10
Water-gage gaskets, lb.	30	Brass hose nipples	25
J. M. manhole gaskets	89	Fire-hose gaskets, 1½-in.	12
Handhole gaskets	272	Babbitt-metal ring, sets	96
Copper cylinder gaskets	41	Expansion ring	1
Packing expanders	6	Air-pump packing, sets	50
Steam hose, ½- and 1-in., ft.	3,088	Candle wicking, balls	542

Rope, Cable, and Chain

Manila rope, 1-in., lb.	1,303	Special steel cable, ft.	1,369
Spot sash cord, ft.	6,004	Drill cable, 2-in., ft.	7,850
Swing cables, ft.	796	Boom cables	2
Cable clamps	63	Chain, ½-in., ft.	210
Rope socket	1		

Chemicals

Calcium carbide, lb.	282,100	Sodium carbonate, lb.	50
Muriatic acid, carboys	3	Carbonate of lime, lb	50
Nitric acid, carboys	1	Soda, lb.	200
Ammonia, carboys	2	Glycerin, qt.	1
Formaldehyde, gal.	12	Borax, lb.	50

Assay Office Supplies

Bucking board	1	Sample envelopes, 5x7	5,000
Canvas sample sacks.	1,000	Burettes	2

Engineering Supplies

42-in. straight-edge	1	Level rod	1

Office Supplies

Millionaire calculator	1	Adding machine	1
Oak cabinets	2		

Miscellaneous Supplies

Cotton and wool waste, lb.	7,726	Tanned leather, side	1
Oakum, lb.	10	Red lead, lb.	493
Babbitt, lb.	9,322	White lead, lb.	7,776
Solder, lb.	228	Sundry paints, gal.	1,096
Bright tin, lb.	91	Sundry colors, lb.	653
Pig lead, lb.	200	Putty, lb.	97
Bar brass, lb.	4,015	Bee's wax, lb.	2
Sheet brass, ft.	25	Tin funnels	2
Sheet brass, sheets	20	Tin dippers	36
Copper sheets	21	Ticket punches	2
Lead tinplate, sheets.	14	Copperized oilers	76
Copper tubing, ft.	48	Oil cans	37
Brass straining cloth, sq.ft.	5	Granite wash pans	64
Welding compound, lb.	735	Gasoline stove	4
Boiler compound, lb.	10,356	Heating stoves	1
Boiler compound, gal.	1,550	Stove parts, pieces	33
Solder paste, lb.	5	Stove pipe, lengths	26
Soap, cakes	300	Stove-pipe elbows	5
Bon Ami, cakes	156	Stove grates	12
Sapolio, cakes	3	Stove dampers	56
Lye, cans	105	Coal shovels and hods	26
Matches, cases	2	Stove polish, cans	3
Towels	48	Mesh netting, pieces	15
Pillows and bed sheets, each	6	Brass checks	4
Pressboard sheets	50	Moonstone copying stone	1,000
Window shades	12	Congress chairs	1
Pint condenser	1	Hospital beds	60
Smooth-On cement, lb.	40	Mattresses	24
Balls of twine	30	Bed springs	273
Staples	1,000	Mirror	29
Fiberette, sq.ft.	500	Emery cloth, sheets	1
Rubber boots, pairs	70	Sandpaper, sheets	704
Tarpaulins	5	Toilet paper, cases	100
White duck canvas, yd.	72	Hotel cooking utensils, pieces	2
Oil coats	200	Bales wood	169
Tents	2	Tin mal. ears	293
20-gal. stone jars	2	Copper ferrules	288
		Tanned felt, rolls	2,406
			26

NEVADA CONSOLIDATED COPPER CO.

Supplies Used in Underground Mining at the Veteran Mine, Months, Jan. 1, to Oct. 31, 1913; 216,794 Dry Tons of Ore Mined

Drills and Drill Parts

Stoping drills	14	Pawl springs	12
Sleeves	6	Rotation pawls	1
Valves	5	Rotation pawl springs	3
Feed cylinders	2	Rotation pawl plungers	2
Feed cylinder bushing	1	Rotation washers	1
Hose spuds	59	Oil cocks	2
Ratchet springs	2	Air front heads, set	1
Lock-ring springs	2	Air front head bushing	1
U-bolts	2		
Cup leathers	29		

Brass nuts	2	Machine bushings	2
Stoping bar and nut	1	Lock nut and bushing	1
Stoping bar top clamp	1	Feed screw	1
Arm bolts	2	Feed-screw nut	1
Column arm bolts	2	Throttle cocks	2
Lock rings	4	Packing rings	13
Union nipples	6	Ring gaskets	2
Waugh barrels	2	Retaining key	1
Waugh nuts	2	Waugh side rods	2
Waugh machine handles	2	Waugh piston hammers	2
Pistons	1		

Electrical Supplies

Electric light globes	1,568	Bronze telephone wire, lb.	20
Drop cord, ft.	8,301	Telephone wire, ft.	620
Lamp guards	6	Telephones	5
Glass lamp shade	1	R. C. Wire, ft.	13,880
Brass snap sockets	16	Manson's tape, lb.	32
Brass socket hanger	1	Wire solder, lb.	9
Rosettes	43	Soldering paste, lb.	1
Keyless sockets	94	10-amp. fuse	35
Dry batteries	31	Fuse plugs	182
Carbons	4	600-volt fuses	10
Contactor points	42	Enclosed fuse cut outs	8
¾-in. tubular gaskets, lb.	3	Fuse blocks	4
Glass insulators	1,000	Pole cut out switches	10
Porcelain insulators	3,077	Enclosed fuses	5
Snap switches	2	Comb. switches & cut outs	2
Porcelain knobs, ⅜-in.	84	W. T. case 40,000 volt	1
Induction coils	1	Bell ringer	1
Perkins switches	2	Telephone protectors	2

Belting, Packing, Hose, Etc.

Rubber belting, ft.	202	Air hose, ft.	1050
Leather belting, ft.	70	Air hose couplings	15
Leather belt lacing, in.	580	Air hose nipples	2
Belt dressing, lb.	12	Air hose clamps	60
Various packing, lb.	594	Air hose menders	6

Rope, Cable, Etc.

Manila rope, ft.	3135	½-in. wire cable, ft.	2000
Drill cable, 2-in., ft.	675	Tiller rope, ft.	450
Sand lie, ft.	509	Sash cord, ft.	250
Cable clamps	27	Cable lubricant, gal.	22

Chemicals

Calcium carbide, lb.	850	Iron carbonate, lb.	10
Ammonia, carboys	8	Potassium cyanide, lb.	10
Nitric acid, carboys	4	Potassium chlorate, lb.	65
Sodium thiosulphate, lb.	1	Bromine, lb.	½
Sulphur, lb.	1	Barium chloride, lb.	1
Zinc oxide, lb.	1	Microcosmic salt, lb.	½
Hydrofluoric acid, lb.	1	Ferrous sulphide, lb.	2
Stannous chloride, lb.	½	Acetic acid, lb.	1
Barium carbonate, lb.	1	Calcium carbonate, lb.	1
Silver nitrate, oz.	1	Ammonium sulphide, lb.	1
Zinc shavings, lb.	1	Hydrochloric acid, lb.	16
Sulphuric acid, lb.	16	Aluminum, sheet	½

Assay Office Supplies

Porcelain crucibles	6	Pipe stem triangles	3
Forceps	2	Woulff bottles	1
8-oz. copper flasks	60	Test tubes	12
Rubber sheeting, yd.	2	Filters	1,500
Annealing cups	12	Rubber tubing, ft.	76
Burette tips	12		

Miscellaneous Supplies

Waste, bales	2	Sandpaper, sheets	24
Stove	1	Grate for stove	2
Coal scuttles	2	Lengths of stove pipe	53
Coal shovels	2	Stove pipe elbows	1
Sundry paints, gal.	14	Burnt umber, lb.	2
White lead, lb.	170	Solder, lb.	2
Babbitt, lb.	129	Creolin, lb.	5
Emery powder, lb.	3	Tent	1
Smooth-On cement, can	1	Burners for acetylene lamps	200
Rubber tubing, ft.	16	Welding compound, lb.	25
Danger signs	24	Bottles for fire extinguisher	60
Garbage cart	1	Acetyline lamp felts, gasket screens, each	200
Cement sacks	40		
Emery cloth, sheets	12		

MIAMI COPPER CO.

Mine Supplies, Jan. 1, to July 1, 1913, Underground Mining; 489,627 Tons of Ore and 32,668 Tons of Waste Mined

Electrical Supplies

Lead cables, lb.	10,481	3-pole fuse boxes	3
Copper and trolley wires, lb.	13,966	Cooper-Hewitt tubes	32
No. 1 braided wire, ft.	5,180	Triple pole switch	1
All wire bonds	175	Disconnecting switch	1
Electric light bulbs	4,558	Alexalites	14
440 V. compensators	2	Corr. Glass linings	6
Type R controller	1	Holophane Hemispheres	20

Belting and Hose

12-in. 6 and 8-ply, ft.	368	2-in. linen garden hose, ft.	450
14-in. 8-ply, ft.	659	¾-in. 5-ply air drill hose, ft.	2,400
16-in. 5 and 8-ply, ft.	179	¾-in. garden hose, ft.	1,965
18-in. 8-ply, ft.	248		
24-in. 12-ply, ft.	60		

Rope, Cable, Etc.

Steel rope, lb.	3,708

Chemicals

Soda ash, lb.	4,917

Miscellaneous Supplies

Waste, lb.	8,559	Water bags, 5 and 10-gal.	24
Desk for office	1	Red Ochre, lb.	1,150
Letter press	1	White lead, lb.	10,499
Stationery	$2,678	Sundry paints, gal.	288
Howe depot scale	1	Pig lead, lb.	8,565
Miners oil cans	22	Nickel babbitt, lb.	2,178

NEW JERSEY ZINC CO.

Mine Supplies Used in Six Months; Ore Broken, 261,650 Tons; Waste Broken, 97,770 Tons; Total Tons Broken, 359,420 Tons

Drills and Drill Parts

Waugh No. 17 valveless stoping drill:		Throttle valves	16
Complete drills	1	Valve chests	2
Chuck	1	N. E. steels	3
Spraying device	1	Rifle bars	9
Tappets	3	Oilers complete	2
Ingersoll-Rand hitch cutter:		Pistons	16
Complete machines	3	Oil plugs	11
Retaining springs	24	Rotating sleeves	12
Valves	2	Valve chest studs & nuts	5
Pistons	4	Butterfly valves	3
Valve springs	3	Ingersoll-Rand MC 50 stopers:	
Ingersoll-Rand BA 13 block holer:		Complete machines	5
Anvil block	1	Anvil blocks	110
Front head	1	Tube bushings	2
Cylinder bushing	1	Tubes complete	3
Front head springs	2	Extensions	3
Ingersoll-Rand hose coupling parts:		Rotating handles	2
Clamps	17	Cup leathers	187
Nuts	4	Nozzles	22
Menders	8	Hose nuts	8
Stems	4	Pistons	9
McKiernan hose coupling parts:		Sprays	4
Clamps	289	Oiler tube	1
Nuts	122	Throttle valves	5
Stems	113	Cup leather washers	2
Menders	99	Hose clamps	3
Spuds	185	Barrel bolts	171
Ingersoll-Rand BCR 33 sinking drill:		Clamps	4
Complete machines	4	Front cylinders	8
Buffer blocks	2	Extension gibs	4
Plunger buffers	2	Clamp keys	5
Casing linings	2	Hose nipples	8
Piston	1	Bar bolts & nuts	68
Plunger	1	Tube nuts	3
Locking plungers	6	Slide rods	29
Sleeves	4	Lock springs	3
Pawl springs	34	Inner tube	1
Anvil blocks	11	Lock washer	1
Front head bolts & nuts	13	Leyner Ingersoll Drill:	
Front head	1	Through bolts and nuts	2
Rotating pawls	144	Back head clamp	1
Oil plugs	3	Cap gasket	1
Pawl plungers	13	Chuck keys	8
Rings	9	Chuck nuts	1
Head springs	13	Rotating pawls	11
Rotating valves	6	Bach head plugs	1
Ingersoll-Rand BCR 43 jackhamer:		Tube rubbers	6
Through bolts and nuts	21	Pawl plunger springs	26
Steel holders	14	Water valve	1
Sleeve nut and washer	1	Chuck bushings	2
Rifle nuts	3	Steel chuck	1
Pawls	11	Front heads	2
Pawl springs	22	Rifle nuts	2
Plungers	11	Feed nuts	1
Through bolt springs	8	Pistons complete	3
		Pawl plungers	11
		Cushion springs	9
		Water tubes	19
		Front cylinder washer	1

Electrical Supplies, Etc.

Electric lamp globes	173	Split knobs	100
Lamp cord, ft.	4	Electric cut out	1
Porcelain tubes	3	Mesco batteries	23
S. B. magnets	2	Telephone parts:	
Fuse plugs	8	Coils	2
Solid knobs	90	Mouth pieces	2
Tape, lb.	3	Ringers	4
Wire connectors	9	Transmitter	1
Push button	1	Cords	8
Pig tail motor brushes	24	Receivers	2
Sockets	9	Springs	2

Belting, Packing, Hose, Etc.

Gandy belt, ft.	125	Air hose, ft.	1,525
Leather belt, ft.	2	Steam hose, ft.	22
Rubber belt, ft.	18	Clamps	42
Candor belt, ft.	5	Packings, lb.	164
Steel lacing, in.	19	Felt packing, sets	10
Leather gaskets	734		

Rope, Etc.

Rope, lb.	451	Cable dressing, lb.	810
Chain, lb.	203		

Chemicals

Carbide, lb.	22,550	Borax, lb.	14
Chloride of lime, cans	60	Hydrated lime, lb.	3

Miscellaneous Supplies

Waste, lb.	329	Dippers	3
Wicks	22	Babbitt, lb.	152
Cotton wicking, balls	2	Sheet brass, lb.	4
Acetylene lamps	543	Soldering paste, boxes	15
Acetylene lamp burners	1,256	Solder, lb.	20
Acetylene lamp reflectors	60	White lead, lb.	3
Carbide cans	192	Red lead, lb.	5
Oil flasks and cans	37	Asphalt paint, gal.	69
Oilers	1	Shellac, pt.	1
Chain guard	1	White felt, lb.	7
Duck, yd.	5	Twine, balls	72
Emery, pulverized, lb.	2	Cord, hanks	8
Emery, sheets	45	Rubber boots, pairs	2
Sand paper, sheets	32	Oil coats	2
		Oil pants, pair	4
		Oil suits	28

HOLLINGER GOLD MINES

Supplies for 1 Year (Part Used in Construction); 140,131 Tons of Ore and 11,544 Tons of Waste Mined

Drills and Drill Parts

New drills:	
Little giants Rand No. 43	3
Sullivan Hammer D. A. 21	11
Type L plugger	1
Rand hammer No. B. C. 21	1
Rand plugger B. C. 26	4
Parts, L. G. 43 Rand Rock Drill:	
Chuck bolts	864
Chuck bolt nuts	530
Buffer springs	490
Pawl springs	290
Pawls complete with springs	130
Pawl springs, rivets & burrs, lb.	10
Pawl bolts and nuts	210
Cylinders	27
Cylinder chest studs & nuts	130
Steam chests	53
Steam chest studs & nuts	242
Taper ring head leathers	570
Taper ring head bushings	43
Taper ring head collars	28
Machine ends	380
Chuck head liners	210
C. H. ring head bodies	31
Slide valves	170
Valve seats	27
Throttle valves	137
Jamb nuts	192
U. H. stuffers	19
U. H. packings	4
Oil plugs	94
Pistons	47
Piston rings	360
Piston ring springs	210
Feed screw handles	59
Feed nuts	180
Feed screws	140
Feed screw washers	180
Chuck keys	103
Chuck bushings	310
Chuck wrenches	53
Crossheads	185
Standards	185
Rockers	209
Rocker bolts with nuts and lock washers	240
Ratchet box rings	38
Ratchet box covers	29
Solid ratchets & rotating bars	60
Rotating nuts	50
Shell bolts with nut and lock washers	95
Positive hose couplings and clamps	236
Throttle plugs	160
Parts for 4½ Rand S. S. Column:	
Column heads	107
Column arm bolts	105
Jack screw nuts	92
Jack screws	87
Base blocks	119
Clamps, cone half	43
Clamp caps	116
Clamp hook bolts	124
Clamp bolts	72
Base block bolts & nuts	131
Parts B. C. Rand Plugger Drill:	
Striking blocks	9
Rotating handles	2
Front head springs	3
Front heads	5
Front head bolts and nuts	37
Parts B. C. 21 Rand Hammer Drill:	
Cylinder bushings	42
Packing leathers	98
Front heads	7
Feed tail pieces	19
Pistons	11
Valve chests	3
Cylinders	1
Butterfly valves	38
Parts L Rand Plugger:	
Pistons	2
Cylinders	5
Strainers	8
Valve box cap	1
Valve boxes	2
Valve buffers	2
Parts D. A. 21 Sullivan Hammer Drill:	
Pistons	23
Cylinders	38
Clamps	113
Clamp keys	147
Bushings	382
Rotating handles	91
Retaining keys	207
Feed pistons	138
Inlet bushings	140
Inlet elbows	88
Valve boxes	49
Valves	412
Valve box covers	53
Throttle valves	318
Heads	9
Feed cylinders	104
Feed cylinder bushings	119
Lock rings	217
Lock ring springs	198
Sundry drill parts:	
Sullivan U. E. 2 cylinders	2
Sullivan U. E. 2 pistons	3
Sullivan U. E. 2 foot plates	6
Waugh chucks	6
Waugh sprays	9
Diamond drill parts:	
"E" splines, set	1
"E" lining for quill	1
"E" drive spindle	1
"E" rods, ft.	220
"E" core barrel, ft.	10
Drive chuck jaws	1
Core shells	2
Diamonds	11
"E" blank bits	50

Electrical Supplies, Etc.

Conduit, ft.	1,530
R. C. wire, ft.	5,855
W. P. wire, ft.	1,950
W. P. copper wire, lb.	352
Lead covered cable, ft.	500
Lamp cord, ft.	1,400
Bare copper cable, 4/0, ft.	200
Conduit cable conductor, ft.	505
Telephone wire, ft.	1,475
Telephone wire, iron, lb.	140
Flexible cord, ft.	400
Circular loom, ft.	530
German silver wire, lb.	4
Fuse wire, lb.	34
Fuse plugs	170
Fuse blocks	43
Fuse shells	27
Enclosed fuses	430
Outdoor fuse blocks	11
Fusible receptacles	70
Fuse bases	8
Transformer fuse blocks	6
Carbon lamps	1,680
Tungsten lamps	340
Lamp shades	23
Wire lamp guards	48
Brass key sockets	580
Portable lamp guards	2
T-10-J cylinder complete	1
Distributor boxes	6
Contact fingers for controller, set	1
Attachment plugs	62
W. P. fixtures	47
Cleat rosettes	280
Porcelain tubes	1,850
Concealed rosettes	240
S. W. cleats	750
Flush receptacles	18
Wire molding, ft.	400
Snap switches	95
Combination switch and cutouts	47
Cutouts	43
Knife switches	29
Disconnecting switches	4
Split knobs	2,560
Oak top pins	67
Oak side blocks	82
Giant strain insulators	23
Glass insulators	42
Insulated staples	500
Electric bell pulls	15
Dry batteries	113
Electric bells & gongs	14
Magnet resistance coils	2
Field coils	3
Receptacles for iron	4
Pierce brackets	16
Angle wall receptacles	8
Keyless cleat receptacles	12
Short circuiting rings	2
Nichrome resistance, lb.	4
Chatterton compound, lb.	10
Contact blades for 50 hp. compensator, set	1
Carbon brushes for generator	32
Motor bearings, sets	3
Condulets	187
Cable rings	270
T-10-J contact bases, sets	8
Segments for compensator	6
C. T. W. P. junction boxes	6
W. P. sockets	109

Belting, Packing, Hose, Etc

Leather belting, ft.	719
Stitched M. X. belting, ft.	481
Belt punches	107
Rawhide belt laces, lb.	75
Fire hose, 2½-in., ft.	1,550
Miscellaneous hose, ft.	1,500
Suction hose, lengths	5
Hose couplings, sets	109
Fire hose adapters	
Packing, various kinds, lb.	1,046
Conveyor belting, ft.	61
Rubber belting, ft.	1,512
Steel laces, boxes	43
Air hose, under 1 in., ft.	2,950
Air hose, 1 in., ft.	2,600
Fire hose reels	2
Fire hose nozzles	12
Fire hose spanners	50
Asbestos manhole gaskets	63

Rope, Wire, Etc.

Steel cable, below 1 in., ft.	3,190
Steel cable, 1 in., ft.	4,260
Guy wire, ft.	500
Spring and miscellaneous wire, lb.	192
Chain, lb.	207
Open wire rope sockets	42
Galvanized cable, ⅝-in., ft.	900
Manilla rope, lb.	3,012
Bell wire, ft.	1,800
Cable clamps	190
Jack chains	276

Chemicals

Muriatic acid, lb.	72,617
C. P. Nitric acid, lb.	96
Caustic soda, lb.	600
Litharge, lb.	17,755
Zinc dust, lb.	119,370
Cyanide, lb.	87,660
Soda bicarbonate, lb.	3,600
Niter, lb.	800
Silver Nitrate, oz.	8
Com'l. prussiate of potash, lb.	14
Lead foil, lb.	83
Silver foil, lb.	50
Calcium carbide, lb.	11,700
Manganese dioxide, lb.	340
Soda ash, lb.	1,120
Bone ash, lb.	7,347
Lead acetate, lb.	380
C. P. lead acetate, lb.	9
Borax, lb.	33,690
Sodium silicate, lb.	1,338
Nitrate of soda, lb.	1,460
Pot. iodide, lb.	1.5
Silver nitrate, lb.	4.25
Chloride of lime, tons	1¾
Mercury, flasks	23
Unslacked lime, tons	187

Engineering Supplies

K. & E. drawing paper, rolls	9
Gallia paper, rolls	4
Tracing cloth, rolls	5
Cross section paper, rolls	2
Blue process paper, rolls	8
Blueprint paper, rolls	26
Direct black print paper, rolls	21
Water colors, pans	4
Camel hair brushes	36
Oil colors, tubes	12
Rubber cement, tube	1
Art gum, pc.	36
Field and level books	18
Steel erasers	48
Lettering pens	6
Brass thumb tacks, gross	2
Tapes, steel and linen	20
Brass plumb bobs	11
Plumb bob string, yd.	150
Plumb bob suspending cup	1
Anemometer	1
Parts for instruments	5
Heavy glass plates	5

Stationery and Office Supplies

Report forms, etc.	51,300
Envelopes, large & small	6,000
Letter heads	10,000
Foolscap paper, pads	96
5x8-in. pads	600
Telephone paper, rolls	6
Linen tags	500
Journal and ledger, pages	2,700
Memo. books	168
Record books	5
Time books	192
Carbon paper, boxes	9
Hook files	12
Majestic binders	3
Shannon files	18
Letter trays	2
Bedford McNeill code	1
Pen nibs, gross	14
Penholders	48
Pencils, gross	8
Blue and red pencils	120
Ideal paper clips	4,000
Hotchkiss staples, boxes	30
Rubber bands, lb.	4
Erasers	48
Chemical ink eraser, boxes	4
Ink, red and blue, qt.	33
Steel figures and letters, set	2
Typewriter ribbons	36
Adding machine ribbons	3
Paste, bottles	3
Steel erasers	3
Ink pots	5
Telephone roll holder	1

Assay Office Supplies, Etc.

Silver foil, oz.	15
Platinum weights, 1 M. G.	16
Platinum weights, 2 M. G.	5
Screens, sets	6
Sampling pans	60
Rubber tubing, ft.	210
Rubber bulbs	2
Rubber stoppers	156
Furnace pump	1
Grate bars	51
Furnace liners, sets	5
Winchesters	32
Bucking board	1
Battersea crucibles, No. 5½	124
Battersea crucibles, No. 5	20
Gold pan	1
Gold washing horn	1
Moisture scale	1
Hand bellows	1
Steel forceps	11
Double graduates	11
Single graduates	7
Glass beakers	48
Watch glasses	36
Glass funnels	48
Bucket for sampler	1
C. I. muffles	27
Furnace flat plates	9
Furnace clay rings	6
Iler disks, sets	9
Large graphite crucibles	27
Small graphite crucibles	29
Denver crucibles, 30 gr.	200
Asbestos mitts, pairs	29
Sample grinder	1

Dry Goods, Etc.

White oil cloth, yd.	160	Sewing machine needles, gross	6
Heavy canvas duck, 84-in., yd.	500	Brown kearsarge flannel, yd.	3,400
Heavy canvas duck, 72-in., yd.	300	Overalls, suits	36
Heavy canvas duck, 54-in., yd.	250	Oilskins	588
Rubber boots, pairs	192	Oil hats	280
Cotton gloves, pairs	120	Rubber gloves, long, pair	516
Thread for machine, lb.	102	Towels	36
		Glovers needles	324
		Sail maker's needles	12

Miscellaneous Supplies

Babbitt metal, lb.	4,300	Candle wick, balls	370
Brass for bushings, lb.	100	Hair insulator, bales	44
Pig lead, tons	13	Hair felt, rolls	28
Red lead, lb.	700	Rawhide leather, lb.	56
White lead, tons	2.25	Sole leather, lb.	93
Lamp black, lb.	130	Emery cloth, great gross	5 5/12
Welding compound, lb.	180	Sand paper, great gross	1 5/12
Pig zinc, lb.	1,180	Resin, lb.	280
Emery flour, lb.	23	Stove pipes, lengths	90
Soft soap, lb.	1,870	Stove pipe elbows	37
Brass time checks	5,000	Carbide candle	1
Bristol counters	7	Dynamite thaw cans	4
Cement, special high temperature, lb.	200	Engine room clock	1
Lantern globes	384	Oil measures, 1-qt.	12
Oakum, lb.	360	Oil measures, 1-gal.	15
Heavy galvanized iron pans, 28x30x4 in.	36	Respirators	60
Heating stove	1	Safe	1
Enamel danger signs	48	Standard scales	4
Toilet soap, cases	21	Telephones	12
Fire extinguishers	40	Turnbuckles	260
Speaking tube whistles	72	Fire extinguisher charges	63
Cotton waste, lb.	7,388		

Developments at Candor, N. C.

Special Correspondence

In the latter part of August, the mill of the Candor Mines Co. was shut down and with the exception of pumping, work was stopped in its Iola mine. A few weeks later, the property was sold to Elie Sheets and associates of Washington, for a reported price of $30,000. The buyers of the mine are interested in the Martha Washington which lies to the west and southwest of the Iola and has been in process of development for several months. It is the intention to treat the Martha Washington ore at the Iola mill, which will be started again soon. At present, the mill bins are being loaded with ore from the old Iola dumps. While it is conceded that the known reserves of the Iola have been practically stoped out, the new owners are starting a search for more ore. Two vertical shafts are being sunk; one is shallow to cut a pillar of ore supposed to have been left in the upper workings on the Iola vein, and the other is to develop what is known as the hanging-wall stringer, a branch from the main vein. This latter shaft may be sunk as deep as 400 ft., and sinking may be done below the present deepest level of the mine, 650 ft. If the vein continues on its present dip of 57°, it will eventually pass out of the boundary lines of the Iola property to the Martha Washington, and as the mining laws of the Western states do not prevail here, it will become the property of the latter company; thus by acquiring the Iola the depths of the Martha Washington can be explored with greater economy. It will become the first deep-level mine of the South if ore is found in this part of its territory, and it does not seem probable that the vein will cease to yield pay ore at 650 ft.

During its life of nearly 14 years, the Iola has been the most interesting precious-metal mine of the South, and has been the most important producer during that time. With one possible exception, no other southern mine has ever made such a production of ore of uniformly good grade. In the early days, the average value of the mill heads was around $20 per ton, and later, with greater depth and greater tonnage, it is reported to be around $10. Six different milling plants have been built on the property, two of which were destroyed by fire. The first cyaniding plant for separate treatment of slimes and sand in the South was built here in 1904 by H. A. Megraw, and was operated until the sale of the mine to the Candor company in 1908. The new mill built in 1911 employed the heaviest gravity stamps used in the United States at that time, and introduced to this section, modern milling equipment, such as Dorr classifiers and thickeners, the Parral method of agitation and the Kelly filter.

The Candor Mines Co. was composed of interests also active in the Mines Company of America, and other enterprises. Their retirement from this field is viewed with regret. They developed the mine after buying it from the Iola company, built two different mills, and have without doubt, made a fair profit. They prefer to sell, however, rather than to enter on a new campaign of development on the lower levels. A former owner of the mine also gained wealth by its exploitation, and there is a railroad not far from here that was built in part by the production of this mine. The general development of the surrounding country has received marked impetus from the same source.

Operations are also under way once more, at the adjoining Uwarra mine, both underground and in the mill. The mill is handling ore and at the same time is being rearranged under the direction of the general manager, Andrew Walz. The Uwarra company has arranged with the Iola management to take care of all its underground water, thereby effecting a saving in power for the Uwarra, all the water being handled by the big Cornish pump in the Iola main shaft.

Inquiry into Iron Mining in Canada

Pursuant to a request made to the Dominion Government for the granting of some measure of assistance toward the development of iron-ore mining in Canada, and in accordance with the statement of the Minister of Finance, that the iron-mining industry would be investigated, a committee has been appointed, consisting of O. E. Leroy, G. C. Mackenzie, E. Lindeman, and J. McLeish, secretary, of the Department of Mines, to inquire into the situation.

Every owner or operator of an iron-ore property in Canada should be interested in facilitating this inquiry and should communicate with the Deputy Minister of Mines, at Ottawa, or the secretary of the committee, who will furnish a schedule of questions covering the information required by the committee.

Chief Consolidated

The semi-annual report of the Chief Consolidated Mining Co., Eureka, Utah, for period ended June 30, 1914, shows a balance of receipts on hand amounting to $228,134.99, after paying a dividend of $43,838.20. This makes an increase in balances on hand of $13,073.13 since the first of the year and indicates a net profit of $56,911.33 for the period. This profit was made from shipments of ore amounting to 23,739 tons, with a gross value of $16.46 per ton. Freight, smelting and sampling charges amounted to $8.74 per ton, leaving a net value of $7.72 per ton before deducting mining expenses.

Driving the Sheep Creek Tunnel*

SYNOPSIS—Detailed description of driving 8707 ft. of the Sheep Creek adit of the Alaska Gastineau Co., near Juneau, for development purposes and for ore haulage to the mill. Preliminary work, equipment, routine of drilling and mucking, costs, rate of progress, survey for the connection, are covered. Maximum speed, 661 ft. per month; average for last six months, 596 ft.; average for entire 16 months, 544.2 ft., a world's record. Four piston drills on horizontal bars, stick sheets instead of switches, storage-battery locomotive, exhaust fans in relay, were features of work. Bonus system and perfect discipline largely responsible for speed.

The Sheep Creek tunnel was part of the development program of the Alaska Gastineau Mining Co., at Juneau, Alaska. The Alaska Gastineau is the operating company of the Alaska Gold Mines Co. The tunnel was driven to develop the lode, and to form part of the transportation system between the mine and the 6000-ton mill under construction on the shore of Gastineau Channel.

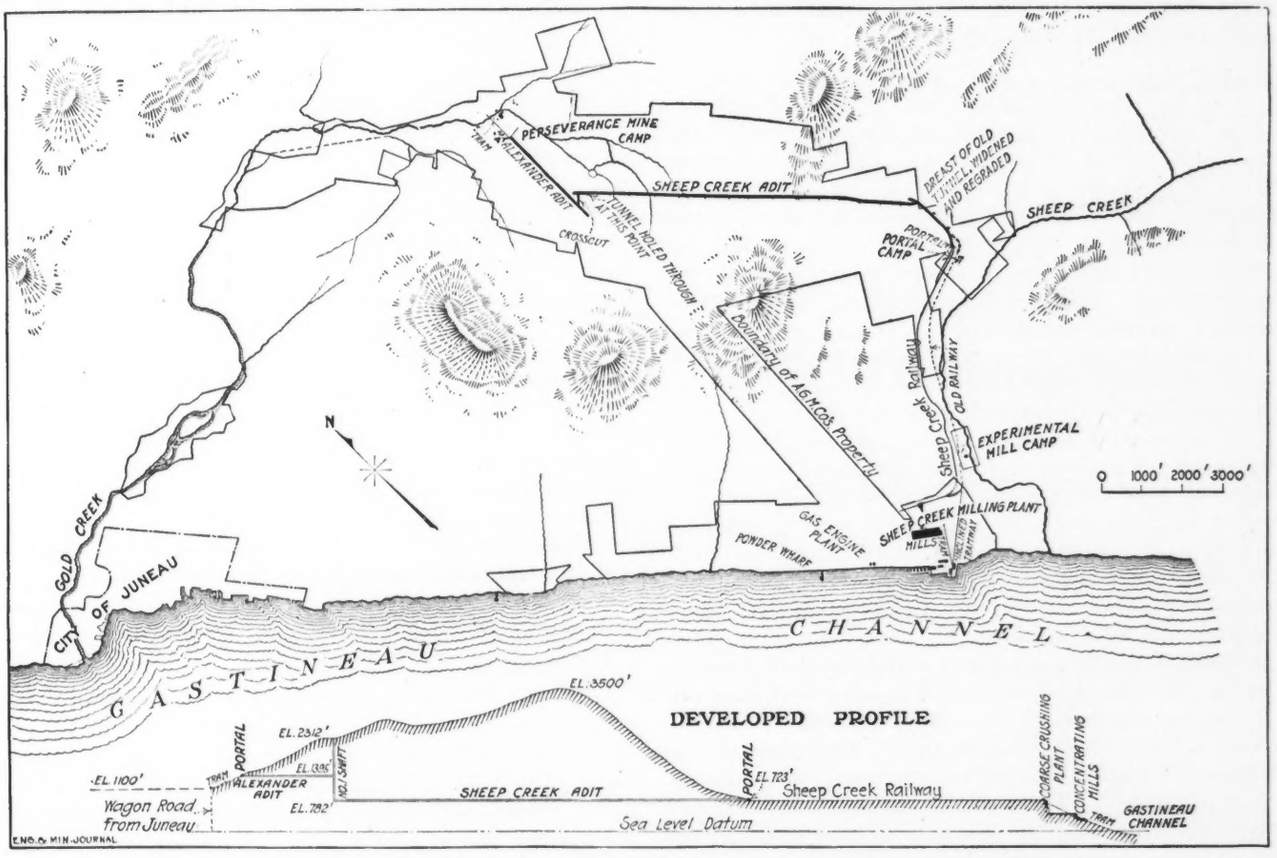
The portal of the tunnel is 723 ft. above sea level and 7250 ft. distant from the coarse-crushing plant of the mill. Its underground terminal is its intersection with the main or No. 1 shaft of the Perseverance mine, 1530 ft. below the surface and 613 ft. below the Alexander level, previously the lowest working adit on the Perseverance property.

*An abstract of a report made by the engineering staff of the Alaska Gastineau Mining Co., and communicated to the Journal by the managing director of the Alaska Gold Mines Co.

In locating the tunnel, the object was to attain the maximum amount of development with the shortest possible length. The first 1450 ft. is crosscut, the remainder is parallel with the foot wall of the lode and close to it. It is intended to explore laterally from the tunnel with crosscuts and diamond-drill holes.

Preliminary Work

A good deal of preliminary work was necessary before the actual driving of the tunnel was begun. A camp with warehouses, etc., was established on Gastineau Channel. From this point a 2200-ft. inclined tramway connected at an elevation of 650 ft. with an old narrow-gage railroad or tramway, which ran along the side of Sheep Creek Basin to the old mine. This railroad was built entirely on trestles which had to be strengthened and rebuilt. The money put into this preliminary construction is not chargeable to the tunnel, inasmuch as the installation will be used for future operations of the property.



PLAN AND PROFILE OF THE TUNNEL UNDERGROUND CONNECTIONS AND SURFACE WORKS

The Tunnel Camp

A camp was established at the end of the narrow-gage railroad near the entrance to the tunnel. There was a three-story rooming house, 20x66 ft., and a one-story mess house, 24x66 ft., containing dining room, kitchen, storeroom and in the basement a room for the fire-fighting apparatus. A third building was used for a change room on the lower floor and a club room on the second. The change room was equipped with steam-

heated lockers, bathrooms, shower baths and lavatories. The club floor had a reading room, writing room, card room and assembly room. The central heating plant was located in the power house. The tunnel foreman had a cottage, and another small building provided sleeping quarters for the cooks and mess-house help.

The blacksmith shop was 24x50 ft., equipped with two forges, one No. 5 Leyner-Ingersoll sharpener, benches, tools, etc., and an air hammer made from a 3¼-in. piston machine. The carpenter shop was 12x24 ft. Adjacent to the two shops was a storeroom, 12x30 ft., for spare drill parts, fittings and miscellaneous supplies.

The powder magazine was on the railroad track about one-half mile from the tunnel. An auxiliary magazine and thawer was situated about 150 ft. from the tunnel entrance with which it was connected by a covered passage. All powder was thawed in the original boxes by electricity and was taken to the face in the same boxes, except that made into primers; the primers were made up in this auxiliary magazine.

Compressors, Drills and Ventilating System

The compressor was an Ingersoll-Rand, Imperial, type 10, cross-compound, 22 and 13x16-in. machine; it was belt driven by a General Electric, form K 200-hp., 2200-volt induction motor. The air left the receiver at 105 lb. and was carried in 7-in. casing pipe for about half the distance to the end of the tunnel and in standard 6-in. for the remainder. Flange unions were used throughout to facilitate making connections.

An exhaust ventilating system was used. The first fan placed just outside the tunnel was a No. 5, Type K, American Blower Co. exhaust machine, belt-driven by a 20-hp. motor at a speed of 3000 r.p.m., and delivering 3000 cu.ft. of free air per min. against a 12-oz. pressure. At 3000 ft. in a second fan, built by the Lewis Burton Co., was installed in series to handle the same amount of air against an 8-oz. suction; it was belt-connected to a 15-hp., 1740-r.p.m. induction motor. At intervals of about 2550 ft., additional fans of the same size and type were installed. A 15-in. ventilating pipe was made up of 18-gage galvanized iron in 25-ft. lengths. The lengths were provided with slip joints with lugs for wiring them together; all joints were wrapped with tarred canvas to insure their being air-tight. The pipe was riveted and thoroughly soldered and practically tight against the pressure used. The series operation of the fans was intended to eliminate the necessity of heavy pipe to resist collapse, such as might have been necessary with a single machine operating on a much higher suction, and also to reduce the leakage along the line, which would have accompanied a high suction.

The drills were Ingersoll-Rand E 44, 3¼-in. piston machines. Six were kept on hand, four at the face, one in the tunnel and one in the shop being overhauled. In use they were mounted on 4½-in. horizontal bars 9 ft. long. Of the drill steel the starters were made of 2-in. cruciform, with 2¾-in. gage, 32 in. long. The seconds were of 1¾-in. cruciform, with 2½-in. gage and 52 in. long; the last three pieces were made of 1½-in. steel, gages $2\frac{5}{16}$ in., 2⅛ in. and $1\frac{15}{16}$ in., length 74 in., 94 in. and 116 in. About 750 pieces were kept up, sharpening being done on the day shift only and over 500 pieces frequently being dulled per day.

Features of the Tunnel

Of the total tunnel length, 474 ft. was driven through slide rock and gravel near the portal; 4009 ft. in greenstone, 4224 ft. in slate and 1085 ft. in metagabbro; the last three rocks alternated, the stretches varying from a few feet, up to several thousand.

In general the direction of the tunnel followed the strike of the formation, making it difficult to break the rock, especially the hard silicified slate, where the effect of the cleavage planes was marked. The holes broke short and a great many were required. Greenstone also developed cleavage planes in places with a similar result. When the tunnel was in homogeneous blocky greenstone, the rate of progress jumped to about a foot per hour, and there is no doubt but that if the entire distance had been driven in such rock, the record made would have been improved by at least 25%, and the costs correspondingly reduced. In general, shallow rounds giving an average advance of 4 ft., were found to be most economical and rapid.

The tunnel was 10 ft. wide and 8 ft. high, with a small ditch along one side. Timbering was necessary only in the loose ground near the portal, and at this point the section was kept 8x10 ft. inside timbers. While the total length of tunnel is 9792.2 ft., 940 ft. had previously been driven, and 564.5 ft. of this was widened out and became part of the main tunnel, while 427 ft. adjacent to the portal had to be driven anew in order to get proper alignment and cross-section. This work was done apart from the driving of the main tunnel, and only the latter will be considered here. From the solid rock face from which the main tunnel started to its intersection with the crosscut from the Perseverance shaft, the distance is 8800.5 ft.; 240 ft. of branch tunnel was also driven by the same crew. The relations of the different parts of the tunnel, as well as surface construction, are shown in the accompanying map and profile.

The tunnel was driven for single track its entire length, with the intention of widening out for sidings later. The average upgrade from the entrance was 0.65%, based on questions of drainage and equalization of tractive effort with loaded and empty cars.

Force Employed and Shift Arrangement

The force employed consisted of 70 men. Working on day shift only, there was a general foreman, a timekeeper, a tool sharpener, a tool-sharpener helper, a blacksmith, a blacksmith helper, a carpenter, an electrician, a powderman, and an outside man. Two compressor men worked 12-hr. shifts each. Divided into three shifts there were three shift bosses, 12 upper-bar machinemen, 12 lower-bar machinemen, 18 muckers, three carmen, three locomotive engineers, three locomotive brakemen and four pipe- and trackmen.

The arrangement of shifts was unusual. The cycle was completed in 18 instead of 24 hr.; during this time each of the three crews into which the force was divided worked 6 hr. and rested 12, so that in each 24 hr. there was 8 hr. of work for each man. The incoming shift would relieve the outgoing shift at the working face and there was no intermission in the work for the purpose of eating a meal; this eliminated the delay of the meal time and the slackening of work following heavy eating. The plan was eminently successful and acceptable to the men; the only objection was the complication in the meals at

the boarding house; eight meals had to be served every 24 hr., two for each 6-hr. shift; each shift got a meal about three-quarter of an hour before it went on and another when it came off.

Routine of Drilling

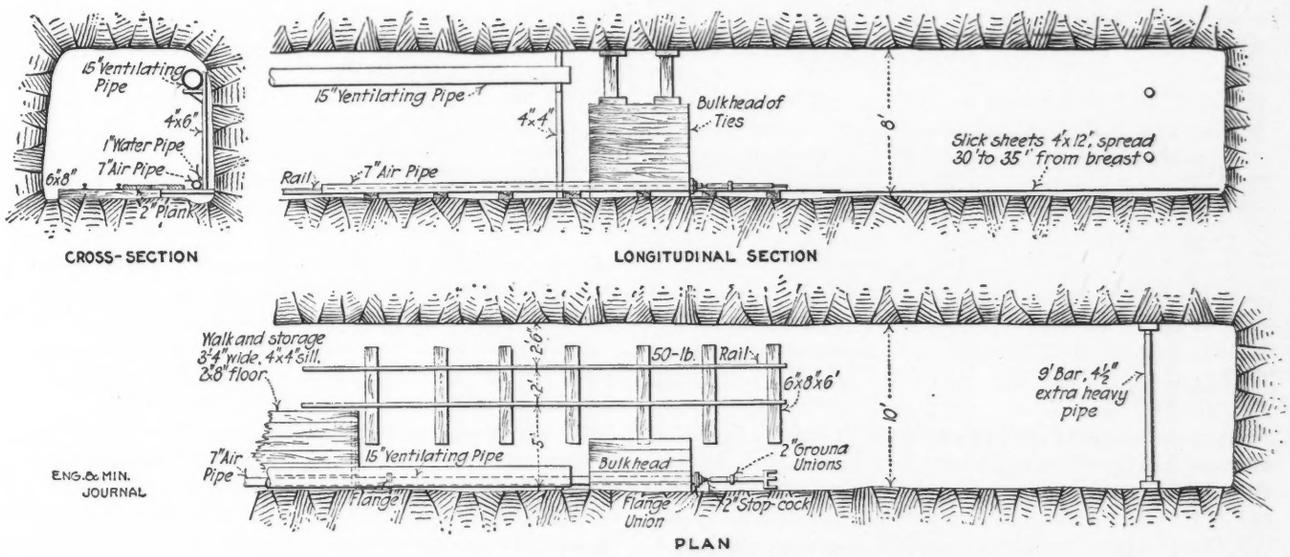
After spitting the round, the men walked back in the tunnel about 1000 ft. The holes were counted and immediately after the last lifter went off the men started toward the face again. The fans being in full operation continuously, no smoke was encountered until within about 60 ft. of the face. One man then carried to the breast a water hose, previously connected to the water line and sprayed the muck. Meanwhile the manifold was connected to the air line and the air hoses attached thereto. The top bar was next brought up and jacked into place; two machines were placed on the bar, the air hose connected as soon as possible and drilling started. At the beginning of tunneling operations it required about 30 min. from the time the last lifter was fired until the top-bar machines were running. By the end of the undertaking, this took frequently only 10 min. and seldom more than 15.

hundred feet back from the face another slick sheet was maintained and when the locomotive brought in a train of empties, they were thrown off the track on this sheet. The loaded cars were run back to this point, made up into a train and hauled out. From this latter sheet, the empty cars were run one at a time up to the sheet near the face. The empty cars weighed about 1100 lb. and were handled by a man using a crowbar. The sheets were kept about the same height as the top of the rail so that the car required to be lifted only the height of the flange. No switches were used anywhere. At no time did the removal of the muck limit the speed of drifting or interfere with the drilling cycle.

The steel plates used for the slick-sheet sidings were ¼x48x140 in. The siding some distance from the face was 48 to 60 ft. long; directly opposite it were ¼x22x140-in. sheets, resting on planks down the center of the track, and also flush with the rail heads.

Track-Laying

After practically all the muck was cleaned out, the shovelers laid ties to grade as the tunnel advanced, thus facilitating the subsequent laying of the rails. A 25-



Sections and Plan of Arrangements at the Tunnel Heading

With the top machines in operation, the four lower-bar machinemen started mucking out to make room for the lower bar. They threw back to the slick sheet, from which the muckers loaded into the cars. It was usually possible to set the lower bar and finish drilling the lower holes by the time the top machines were finished, so that all of the machines were torn down together.

Routine of Mucking

While the machines were being placed in position, mucking began. The empty car was brought ahead and the track cleaned up to the slick sheet. Of the six muckers, four were shoveling continually and two resting. The average output of the force was 10 to 12 tons per hour. On a slick sheet beside the track, within 50 ft. of the face at all times, an empty car was kept. Whenever a car was loaded, the carman took it down the track and brought back the empty. There was thus only a fraction of a minute lost in changing cars. A few ft. false track was advanced over the ends of the rails as necessary, so that the cars were always next to the muck pile. When the advance permitted the insertion of a set of rails, the foreman and muckers did the work in 15 to 20 min., without disturbing the machinemen.

Blasting

On the completion of the round, shovelers, machinemen and everybody helped to tear down the machines and bars. Then ¼x36x140-in. slick sheets were spread out for 30 ft. back from the face and covered with a little muck. These sheets were handled with grappling hooks through holes in each corner. When the machines were removed, an air hose was attached to a blow pipe and the holes cleaned. The shift boss, machinemen and foreman then did the loading. Double fuse was used on the lifters. The explosives were Bear Brand fuse, California 8X caps and Hercules E. L. F. extra 60% powder. Spitting the fuses completed the cycle. There is no re-

lation whatever between the shift and the drilling cycle, the machinemen relieving each other without stopping drilling.

Time Schedule

Beginning with the time the last hole was heard to explode, the average time schedule for the last five months' operations would be about as follows:

Operations	Time Consumed Min.
Returning to face	4
Setting top bar	5
Mounting and starting up two machines	3
Shoveling back for bottom bar	30
Drilling 20 to 25 holes	210
Tearing down machines	5
Blowing out holes	4
Loading holes	6
Cutting and spitting fuses	2
Interval to report of first hole	4
Interval from report of first hole to report of last hole	3
Total	4 hr. 37 min.

The Round

In drilling the round the standard center cut, generally with six holes, was used; these cut holes varied from 7½ to 8 ft. The side holes and lifters, which averaged 5½ ft., were put in to suit the ground. Variations in the nature of the information necessitated a good deal of variation in the layout of the holes. A good many relievers and "kickers" were frequently necessary. The usual round required 21 to 23 holes, although at times 29 were necessary. For a 22-hole round the total footage was about 140; the average rate of drilling dry holes was 6 ft. per hr., of drilling wet holes, 7 to 10 ft. per hr.; the average time for a complete round was 3½ to 5 hr.; the average advance per round was about 4 ft.

Tramming

The muck from the face was hand-trammed at first, subsequently a storage-battery locomotive was used, transporting material, men and waste rock. This was a 4-ton Jeffrey machine, equipped with 63 Edison, A-8, nickel-steel cells. The cells were charged from a 14-kw. motor-generator set, consisting of a 20-hp., 400-volt, alternating-current motor, direct-connected to a 125-volt, compound-wound, direct-current generator. The Matheson side-dumping roller-bearing cars had a capacity of 30 cu.ft.; they were made by the Joshua Hendy Iron Works, of San Francisco. Drill steel and miscellaneous material were handled principally on small flat cars. The 30-ft. capacity cars were the largest that could be used on the slick-sheet sidings. They were loaded heaping full, since when loaded they did not require to be derailed. The track gage was 24 in., the widest for which the side-dump cars could be built and allow the loaded car on the track to pass the empty on the siding.

At the beginning of operations, the locomotive hauled but 12 cars in a train, but as the length of the tunnel increased, it became necessary eventually to handle trains of 30 cars. The material was used for fills on the surface railroad between the tunnel portal and the mill site, the filling being dumped from temporary trestles constructed for the purpose. One motorman and one brakeman handled and dumped the trains.

Pipe, Track and Wiring

The ventilating pipe was carried on 4x6-in. vertical posts spaced 15 ft. It was kept close to the face and protected by a bulkhead of ties. A compressed-air line was carried along the bottom on 4x4-in. sills, which also supported the board walk; the end of this pipe was protected by the same bulkhead. The main line was always thus within a hose length of the face. An extra manifold was kept on hand and when it was necessary to extend the pipe line, this manifold was attached to the new length of pipe before the latter was put on; this considerably facilitated the operation.

The rails used were 50-lb. and were laid on 6x8-in. by 6-ft. ties. When the track is widened to its permanent gage of 36 in., one rail only will be moved.

TABLE I. COMPARATIVE DATA ON AMERICAN AND EUROPEAN TUNNEL DRIVING RECORDS

Name of Tunnel	Size in Ft.	Character of Rock	Progress for Entire Length: Average Monthly Advance in Ft.	Progress for Entire Length: During Months	Progress over Long Periods: Average Monthly Advance in Ft.	Progress over Long Periods: During Months	Best Monthly Record, in Ft.	Authority
Sheep Creek	8x10	Greenstone and slate	544.2	16	596	6	661	
Loetschberg, Switzerland	6x10½	Limestone and gneiss	490	54	683	18	1013	Trans. A. I. M. E., 1911
Simplon, Switzerland	6½x9½	Schist	....	..	....	..	685	E. & M. J., July, 1913
Arlberg, Switzerland	8½x9½	Gneiss	474	36	....	..	641	Prelini "Tunneling"
Tauern, Austria	....	....	....	..	525	11	548	Engineering News
Laramie-Poudre	7½x9½	Granite	473	19	525	12	653	Trans. A. S. C. E., 1912
Strawberry, Utah	9x11	Limestone	....	..	426	11	492	E. & M. J., June 10, 1911
St. Louis Waterworks	10 ft. diam.	Limestone	439	5¼	....	..	745	Comp. Air, June, 1914
Arizona Copper Co.	8x8	Porphyry	....	..	669	3	799	E. & M. J., Aug., 1912
Rawley, Colo	7x8	....	....	..	358	17.4	....	E. & M. J., Feb. 1, 1913
Mammoth, Calif.	8½x9½	....	....	..	316	9½	395	E. & M. J., Dec. 21, 1912
Roosevelt, Colo.	6x10	....	....	..	292	12	435	Mines and Minerals
Mt. Royal, Montreal	8x12	Limestone	....	..	....	..	810	E. & M. J., July 26, 1913
Gunnison	6x10½	Soft limestone	....	..	....	..	824	E. & M. J., July 26, 1913
Los Angeles Aqueduct	12x13	Black shale	....	..	....	..	604	Mines and Minerals
Los Angeles Aqueduct	12x13	Cemented sand	....	..	....	..	1061	Mines and Mineral

Six wires were carried the length of the tunnel; three of these were used for the single-phase, 110-volt lighting system, the purpose of the third wire being to give equal voltage at all points in the tunnel. The other three wires constituted the three-phase, 440-volt alternating circuit for the ventilating-fan motors.

Speed of Advance

Drilling was started November, 1912, but the work was not considered as completely organized until December, 1912. Between Dec. 1, 1912, and April 1, 1914, a period of 16 months, the tunnel was advanced 8707 ft. with a single heading, an average of 544.2 ft. per month. During the last six months, the average monthly advance was 596 ft. The greatest monthly advance was 661 ft. made in November, 1913. At various times advances of 24 ft. per day were made. It is believed that this constitutes the world's record for sustained progress in extremely hard rock with an 8x10-ft. tunnel section. Monthly records have been made considerably in excess of 661 ft., but we know of no record which equals the average advance of 544.2 ft. over the entire period of operation covering 16 months and of no American record which equals that of 596 ft. maintained for six months. Tables I and II present data covering this point.

TABLE II. COMPARATIVE DATA ON SHEEP CREEK AND LOETSCHBERG TUNNELS

	Sheep Creek	Loetschberg	Ratio
Size of tunnel, ft.	8x10	6x10½	
Area of cross-section, sq.ft.	80	63.5	1.26 : 1
Best monthly record, ft.	661	1013	1 : 1.53
Record on entire length, ft.	544.2	490	1.1 : 1
Average progress per round, ft.	4	3.97	
Average length holes, ft.	6.37	4.54	1.4 : 1
Number of holes per round	22	13.4	1.64 : 1
Total footage holes per round	140	61.3	2.28 : 1
Drilling time per round, hr.	1.58	4	1 : 2.53
Drilling time per ft. of hole, min.	1.72	1.55	1.1 : 1
Entire duration one round, hr.	5.3	4.48	1.18 : 1
Strength of dynamite used	60%	85%	
Pounds used per ft. advance	34	15.5	
Number of drills used	4	4	
Support for drills	Horizontal bars	Carriage	

The data on the Loetschberg tunnel are based on a paper "Tunnel Driving in the Alps," by W. L. Saunders, A. I. M. E. Trans., 1911. Detailed data are given only for a period from January, 1908 to July, 1910. The tunnel was started Oct. 1, 1906 and finished Mar. 31, 1911. The details given would probably be slightly modified if a complete record were available. The record of 1013 ft. was made subsequent to July 1, 1910.

Wages and Bonus

On account of the peculiar shift arrangement, the men were paid by the hour, and in addition a bonus was distributed. The wages were as follows:

Machinemen, muckers and carmen	$0.50
Shift bosses	0.58
Blacksmith	0.60
Tool sharpeners	0.50
Tool-sharpener helpers	0.40
Blacksmith helpers	0.35
Compressor men	0.40
Electricians	0.50
Timekeepers	0.45
Carpenters	0.60

A bonus was paid as follows: For 300 ft. per month or under, no bonus; for 300 to 350 ft. per month, $7 per ft. for the 50 ft.; for 350 to 400 ft. per month, $8 per ft. for the 50 ft.; for 400 to 450 ft. per month, $9 per ft. for the 50 ft. This increased $1 per ft. for every additional 50 ft.

The foreman distributed the bonus according to his judgment. It was his practice to give the lower-bar machinemen $30 a month bonus, independent of the total amount received. The muckers, carmen and motormen each received $10 to $15 per month bonus at the foreman's discretion. The tool sharpeners received $45 per month bonus. The amounts noted above were deducted from the total bonus of any one month and the remainder divided equally among the top-bar machinemen and the shift bosses. His idea was to give the greatest reward and the greatest incentive to the men chiefly responsible for the rate of progress. The result was thoroughly satisfactory.

Necessity for High Speed

The development of the Alaska Gastineau property involves the expenditure of an extremely large sum. It consists of several different elements, and economy requires that these be completed as nearly as possible at the same time. Driving the tunnel was the work which involved the greatest number of contingencies and unknown factors. It was, therefore, imperative that it be completed in time, and for this reason the high speed of driving was aimed at. More important, however, was the fact that by pushing the tunnel through rapidly, it became available for development work by raises which otherwise would have had to be done by sinking, and the raising cost is only about one-third of the sinking. The tunnel was also made available for handling a considerable amount of muck, 300 tons, which otherwise would have required hoisting to the Alexander level and dumping on a hillside where room was limited. There is no doubt but that the tunnel could have been driven more slowly at a lower cost per foot, but the indirect economies mentioned would not have been obtained.

Costs

The following cost data apply to the 8707 ft. driven between Dec. 1, 1912, and April 1, 1914, this representing the distance driven under the standard conditions described:

Wages	$14.72
Bonus	4.14
Explosives	4.47
Lighting	0.28
Tool replacement	1.35
Lumber and miscellaneous supplies	0.75
Store expense and transportation	0.38
Power and compressed air	2.53
Loss on boarding house	1.17
Depreciation on mining tools	1.29
Total	$31.08

A $1 charge per man per day for board did not cover the cost, inasmuch as the food was of high class and expenses of transportation and help were excessive. Nearly all the men ate four meals per day. Under "power and compressed air" is concluded the operating expense of furnishing the compressed air and of ventilating. The labor of installing pipes is included, but not the cost of the pipes themselves, since this became permanent equipment.

Survey for Connection

The survey for the tunnel connection was a rather elaborate affair. The triangulation system was worked out with the principal base lines on the shore of Gastineau Channel, and check base lines adjacent to the Sheep Creek portal and the Alexander-crosscut portal. The base lines and the angles were measured with extreme care and adjusted by the method of least squares. The stations used for the connection were about 12,000 ft. distant from each other horizontally and 700 ft. vertically. The range of mountains between rose 2500 to 3500 ft. higher than the tunnel portals. The traverse was carried 2400 ft. through the Alexander crosscut to the shaft, involving four angle points. This traverse was closed to a plumb-line down the shaft from the surface, the plumb-line being located from the triangulation point near the shaft collar. The check was within 0.2 ft.

The line was carried down the shaft from the Alexander level 620 ft. by means of double-wire plumbing. The base was about 12 ft. Piano wire was used and 10-lb. weights in the form of crosses. During plumbing, hoisting in the shaft was suspended. With this base the probable error in azimuth was at least 1 min. From the bottom of the shaft the traverse was carried 400 ft. to the connection with the Sheep Creek tunnel. This involved three set-ups with a probable error of 52 sec. The traverse from the Sheep Creek side through the tunnel was 10,400 ft. long and involved 25 sets-ups. The angles were repeated six times, the last three times with the telescope plunged. Each angle was measured thus twice, and the mean of the readings taken. Two complete traverses were run and the resulting probable error was 7.25 sec. The tape used had been standardized against the tape used for the triangulation base lines and corrections for pull and temperature were applied. The probable error of linear measurements was 0.006 ft. Elevations were carried by wye-leveling along the wagon roads from the Alexander crosscut to the Sheep Creek portal. The distance covered was a little over 12 miles.

Double turning points were used throughout and fore and back sights kept nearly equal. The rod used was standardized and two complete lines of levels were run.

When the connection was made between the Sheep Creek tunnel and the crosscuts in the shaft, the error of closure was 0.675 ft., or 1 in 37,000. The error in levels was 0.114 ft., or one in 570,000.

It is believed that the excellent results obtained in driving this tunnel were due to the following factors: (1) The energy and skill of the foreman, P. H. O'Neill; (2) the bonus system; (3) efficient ventilation; (4) the elimination of switches in the tramming system; (5) the excellent equipment and the large supply of spare parts kept on hand.

Dry Washing for Gold

By Hugo W. Miller*

It is well known by many mining men of this country that Sonora and the west coast of Mexico have produced a great deal of gold. Having been for some time at the gateway to this mining region, and having some idea of what it produces under the worst possible conditions, I can predict nothing but a boom for it when the troubles are settled, and the country is again under development.

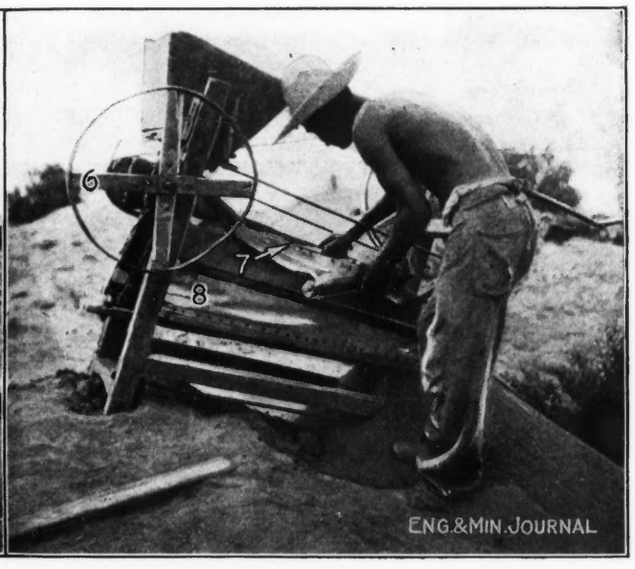
The two photographs shown here will give a good idea of the method employed by the natives in recovering the gold from the gravels in the Altar, as well as other districts of Sonora. In this case, an old dump is being worked over.

The Altar gold occurs in ancient river beds. The bedrock in most places is about 60 ft. below the present surface. The ore or gravel immediately above the bedrock is followed by underground-mining methods. Timbering is in most cases unnecessary. It is called a cement rock, and consists of gravel and fragments of granite, schists, diorite, limestones, and porphyries, of different sizes which have been cemented into a hard mass by a red silt, and calcareous salts. The ground is drilled and shot as in lode mining. The ore is drawn out and screened, the fines are scattered in the sun to dry and the coarse laid aside on a dump to weather. On weathering, the cement seems to disintegrate, thereby in time freeing more gold which can be recovered by more screening and dry washing. Where the American has taken charge of properties, however, the Quenner machine has been installed to break up the cement just after it is hoisted, hence freeing most of the gold the first time and leaving the naked barren pebbles to be worked by the natives.

In Fig. 1 is shown the native; (1) screening the dump. One of his boys, with a rawhide bucket (2) carries these fines and dumps them into the hopper (3), while still another turns the handle of the machine which furnishes the power necessary.

The ore runs over a stationary table (4) covered with a tightly stretched muslin cloth which is porous enough to permit the passage, uniformly, of air through the surface of the table. In the other picture will be seen the riffles or strips of wood (7), which stop the heavier gold on its downward passage over the table. The air is furnished by a large bellows (8) driven by a crank in the back of the machine under the hopper. The wheel (6) serves to balance the drive pulley and acts as a sort of a flywheel.

Fig. 1. Working Old Dump with Dry Washer



Cleaning Up Gold from Dry Washer

The gusts of air made by the bellows, cause the lighter gangue on the table to fly up, and the inclination of the table causes it to work forward, but the gold which is too heavy to be lifted by the air moves down the table till it lodges against one of the riffles (7). After all the fines are run through the washer, the side board is removed, and the concentrates brushed off. These concentrates consist of magnetite, garnet, black sands, and gold dust and nuggets. The gold is separated from these impurities by dry panning in the ordinary gold pan. The fineness of the melted gold bars varies from about 850 to 930. In some of the old mining camps these mines and dumps have been worked for over thirty years. At one place I stopped where an American was in charge, and out of about five tons of fines screened out of a dump which had been worked over three times before, a recovery was made of about 3 oz. fine gold.

*Mining engineer, Nogales, Ariz.

Details of Practical Mining

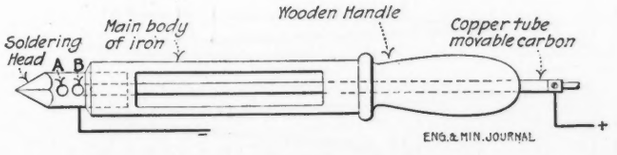
Electric Soldering Iron

By Frederick W. Foote*

I saw recently at Castle Gate, Utah, a simple and efficient electric soldering iron. It was made there in the shops by G. P. Curry, assistant electrician.

Essentially, it is an electric arc in a soldering head. This gives sufficient heat; in fact, the current has to be shut off at intervals to prevent burning. The iron in use was operated at 60 volts and consumed about 10 amp. This with power at 1¼c. per kw.-hr. amounts to ¾c. per hr., which is not excessive.

Referring to the drawing, the soldering head, square in section, has two ⅜-in. holes drilled into it. The hole *A* goes all the way through and is used to hold a ⅜-in. carbon rod connected to the positive terminal of the source of power. The second hole *B* goes to the center where it connected at right angles to a ⅝-in. hole containing the other carbon, an air gap being left.



Soldering Iron Heated by Electric Arc

The hole *B* acts as a ventilator to supply air to the gap, increasing the efficiency. The main body of the iron is a piece of circular steel tubing to which the head is riveted. Slots are cut in the sides, as shown, to facilitate the manipulation of the movable carbon. This is insulated by means of a band of mica at the junction, so as not to heat the wooden handle. A ½-in. hole drilled through the handle allows the insertion of a copper tube in which the movable carbon is placed. The electrical connections are made at the head and the copper tube as shown.

The spark gap is regulated by shoving the carbon in and out in its copper casing. The dimensions depend on the size of head used. The drawing shows approximately the proper proportions.

Gold Dredge Stacker Motor†

The stacker motor on a gold dredge is subject to severe duty, owing to the fact that the motor is usually at the far end of the stacker and therefore exposed to the weather, and also when the loaded stacker has been at rest, considerable torque is required to start it.

In cold climates, a stacker when at rest is often apt to freeze, due to moisture contained in the waste being carried by it. Starting under these conditions is particularly arduous for the motor and in some places this trouble is overcome by putting the stacker in a continuous canvas tent or tunnel, and passing steam pipes up inside this tent, steam being provided by a small low-pressure heating boiler. But this again makes life hard for the motor, because moisture vaporized by the heat of the steam pipes rises to the far end of the stacker where the motor is placed, and often condenses there on the motor whenever that machine is shut down and allowed to cool. Accordingly, a motor for stacker service should be designed with adequate insulation to resist continuous moisture and in some cases drip guards have advantageously been placed over the ventilating opening in the motor.

Squirrel-cage motors with heavy-torque characteristics have been used successfully for stacker drives, but the general tendency is to use motors with phase-wound rotors in order to obtain a good starting torque. Whether the complications of a phase-wound motor are justifiable is a question, says Girard B. Rosenblatt, who expresses a preference for a squirrel-cage motor designed for good torque characteristics, with possibly a trifle more resistance in the secondary circuit than is found in standard squirrel-cage induction motors. A stacker motor is relatively small, as compared with the total motor installation on the dredge, and a slight loss in efficiency on such a small unit, is more than offset by a saving in the maintenance.

New Stadia Method

A real novelty in stadia methods, according to Engineering News, has been brought out by J. Zwicky, of St. Gallen, Switzerland. Instead of using two horizontal crosswires in the telescope reticule as stadia interval, he forms a horizontal stadia interval by using two telescopes whose horizontal axes make a small angle with each other. In the instrument as practically constructed, one of the telescopes is mounted immediately above the other, and a link connection causes the two telescopes to rotate together vertically. Since both telescopes revolve in vertical planes, the intercept which they cut off on a horizontally held stadia rod is proportional to the horizontal distance between instrument and rod, instead of being proportional to the slope distance (as with upright rod held normal to the line of sight, or with horizontal rod and ordinary stadia wires), or proportional to a function of the slope distance (as with ordinary vertical stadia rod).

The two prime advantages of this instrument and stadia method are claimed to be: (1) The possibility of using a much smaller stadia ratio than 100, thus permitting the attainment of much greater accuracy on ordinary lengths of sight; (2) the elimination of all calculations to get horizontal distances. The former advantage permits of getting a precision of better than 1:1000. In a survey of an 80-acre tract, where all measurements (except those in woodland, where the tape was used) were made by this stadia method (with interval 1:20), a precision of about 1 in 3000 was obtained.

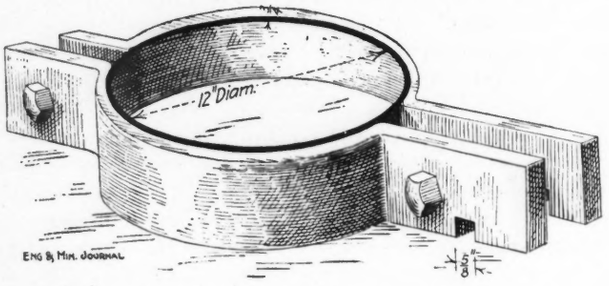
Holding the rod in horizontal position needs two rodmen instead of one, which is a disadvantage. To elimin-

*Britannia Beach, B. C.
†Proc., A. I. E. E., August, 1914.

ate calculation for obtaining elevations also, a reduction chart is attached to the side of the transit standards and a pointer fixed to the horizontal axis of rotation moves over this chart as the telescope is revolved. The inventor describes the new method and instrument in the *Schweizerische Bauzeitung,* of Sept. 5, 1914.

Ventilating and Counterweight Pipe*

In sinking the Palms shaft of the Newport Mining Co., two birds were killed with one stone in an ingenious manner. A 12-in. pipe connected to a 7½-hp. electric fan was used for ventilating and then left in the shaft to serve as a guide-way for the cage counterweight. The pipe extended to within 15 or 25 ft. of the bottom of the shaft, and was used to exhaust the smoke and gases after blasting. The joints were flanged; to lower a section of pipe the bucket was removed from the hoisting rope, eye-bolts were inserted in three of the flange holes, and rods connected these bolts to a ring in the clevis at the end of the hoisting rope. At the end of the 12-in. line already in place, two chain blocks were hung, and by means of two ¾-in. wire rope slings the section of pipe was taken from the hoisting rope and placed in the proper position for connection with the 12-in. line.



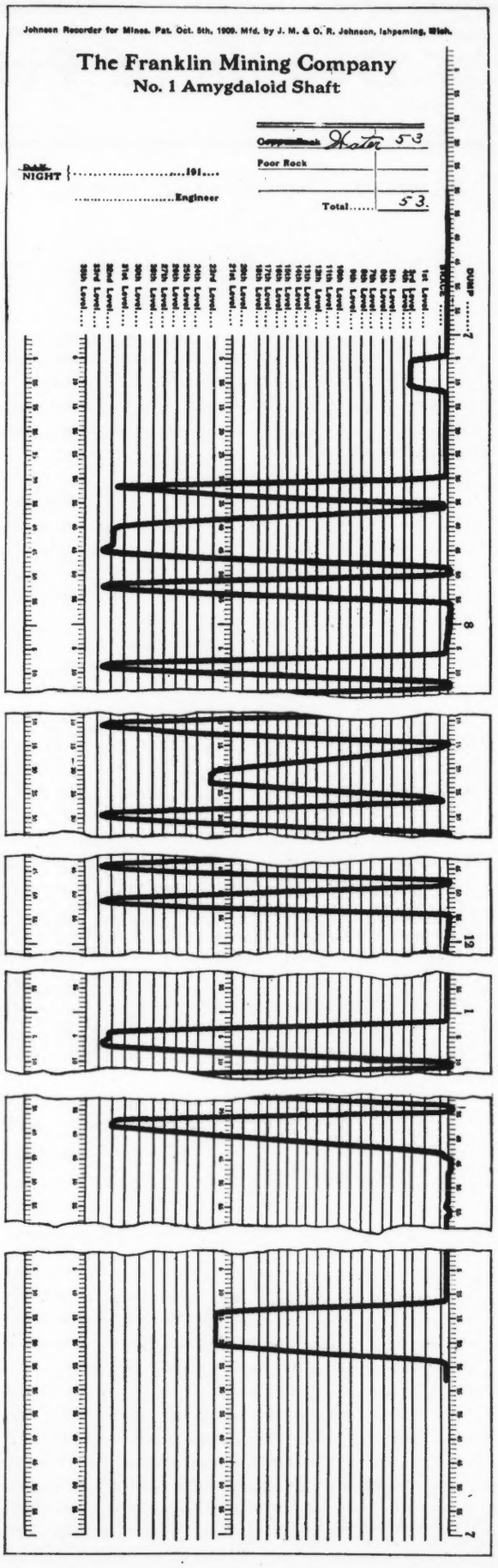
PIPE HANGER TO CATCH OVER FLANGE OF STEEL SHAFT SETS

To support this pipe in the shaft, the clamps shown in the accompanying illustration were used. The slots in one end engaged the flange of the H-section steel members, which formed the shaft sets. Every alternate one of these rested upon a wall plate, and the others upon dividers.

Automatic Skip Recorder

The Franklin Mining Co., in the Lake Superior copper district, is using on its hoist at the Franklin Jr. mine an automatic recording device which provides a permanent record, on paper, of every movement of the skip during a 12-hr. period. The mechanism is comparatively simple. Two drums are mounted on vertical spindles, about 12 in. apart, and these drums contain a paper chart. The paper travels from right to left, the left-hand drum being driven by clockwork. The chart is divided longitudinally according to hours and minutes, from 6 a.m. to 7 p.m., or *vice versa.* A vertical arm, bearing an ink pen, containing red ink, registers both horizontal and vertical lines on this chart, and receives its motion through a chain sprocket and gears from the

*An excerpt from an article presented before the Ishpeming meeting of the Lake Superior Mining Institute, Aug. 31, 1914.



SAMPLE OF GRAPHIC RECORD OBTAINED. THE BREAKS REPRESENT A SERIES OF UNIFORM CURVES, SHOWING UNINTERRUPTED HOISTING

countershaft of the hoist. There is also a lower arm on the machine which can be connected to the electric-signal system and to operate a pencil vertically across the lower line of figures on the chart, and thus show the time at which any signals are rung. In the particular case of the Franklin Mining Co., this part of the machine was not satisfactory, because the electric signals are given so fast that the clockwork is not rapid enough to record them.

The other part of the device is giving entire satisfaction at this mine. Before it was installed, there was no way of checking conflicting statements of the hoisting engineer and the men underground, in disputes arising as to the position of the skip at any time. In cases where hoisting was held up, the underground dumpers would be likely to say that they could not get the skip, which was lying idle at some level above or below them. The engineer, on the other hand, would claim that the signals were not rung and that there was nothing wrong with the skip. With this recorder in operation, it is impossible for any such dispute to arise. The chart shows exactly where the skip was at any hour or minute of the day and how long it took to make any trip; the speed of hoisting or lowering can be computed from the figures, since the vertical divisions on the chart show the positions of the various levels in the mine. The only attention the recorder needs is the filling of the pen with ink every day and the occasional oiling of the parts. The engineers like the device because it places the responsibility where it belongs. The charts are removed daily and filed in the office of the superintendent, where they are kept for several months. The recorder is the invention of J. M. & O. R. Johnson, Ishpeming, Mich., by whom it is sold, together with the chart blanks.

Cut and Fill Stoping at the Copper Queen*

In certain portions of the Copper Queen mine at Bisbee, Ariz., notably in the Holbrook, Spray and Gardner divisions, some cut-and-fill stopes have been opened. This system of mining is, of course, applicable only in hard ground, and these stopes are exclusively in sulphide ores. The experiments have to date proved successful, and have materially decreased the mining cost, as compared to the square-set method; it is believed that this system should be worked wherever the conditions are suitable. The method in vogue is somewhat as follows:

The orebody is prospected as far as possible in advance, and the side and vertical dimensions of the ore determined. Drifts are driven where possible under the bottom of the ore and raises put through the ore to the level above to permit the dumping of filling. Chambers are then cut out, drifts formed either by cribs or sets of timber, the back blasted down, raises cribbed up at convenient points, and filling dumped in, upon which the men may work and at all times be kept close to the back. Wherever possible, the stope is worked on an angle of about 45°, so that the broken ore may slide down upon a plank bed laid upon the filling to the chutes. This materially reduces the cost of getting the ore into chutes, and is very desirable wherever it is possible to use it. Prospecting can be done from any elevation, as the stope is worked up to that point, and the filling easily and cheaply disposed of. Wherever it is possible to work them upon an angle of 45°, little timber is needed. Wherever a stope cannot be worked upon the slope and where the backs are carried horizontal, it is often necessary to put up temporary supports by cribbing and blocking up the back to make the stope safe while the ore is being extracted.

One absolute necessity is that the men be watched closely and taught to bar down the backs, taking care before they commence drilling operations that all loose or unsafe ground is taken down. Perhaps the method is

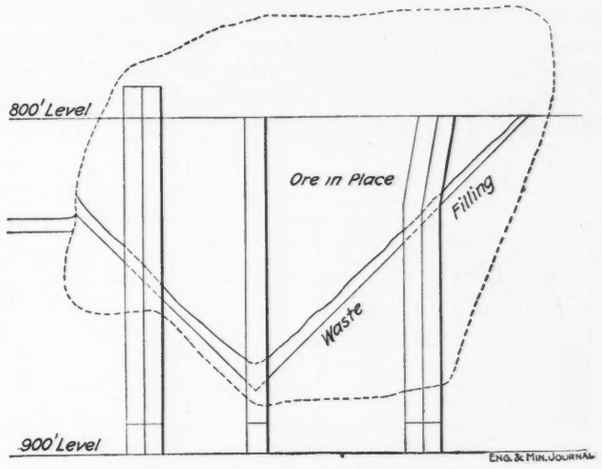


FIG. 1. READY FOR NEW CUT

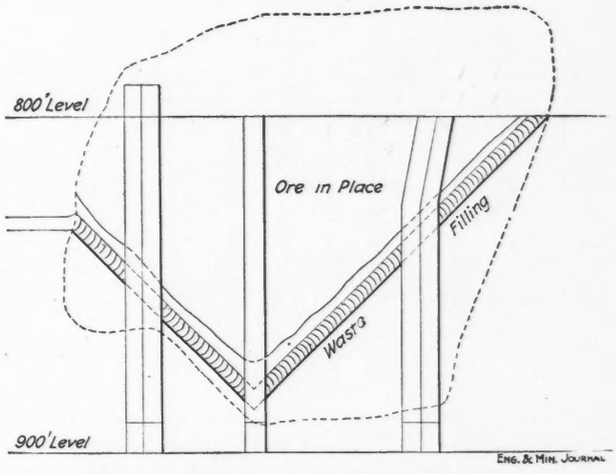


FIG. 2. NEW LAYER OF FILLING RUN-IN

at a disadvantage where ore is intersected by stringers or bunches of waste; but, if care is taken, this waste can always be blasted down or put in the gob and the ore mined clean.

Referring to Fig. 1, starting at the top of the slope, water holes are drilled and a section of ground about 8 ft. thick and 20 ft. wide is blasted down. The drilling is done in this way wherever it is possible in order to keep the back solid. Fig. 2 shows that the ore has been removed, waste filling has been run in and floored over, and the stope put again in the condition as shown in the other figure.

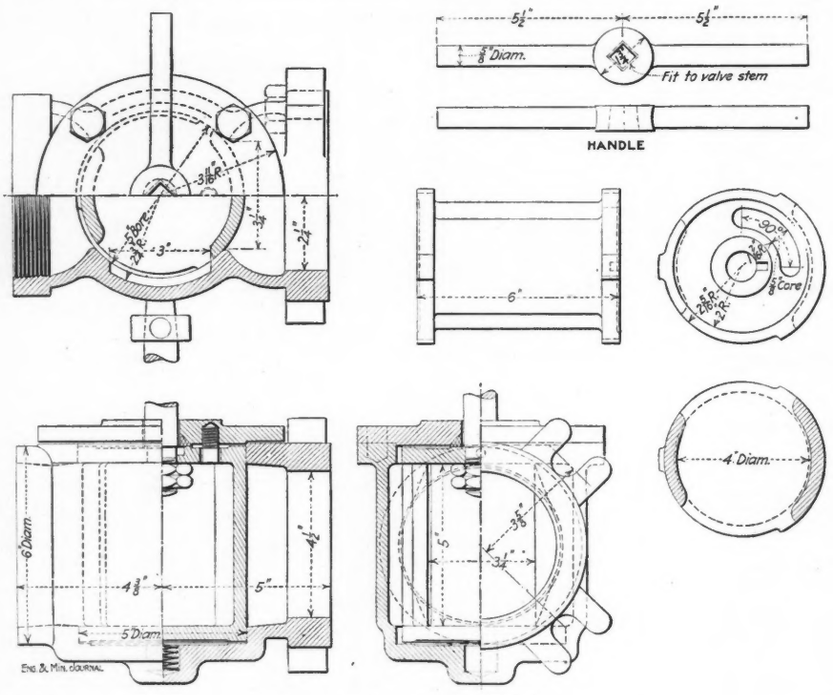
[While the term "cut and fill" is applicable to this mining system, it is more commonly used for cases in which the back of the ore and the top of the fill are kept approximately horizontal—EDITOR.]

*From the A. I. M. E. "Bulletin," August, 1914.

Details of Milling and Smelting

A Stop-Cock Tuyere Valve

In many parts of the country, the tuyere valves used on blast furnaces are of the gate-valve type, but in the Southwest, particularly at the Copper Queen and associated properties, a stop-cock or corliss type of valve is used. This type of tuyere valve, we understand, originated at the Copper Queen works and proved so satisfactory there that it was adopted by the Detroit Copper Mining Co., through whose courtesy the accompanying drawings are reproduced. The valve works more easily than the gate-valve type and may be closed air tight. It has a slotted flange on one end, so that by simply loosening the holding bolts, the tuyere pipe may be quickly removed to facilitate repairs or change of jackets.



STOP-COCK TUYERE VALVE

Leaching Zinc Ores

The difficulties in the way of leaching zinc ores with sulphuric acid or ferric sulphate have long been recognized. Such solutions must be freed from iron, a difficult and often expensive process, while there is usually a considerable amount of zinc left undissolved in the ore.

Anson G. Betts proposes to get around this difficulty (U. S. pat. 1,066,245) by adding a small quantity of a peroxidizing chemical stronger in its action than ferric sulphate to a dilute sulphuric-acid solution. A chromate or chromic acid, or a permanganate or permanganic acid, is suitable. He says: "I am not able to offer any chemical explanation of the action of the oxidizing agent in preventing the solution of the iron in the ore, but can only state that it accomplishes the desired result, even in the presence of an excess of sulphuric acid."

Fettling Practice at North American Smelting Works

The fettling of reverberatory furnaces has undergone a marked change in the last eight or ten years. This is well illustrated in the table on the opposite page, which has been compiled from replies received from officials of the leading smelting works in North America that use reverberatory furnaces. The table presents in concise form much interesting data regarding the reverberatory furnaces of the country, but the most striking feature is the diversity in fettling practice between the older and newer plants. Most of the newer works fettle the furnaces through the roof, while the older plants throw the fettling in through the side doors. The older works still use for the most part quartz or other high-silica material, and naturally use this fettling as sparingly as possible. The newer plants, on the other hand, drop almost any material on the sidewalls and in large quantities, the idea being that the sidewalls will be protected if a sufficient amount of cold materials be dropped thereon. It should be remarked, however, that most of the plants that fettle through the roof use ores or products containing sulphur, some carrying the revolution so far as to use raw concentrates, or converter slag or matte cleanings—materials that a few years ago would have seemed absolutely heretical.

When the fettling is dropped through the roof on the side walls in great quantities, some of it naturally floated out into the furnace, and after some experimentation it was found that raw ore, floating off with the slag, during skimming, was increasing the metal loss; this led to the use of siliceous ores containing copper as sulphide, in which form it would be readily removed by the heat of the furnace. This practice has been carried still farther by the use of ores carrying as much as 15% sulphur as at Douglas, and also by the use of raw concentrates, as at Cananea and elsewhere, confirming the hypothesis that a large quantity of cold materials was what was needed to protect the side walls.

It should be borne in mind in consulting the table that much of the data is approximate and subject to the personal equation of the official answering the series of

Fettling Practice at Important North American Smelting Works

Works at	Coppercliff, Ont.	Great Falls, Mont.	Anaconda, Mont.	Tooele, Utah	Garfield, Utah	McGill, Nev.	Humboldt, Ariz.	Clifton, Ariz.	Douglas, Ariz., C. & A. Wks.	Douglas, Ariz., C. Q. Wks.	Hayden, Ariz.	El Paso, Texas	Cananea, Mex.
Size of reverberatory furnace	19x112 ft.	15 ft. 9 in. x 42 ft.	19x110 ft.	19x102 ft.	20 ft. 4 in. x 123 ft. 5 in.	18 ft. 9 in. x 131 ft. 9 in.	19x60 ft.	22x100 ft.	19x100 ft.	19x91½ ft.	19x112 ft.	19x100 ft.	19½x100 ft.
Kind of material smelted	Calcines, 80%, green ore and flue dust, 20%	Roasted conc. and flue dust	Roasted conc. and flue dust	Low-grade calcines	Roasted conc., flue dust and lime sand	Roasted conc., flue dust, converter secondaries and lime rock	Roasted conc., fine mine ore, raw conc., limerock and "cleanup"*g*	Roasted conc., siliceous ores and fluxes	Calcines and flue dust	Calcines, flue dust and raw ore	Roasted conc. and limerock	Roasted conc. and flue dust	Roasted conc. and flue dust
Present fettling materials	Green ore and calcines	Crushed sandstone	Crushed sandstone*e*	Siliceous ores and crushed silica*f*	Crushed quartz, siliceous tailings and siliceous ores	Siliceous sulphide conc. or mill slimes	Siliceous, 60% ores and mill slimes	Siliceous copper ores, and slag and matte*h*	Copper ores, carrying S, 1.7 to 23.8%; SiO_2, 29.2 to 70.9%	Copper Queen sulphur-bearing ores*m*	Conc. and converter slag	Siliceous ore	High-grade conc. and siliceous ore
How fettled	Dropped through roof	Thrown in	Thrown in*e*	Dropped through roof	Dropped through roof	Thrown in	Thrown in*i*	Dropped through roof	Dropped through roof	Dropped through roof	Fed through special side openings	Thrown in, except at bridge above which are fettling holes	Dropped through roof
Frequency of fettling	Continually	About every 10 days	Monthly	Every 2 to 4 hours	About every 5 days	Daily	Twice daily	Each shift as required	Practically continuously	Practically continuously	Practically continuously	Three times daily	Practically continuously
Tons of fettling used per furnace day	300*a*	2.8	1	8 - 10	5	27	About 5% of total charge	66	55	75	About 20% of total charge	About 6% of total charge	67*n*
Tons smelted exclusive of fettling	100 - 150*a*	200*b*	275	300	401	612	.....	260	290	225	.....	.....	159
Total tons smelted	400 - 450	203	276	310	406	639	125	326*j*	345*l*	300	.....	.....	226
Fuel	Pulverized coal	Gasc	Coal*e*	Coal	Oil*r*	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil
Fuel ratio*	1 : 6	1 : 2*d*	1 : 4.25	1 : 5	0.70 bbl.	0.58 bbl.	1.1 bbl.	0.837 bbl.*k*	0.8 bbl.*k*	0.9 bbl.	.....	.....	0.995 bbl.
SiO_2 in slag	33 - 35%	37.9%	39.68%	39.0%	43.5%	42.6%	42%	38.5%	.....	34.8%	.....	.....	39.8%
Any trouble with siliceous floaters	No	Occasionally	No	No	Some floaters but not enough to make trouble	No	No	Yes	No	No	Occasionally	Occasionally	.....
How often are side walls repaired	Not since starting 8 mo. ago		Once in 8 years	Eight or nine months	Eight months	Semiannually	Not yet rebuilt	When making general repairs	One repair in 8½ months	Eight to nine months	Six to nine months	About once a year; except door jambs which are repaired about every 6 weeks	Large repair about every six months; usually, one small repair during interim
Where is greatest wear in furnace	Roof	At bridge	Matte line near firebox	Arch and sides 20 to 30 ft. from bridge	In the 40 ft. nearest the firing end	In the 50 ft. nearest the firing end	Bridge and side walls, from six to 25 ft. from bridge	Under second charge hole, 20 ft. from burners	In first 30 ft. from the bridge wall	At firing end	In first 30 ft. from bridge	In first 30 ft. from bridge	First 40 ft. of arch and 20 ft. of side walls

Notes:

* Coal consumption expressed in ratio of tons of coal to tons of charge smelted; oil consumption expressed as barrels of oil per ton of charge smelted.

a About. Most of the tonnage smelted is charged through fettling hoppers; when over 25% is dropped from regular charge hoppers a good fuel ratio is not maintained.

b Exclusive of fettling and converter slag.

c Gas-fired furnaces now being replaced by direct fired furnaces.

d The coal used is a high-ash, high-sulphur bituminous coal of the following composition: H_2O, 7.9%; volatile matter, 23.8; fixed carbon 44.2; ash 24.1; sulphur, 4.5; B.t.u., 9310 per lb.

e Now changing to coal-dust firing, and fettling through roof with calcined concentrates and flue dust.

f Siliceous ores used for daily fettling; furnaces tapped down at intervals of one to two months and fettled with crushed silica.

g From 20 to 22 tons of cold charge fed daily.

h Average per furnace-day: ores, 18 tons; slag and matte, 48 tons.

i Furnace equipped for fettling through roof, which will be practiced when certain conveying devices are ready.

j Solid charge.

k Per ton of solid charge, and includes starting and stopping furnaces.

l Solid charge; in addition about 100 tons of liquid converter slag is poured into the furnace.

m Tonnage smelted increased from 230 to 300 tons when Bisbee sulphide ore (15.5% S) was substituted for 80% SiO_2 fettling.

n Average per furnace-day in 1913; conc., 64 tons; siliceous ore, 3 tons.

r Coal-dust firing being tried in one furnace.

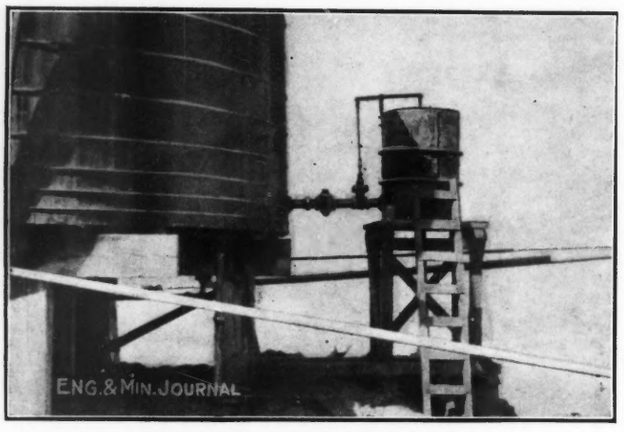
Situation of Works	Composition of Reverberatory Slags							Composition of Fettling Materials								
	Au Oz.	Ag Oz.	Cu %	SiO_2 %	FeO %	CaO %	Al_2O_3	Au Oz.	Ag Oz.	Cu %	SiO_2 %	Al_2O_3 %	Fe %	CaO %	S %	Zn %	Pb %
Coppercliff, Ont.	*nil*	*nil*	0.50*o*	33-35	51.4*p*	.....	.....	*nil*	*nil*	5.50*o*	25.0	.....	41.5	.....	7.0	.....	.....
Great Falls, Mont.	0.001	0.1	0.45	37.9	43.0	4.0	9.0	.....	.....	.....	95.0	1.8	0.7	1.1	.....	.....	.....
Anaconda, Mont.	0.0006	0.19	0.39	39.7	42.3	4.6	7.0	.....	.....	.....	97.5	1.7	0.1	0.2	.....	.....	.....
Tooele, Utah	0.005	0.40	0.35	39.0	46.9*b*	4.5	.....	0.40	20.00	0.40	75.0	.....	6.5	3.0	0.5	.....	1.5
Garfield, Utah	0.001	0.035	0.35	43.5	27.0	18.0	7.5	0.10	7.0	0.20	85.6	1.2	2.9	0.8	....	.....	0.4
McGill, Nev.	0.003	0.008	0.345	42.6	36.3	10.3	6.5	0.02	0.07	3.26	66.1	8.8	7.0	0.9	6.7	.....	.....
Humboldt, Ariz.	.....	.....	0.33	42	29.6*b*	15	.....	.....	.....	.....	60.0	.....	.....	.....	.....	.....	.....
Clifton, Ariz.	.....	.....	.....	38.5	42.4	5.1*c*	9.7	.....	.....	7.30	60 0	10.1	6.5	0.8*q*	2.1		Siliceous ores
								.....	.....	9.50	29.1	6.3	26.6	7.6*q*	4.5		Slag and matte
Douglas, Ariz., C.& A.	.....	.....	0.5	34	46	7	6	0.033	0.45	4.2	29.2	7.1	24.7	0.7	23.8		Sulphide ore
								0.004	0.36	5.4	29.5	12.4	22.7	3.2	1.7		Oxide ore
Douglas, Ariz., C.Q.	.....	0.10	0.487	34.8	43.1	1.9	8.6	0.107	5.00	3.0	70.9	6.6	6.3	1.5	3.6		Siliceous ore
								0.02	1.06	6.45	23.2	7.5	25.4	1.9	15.5		.....
Hayden, Ariz.	.....	.....	.....	.....	.....	.....	.....	.....	.....	18.0	26.0	5.0	22.0	.....	24.0		Concentrates
								.....	.....	1.5	23.0	4.0	51.0	1.0	1.5		Converter slag
El Paso, Tex.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	60.0	16.0	1.5	.....	3		.....
Cananea, Mex.	*nil*	0.12	0.48	39.8	37.5	4.5	10.4	0.013	2.1	37.81	16.0	4.7	14.0	0.5	22.4		Concentrates
								0.001	0.35	3.54	50.9	10.2	12.6	2.8	6.5		Ore

o Cu-Ni. *p* Reported as Fe; converted to FeO for comparison. *q* CaO-MgO

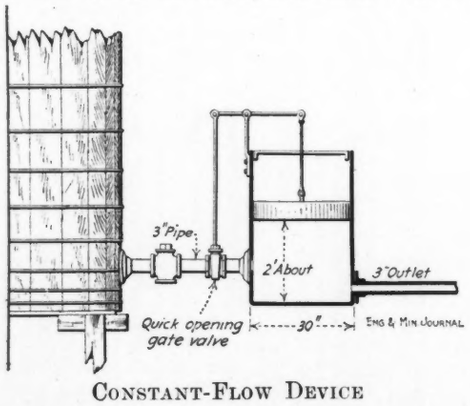
questions submitted. For example, in the matter of tonnage figures, it may readily be that one official is reporting the tonnage of his furnace under the best normal operating conditions, whereas another may have given the average tonnage actually smelted in a given month, thus including interruptions or accidents that invariably reduce the actual tonnage smelted below the average of the furnace under the best conditions. Hence the tonnages given should be merely regarded as approximate. In several instances officials went to the trouble to point out that molten converter slag was not included in tonnage reported. This is what would normally be expected, but it is not clear whether this is the case in every instance. The answers to the various questions have been inserted in the table in the original phraseology of the reporting official wherever that was consistent with a proper interpretation by comparison with other data submitted. The subsidiary table showing the analyses of the slags and of the fettling materials will be of interest, and some of the other incidental information will attract attention, particularly that touching on the practice in Montana, where some important changes are taking place.

Constant- Flow Arrangement

An arrangement for delivering a constant flow of solution has been installed at the Tom Reed mill, Oatman, Ariz., designed by S. S. Jones, superintendent. It consists of a float in an oil drum, connected with a quick-closing gate valve. Action is entirely automatic, and an even flow of solution is maintained at all times. The illustrations explain the device fully.



THE CONSTANT-FLOW DEVICE



CONSTANT-FLOW DEVICE

Fines On Blast Furnace Charge

The advantages of sintered ore for lead blast furnaces were discussed by Irving A. Palmer, in his paper before the Salt Lake meeting of the Ameriena Institute of Mining Engineers. One of the important advantages of sinter is its similarity in composition to the general average of the charge. He said that it was often held that the detrimental effects of fines on the blast-furnace charge were largely mechanical, such as decreasing the furnace speed, increasing the amount of flue dust made, and causing the formation of accretions and blowholes. As a matter of fact, one of the most serious objections to fines is that they cause irregularities in the formation of the slag and matte. The fines of the charge naturally precede the coarse material in getting to the lower part of the furnace. This is due both to the natural fall through the openings in the charge and to the jigging effect of the blast.

Irregularities are almost sure to occur when the fines of the charge differ greatly in composition from the rest of the mixture, as when lead carbonates and sulphides, raw-iron sulphides, and limonite ore are used as flux. Finely divided lead ore is particularly bad; much of it is imperfectly reduced and thus goes in part to the matte and slag. On the other hand, a portion of the lead-carbonate fines is reduced too soon, and the upward rush of the blast carries small particles of metal to the upper part of the furnace, when they again combine with oxygen or sulphur, forming accretions or going into the dust chamber. Shaft accretions always contains a large portion of lead sulphides even though the charge be almost free from galena.

At one of the Mexican smelting plants some years ago, the furnace charges were made up largely of coarse siliceous ores, coarse limerock and limy ores, and iron-lead carbonates containing a large percentage of fines. blast-furnace flue dust and raw lead concentrates and pyrite ores were frequently added. The charge, as a whole, was very open as is indicated by the low blast pressures for the given volume of air. The tonnage smelted was low and the lead losses high. The furnaces ran irregularly and there were continual crucible troubles. Fines of the lead and iron ores, the concentrates and the flue dust, drifting down through the charge, were the first to reach the fusion zone, thus destroying the adjustment of conditions necessary to good work. It was found that by crushing the lime ores and adding siliceous fines to the charge, a material improvement in results were effected.

At Pueblo, Colo., it was a common occurrence at one time for finely divided Cripple Creek ore to fall unfused into the slag. The fines were refractory and fed in large quantities. It should be stated that careful assay showed that the gold tellurides had been thoroughly leached out of the unsmelted ore.

The Jigging Action of the Blast when smelting in shaft furnaces is sometimes very noticeable, particularly when the blowing apparatus is being run at reduced speed, said Irving A. Palmer in his paper before the Salt Lake meeting of the American Institute of Mining Engineers. At one Mexican smelting plant, the first lead furnace was blown in with air supplied from a blower delivering 300 cu.ft. of air per revolution. As the blower was much too large for the particular furnace it was run below normal speed, causing the blast to be delivered in slow pulsations. The furnace charge descended so irregularly that a satisfactory slag could not be made, and the metal losses were high. When more furnaces were blown in and the speed of the blower increased, the furnace work rapidly improved and no further trouble was experienced with pulsations of the blast.

Company Reports

The Lucky Tiger

The report of the Lucky Tiger-Combination Gold Mining Co., the holding company of the Tiger Mining Co., El Tigre, Sonora, Mex., for 1913, shows an operating profit of $729,657 and a profit of $668,578, after charging off $61,079 for depreciation of plant and equipment. This profit was realized from the production of 69,460 tons of ore and 21,778 tons of dump tailings cyanided. Of the ore production 68,528 tons were milled and 932 tons shipped. The contents of the ore per ton were as follows, milling ore: 0.109 oz. Au, 28.4 oz. Ag, 0.05% Cu, and 0.23% Pb; shipping ore: 0.488 oz. Au, 285.16 oz. Ag, 2.32% Cu, 12.05% Pb; dump tailings: 0.079 oz. Au and 13.62 oz. Ag. The average gross value of the shipping ore was $196.90 per ton; of milling ore, $19.46; of all ore, $21.85; of dump tailings, $9.74; of ore and tailings treated about $19 per ton. The net profit, after charging depreciation of plant and equipment, was about $7.35 per ton of ore and tailings, indicating a total cost of $11.65 per ton treated and shipped, including losses. The cost of cyaniding 21,778 tons of dump tails was $3.631 per ton, and marketing bullion from tails 74.9c.; total cost of treating dump tails, $4.38 per ton. The cost of ore produced and treated, not including depreciation, was as follows:

COST OF PRODUCTION FROM ORE MINED, PER TON

Mining	$2.805
Development	0.592
Transporting ore to mill	0.092
Milling:	
Concentrating	1.031
Cyaniding current tailings	2.967
General expenses, including management, local taxes, etc.	0.602
Marketing ore and concentrates	2.741
Marketing bullion	0.823
Total	$11.653
Less sundry profits	1.011
Total cost per ton of ore mined	$10.642

The company paid $450,662 in dividends during the year, making a total of $2,054,472 to date. Total production to date amounts to 323,250 tons, of which 14,590 tons have been shipped to smelters. There were 28,907 tons of ore broken in stopes at the end of the year.

Le Roi No. 2

The report of the Le Roi No. 2, Rossland, B. C., for the year ended Sept. 30, 1913, shows that 51,625 tons of rock were handled, consisting of 19,023 tons of shipping ore, 16,530 tons of milling ore, 12,214 tons of waste to dumps and 3858 tons of waste placed in old workings. The total stoping cost per ton of ore was $3.57, made up as follows: Ore production, $1.22; ore sorting, 15c.; general expense, 43c.; power, 55c.; general mine expense, 55c.; diamond drilling, 67c. Ore-production expense, $1.22 per ton, consisting of labor, 78c.; explosives, 35c.; illuminants, 3c.; and sundries, 6c. per ton. Development work totaled 4633 ft., of which 3503 ft. were drifts, 628 ft. crosscuts, 482 ft. raises and 20 ft. winzes; the average cost of this work was $15.87 per ft. There were 79 diamond-drill holes drilled to an average depth of 190 ft. at an average cost of $1.60 per ft. The mill treated 16,530 tons of ore, averaging 0.12 oz. gold and 11.05 lb. of copper per ton, and produced 1595 tons of concentrates, averaging 0.818 oz. gold, 0.635 oz. silver and 18.1 lb. of copper per ton. The cost per ton treated was $1.09. Smelting charges amounted to $6.38 per ton of concentrates. The shipping ore averaged $19.60 per ton and smelting charges were $6.07 per ton. Depreciation of plants and machinery amounted to $2.84 per ton.

Butte & Superior

An analysis of the Butte & Superior Copper Co.'s 1913 report shows a net gain in quick assets amounting to $184,177.53; of this $3375 came from the sale of capital stock and the remainder from operating receipts. The following tabulation will explain the financial statements contained in the report:

1912 balance of quick assets		$608,592.26
1913 balance of quick assets		792,769.79
Net gain in quick assets during 1913		$184,177.53
Receipts for 1913:		
	Total	Per Ton Treated
From sale of concentrates	$3,013,736.74	$10.149
From sale of residues and concentrates	512,924.15	1.727
Total	$3,526,660.89	$11.876
Less freight and ore penalties	850,007.99	2.862
Receipts above freight and ore penalties	$2,676,652.90	$9.014
Operating costs:		
Mining, 293,706 tons	$918,868.15	3.094
Milling, 296,940 tons	799,878.87	2.693
Other charges	20,111.41	0.069
Total operating costs	1,738,858.43	$5.856
Operating profit	$937,794.47	$3.158
Other income	5,193.81	
Total income as shown in report		$942,988.28
Less apparent adjustment as shown by undivided profits account but not explained in report		771.28
Amount charged to undivided profits		$942,217.00
Less other expenditures:		
For mining claims	$824.45	
Plant and equipment	426,618.56	
Property in process of acquirement	235,592.11	
Investments	36,066.69	
Deferred charges	62,312.66	
Total other exepnditures		761,414.47
Balance		$180,802.53
Received from sale of capital stock		3,375.00
Increase in quick assets during 1913		$184,177.53

In regard to ore reserves the report states that notwithstanding the apparent depletion of ore reserves above the 1300 level, some additional work on the 1400 level and between the 1300 and 1400 levels, commenced toward the end of the year, disclosed extensions of ore bodies near the eastern end of the Black Rock claim somewhat greater than had been expected. Taking this into consideration it is said that developed ore reserves suffered no depletion during the year but rather increased. Technical calculations of ore completely blocked out at the end of the year showed about 1,050,000 tons, compared with 1,200,000 tons at the end of 1912. The additional

ore on the 1400 level was not considered in this calculation. The average grade of the ore blocked out is stated to be over 21% zinc with about 7 oz. silver per ton. The ore also contains small quantities of gold, copper and lead. The following table will give details of ore treated and concentrates produced during 1913:

	296,940 Tons of Ore Milled	Concentrates Produced — 104,174 Tons of Zinc	2269 Tons of Lead
Average assay:			
Gold, oz.	0.021	0.05	0.83
Silver, oz.	10.590	24.19	43.28
Copper, %....	0.23	0.47	0.31
Lead, %.....	1.169	2.08	39.41
Zinc, %.....	19.89	49.00	19.72
Total contents:			
Gold, oz.	6,280.07	5,201.45	187.786
Silver, oz.	3,145,779	2,520,375	98.202
Copper, lb. ...	1,366,618	977,405	14,151
Lead, lb.	6,944,082	4,330,422	1,788,465
Zinc, lb.....	118,137,915	102,102,868	895,048

The average mill extraction follows: For the first quarter of the year, 73.47%; second quarter, 88.33%; third quarter, 89.49%; fourth quarter, 90.15%; average for the year, 86.43%. These figures are based on zinc contained in zinc concentrates only. During the last quarter of the year the zinc concentrates averaged 50.54% zinc and the lead concentrates over 43% lead. The second section of the mill was not completed and put into operation until July. During the last five months of 1913 the average daily tonnage treated with both sections running was 1056 tons. The average tonnage during the last three months was 1087 tons per day. When running full time with a full ore supply from the mine, the mill is said to have a capacity of 1200 tons a day.

Porcupine-Crown Mines

The following figures for the second half of 1913 were taken from the report of the Porcupine-Crown Mines, Porcupine, Canada. Receipts from production of bullion and sundry revenue, $275,038; expenses, $124,466; profit, $150,572. These figures evidently do not include expenditures for development as a tabulation of costs shows. In this statement the cost, based on milling 74 tons a day, is $7.79, made up as follows: Ore breaking, $2.11 per ton; development, $1.17; prospecting, 60c.; general expenses, $1.50; milling, $1.64; administration, 29c. and home-office expenses, insurance, etc., 48c. per ton. Ore reserves in the mine are estimated to contain 72,472 tons, averaging $25.66 gold per ton. Ore in dumps brings the total reserve to 86,000 tons, with an average grade of $22.37 per ton. The mill treated 19,754 tons, averaging $20.30 per ton and the extraction was 85%. The tails from this ore were saved and are now being treated by cyanide.

Crown Reserve

The 1913 annual report of the Crown Reserve Mining Co., Cobalt, Ont., shows a profit of $528,984 on operations at Cobalt. The production amounted to 1,776,678 oz. of silver. The cost of production amounted to 23.02c. per oz. of silver as follows: Mining and development, 7.06c.; power and lights, 1.74c.; maintenance of plant, 0.74c.; general mine expenses, 1.34c.; superintendence and traveling, 0.65c.; head-office expense, 0.57c.; depreciation, 1.02c.; ore handling, 1.95c.; milling, 7.04c.; freight, treatment and smelter deductions, 0.91c. per oz. The average price received for silver was 59.45c. The total production of the Crown Reserve to date amounts to 17,033,821 oz. of silver at an average cost of 12.411c. Dividends in 1913 amounted to $795,966 and $5,571,764 to date. In addition to dividends, $810,026 has been paid in royalties. The high-grade ore has averaged from 3443 to 4784 oz. silver, and milling ore from 17.71 to 24 oz. silver per ton. The production of the company has been reduced owing to the exhaustion of high-grade ore in the Carson vein.

Quincy Mining Co.

The 1913 report of the Quincy Mining Co., Hancock, Mich., shows that it produced 18,161,575 lb. of mineral, which yielded 12,184,128 lb. of refined copper against a production of 20,634,800 lb. during 1912. The falling off in production was due to the strike. The net income from operations was $76,160. After payment of dividends amounting to $412,500 and $150,000 for lands, a surplus of $746,938 remained at the end of the year.

The report states that a safety and efficiency department has been organized with H. L. Chamberlin at its head, who is assisted by a corps of 10 inspectors. Many safety appliances have been added underground and in buildings at the mine and smelter. Instructions have also been given in "First-Aid-to-the-Injured" and in mine-rescue work and fire fighting. Two complete outfits for fire fighting underground and a pulmotor have been installed. Emergency chests for first-aid-to-the-injured have been placed at stations throughout the mine.

North Butte

According to the report of the North Butte Mining Co., Butte, Mont., for 1913, it shipped 462,799 wet tons of ore and 71 wet tons of precipitates, and treated 454,984 dry tons of ore and 45 dry tons of precipitates at the smelter. This ore produced 28,318,321 lb. of copper, 1,602,163 oz. of silver and 1567 oz. of gold. The cost of producing this copper was 9.76c. a lb., divided as follows: Mining and development, 6.484c.; freight on ore, 0.196c.; concentrating, smelting, freights, refining and selling, 6.378c.; general expenses and taxes, 0.165; total, 13.223c.; less a credit of 3.463c. for gold and silver contents and miscellaneous income. The net income for the year was $1,437,777 and dividends aggregating $820,000 were paid. The mine was in operation 345 days, the average number of men employed was 880 and the average number of tons hoisted per day was 1343; this would indicate that a little over 1.5 tons were handled per man per day.

Corbin Copper Co.

The 1913 report of the Corbin Copper Co., Butte, Mont., shows that $260,000 in assessments were collected and that interest receipts amounted to $2233. After paying off a deficit carried forward from 1912 and $179,050 for expenditures for the year, a surplus of $18,631 was left. A summary of the work shows that 300 ft. of shaft and 400 ft. of drifts and crosscuts were driven on the Butte property; and 225 ft. of shaft, 645 ft. of crosscuts, 125 ft. of drifts, and 400 ft. of shaft retimbering on the Rochester property. No work was done on the Glenberg property. Arrangements have been made with the United States Smelting, Refining & Mining Exploration Co. to furnish money for the payment of purchase money due for the Gambrinus group of claims.

Pittsburgh Meeting of the A. I. M. E.

SPECIAL CORRESPONDENCE

SYNOPSIS—Notes of an interesting meeting held in Pittsburgh, Penn., Oct. 8-10, attended by nearly 300 members.

The autumn meeting of the A. I. M. E. was opened at Pittsburgh on Thursday, Oct. 8, about 175 members being registered at the headquarters in the Hotel Schenley. This hotel, in a suburban district, about four miles east of the center of the city, was selected because of its pleasant surroundings, the buildings of the University of Pittsburgh, the Carnegie Institute of Technology, the Carnegie Institute, and other public institutions being in the immediate vicinity.

The first session was held in the afternoon in the auditorium of the Carnegie Institute. S. A. Taylor, chairman of the local executive committee, opened the meeting, speaking very briefly and introducing Dr. W. J. Holland, curator of the Carnegie Institute, who delivered an address of welcome, which was also brief. B. B. Thayer, President of the A. I. M. E., responded and was the briefest of all. But little time having been lost in the preliminaries, the reading of technical papers was begun, S. A. Taylor presiding. All of the papers had previously been printed in the bulletins of the A. I. M. E.

CALIFORNIA MAGNESITE

The first paper presented was by I. C. Morganroth, of the Harbison & Walker Refractories Co., on the occurrence and uses of magnesite. The discussion following this took the form of some questions and answers. Dr. David T. Day wanted to know about the California magnesite deposits and their commercial possibilities. Mr. Morganroth was rather contemptuous and pessimistic respecting them. He said that in general they were small, only one (near San Francisco) being of considerable size, that the mineral was of a kind difficult to burn satisfactorily, the last of the carbon dioxide being hard to expel, and finally transportation costs are severely against the California deposits. He thought that if the California mineral could be had at $2 per ton it would still be cheaper to import the Austro-Hungarian; that if mineral of the same kind as the Californian were wanted it would be cheaper to import the Grecian, which is obtainable from mines only about three miles from sea coast and connected therewith by wire-rope tramway. Mr. Morganroth said that the European War had not yet inconvenienced the domestic users of magnesite who had supplies of several months on hand.

THE IRON ORE OF BRAZIL

A paper on the iron resources of Brazil by E. C. Harder was read by Bradley Stoughton, the author being absent. Mr. Harder wrote: "Few mineral deposits have in recent years attracted such general and widespread attention as the Brazilian iron-ore deposits, due mainly to the quantities of rich ore occurring there, in contrast to the ever-decreasing grade of ores shipped from many large producing iron-ore districts of the world. The Brazilian ore is of very good grade, yielding 67 and 68% metallic iron. In very few places in the world has iron ore been found in marketable quantities which even approaches this ore in grade, while in Brazil several hundred million tons of such ore are in sight. Up to the present time no iron ore has been exported from Brazil and only a very insignificant quantity has been used to supply the small domestic furnaces."

Following this, Dr. I. C. White said that he had inspected iron-ore deposits in Minas Geraes and that they were the largest he had ever seen, but the conditions of bringing the ore to seaboard are highly adverse.

COAL-DUST EXPLOSIONS

George S. Rice, of the U. S. Bureau of Mines, described some experiments in the experimental mine of the bureau on the subject of coal-dust explosions and especially the use of stops provided with some inert dust, such as limestone dust, in checking the extension of such explosions. He said in part:

> The first time in this country that coal dust was considered to be the chief agency in a mine explosion was in 1884, when the Pocahontas explosion occurred, causing the loss of 112 men. Experiments with coal dust were conducted, and it was ascertained that coal dust was chiefly responsible for the majority of mine disasters.
>
> The coal-mining industry of the United States, as compared with that industry in European countries, was backward in taking up experimental investigations relating to coal dust. Finally, in 1907, such a series of disastrous mine explosions occurred that the country was aroused, and Congress appropriated money for the investigation of mine explosions and other mine accidents, which subsequently led to the formation of the Bureau of Mines. Thus the first, and so far, the only large scale coal-dust experiments in this country were started by the Federal Government at the Pittsburgh station, established in the fall of 1908.

The recent experimental work at the Bruceton mine has been in the direction of interposing shelves or tilting boxes containing an inert dust, especially limestone dust, in the probable path of an explosion, which may dislodge the dust and check further progress by its diluent effect.

William Griffiths inquired if ordinary dirt would not serve just as well and have the advantage of being cheaper and more generally available. Mr. Rice replied that he did not know, not having tried it. E. S. Hutchinson made some remarks about his investigation of the Pocahontas explosion in 1884, which was the first thing that drew attention to coal-dust explosions in this country.

TAXATION OF COAL MINES

A paper by H. M. Chance on the taxation of coal mines was not read, Dr. Chance being absent. In discussion of this paper, R. V. Norris presented an entirely new contribution upon the subject, having especial reference to taxation in the Pennsylvania anthracite field. For a long time valuations in that field were simply guessed. Then came into vogue the system of assessing upon a valuation per foot-acre, the rate being $10 per foot-acre up to 1907. Then the counties began to increase it arbitrarily, their figures rising to $65 per foot-acre in some cases, and being determined chiefly by how much money they wanted to raise. The coal interests had but little to say about spending the money. Thus in Hanover townships, 97% of the taxes are drawn from coal lands and that township lately spent upward of $200,000 in build-

ing two miles of road. The taxes have in some cases become so high as to be confiscatory. Mr. Norris mentioned one case of a coal property leased on a royalty basis where the taxes come to $2000 more per annum than the royalties. The owner cannot break the lease and consequently is out of pocket $2000 per annum for owning the property. In this case the taxes were lately raised 163%.

These things have led to a lot of litigation, which has not yet been settled. The Supreme Court of the State has, however, declared the foot-acre basis to be illegal. Mr. Norris is of the opinion that new legislation on the subject of mine taxation in Pennsylvania is necessary and recommends a system based on annual output.

William Griffith warmly approved of Mr. Norris' remarks and suggestions. He said the only legal way for an expert to value mining property in Pennsylvania at present is to act as he would for a private client but never to tell in a court of law what were his reasons. Just value the property and say nothing more.

S. A. Taylor told of a manifest injustice in the corporation law. A mining company is allowed to deduct 5% for amortization. Assuming $1.20 per ton as the price realized for coal in the Pittsburgh district, 5% comes to 6c. per ton, but the actual cost to the company is 15 to 20c. per ton. If a company is operating a leased mine it may deduct the royalty paid from the gross proceeds, but if it be operating a freehold property it is out from 9 to 14c. per ton, i.e., it is taxed on the amount of return of principal.

R. D. Hall spoke against the system of taxing on basis of output, arguing that by exempting nonproducing mines it promoted hoarding of coal lands.

The session was then adjourned.

Moving Pictures of Mining

In the evening session, also held in the lecture room of the Carnegie Institute, T. T. Read delivered a lecture on the native method of iron making in China and of sinking wells for brine. J. W. Paul, of the U. S. Bureau of Mines, exhibited three reels of moving pictures showing methods of mining at Nanticoke, Penn., and Edwin Higgins, also of the U. S. Bureau of Mines, exhibited two reels showing the methods of iron mining as practiced by Witherbee, Sherman & Co., at Mineville, N. Y. Both of these presentations were excellent exhibits of the art of taking motion pictures and were the more extraordinary for having been taken under the adverse conditions of underground. The iron-mining pictures were decidedly the better of the two. In the taking of these pictures the U. S. Bureau of Mines and the mining companies coöperated and shared the expense. Their purpose is to popularize the safety work of the Bureau.

Friday Sessions

In the morning session of Friday, Oct. 9, the technical papers were presented in separate sectional meetings, as follows:

Iron and Steel—J. Birkinbine, "The Reserves of Iron Ore for the United States"; G. K. Burgess, J. J. Crowe, H. S. Rawdon, and R. W. Waltenberg, "Finishing Temperatures and Properties of Rails"; J. K. Furst, "The Plant of the Duplex Process for Making Steel"; Albert Sauveur, "Manganese Steel and the Allotropic Theory."

Coal and Coke—J. Taffanel, "Coal-Dust Explosion Investigations"; H. N. Eavenson, "Coal-Mine Explosions Caused by Gas or Dust"; H. A. Kuhn, "The Pittsburgh Coal Field in Western Pennsylvania"; R. S. Lewis, "The Book Cliffs Coal Fields, Utah"; A. E. Gibson, "An Aërial Tramway for Mining Cliff Coal"; M. B. Yung, "Tin and Coal Deposits of the Fu Chuan District, China"; J. P. K. Miller, "The Manufacture of Coke."

Non-Metallic Minerals—E. H. Sellards, "The Origin, Mining and Preparation of Phosphate Rock"; J. A. Barr, "Tennessee Phosphate Practice"; W. C. Phalen, "Salt Making by Solar Evaporation"; J. A. Dresser, "Asbestos in Southern Quebec"; O. B. Hopkins, "Asbestos Deposits in Georgia"; D. T. Farnham, "Quarrying Shale by the Tunnel System"; H. A. Gardner & G. B. Heckel, "Barytes as a Paint Pigment."

In the iron and steel division, following the reading of the paper by G. K. Burgess and others on the properties of rails, J. E. Johnson, Jr., tried to start a discussion by asserting that all of the transverse fractures of steel rails are found to occur in those made of openhearth steel, the old bessemer rails being not guilty. The steel men present seemed to regard this like the unlocking of a door of a closet containing a skeleton and did not feel like talking about it. Anyway there was no discussion about it.

Excursions

Friday afternoon was devoted to excursions, members having the option of visiting the Homestead Steel Works, the plant of the National Tube Co., the works of the Harbison-Walker Refractories Co. and the U. S. Bureau of Mines' experimental mine at Bruceton.

The Harbison-Walker Refractories Co. makes daily about 150,000 firebrick, clay and silica, at its plant near Pittsburgh. In other plants, of which it has a large number, it swells its daily output to about 1,000,000 brick, its manufactures including clay, silica, chrome, magnesite and bauxite brick and special shapes. At the Pittsburgh plant the clay and silica brick are made by the old hand process, which has been found to be the most reliable. The Pittsburgh district is, of course, the largest consumer of its products, large quantities of which are required by the metallurgical works of the vicinity, but a large business is also done with the metallurgical works west of the Mississippi River, especially in magnesite and silica brick which are used extensively by the copper smelters. The magnesite-brick business with them has grown to large proportions since the basic converters came so largely into use. The silica-brick business is growing with leaps and bounds in many quarters. The Harbison-Walker technical staff is loud in its expressions about the superiority of silica brick for many purposes for which clay brick have heretofore been used. Of course, it is necessary to have the silica brick properly made, which requires a good deal of experience. There is a growing demand for bauxite brick, especially for lining fireboxes, it being found that coal clinkers do not stick to such a lining. In making bauxite brick some clay is mixed with the bauxite to serve as a binder. In making silica brick the binder is 2% of lime, added as milk of lime in the edge runners, and it is important to be careful in adhering to the exact proportion.

A new department of the Harbison-Walker plant near Pittsburgh is a testing and research laboratory. Interesting experiments are being made upon the action of

slags on firebrick of various classes. The test brick is made with two small saucer-like depressions. Into these is weighed a certain quantity of the slag to be tested and the brick holding this is heated to the desired temperature. After a certain time the brick is cooled and cut longitudinally through the saucers and the action of the slag on the brick is noted. In keeping the records a full-size sectional drawing is made and is inked to correspond with the showing of the brick itself, the conditions of the test being entered upon the same sheet.

Visitors to the plant of the National Tube Co. spoke appreciatively of witnessing the manufacture of 10-in. pipes, 40 ft. long. At the Homestead works of the Carnegie Steel Co., the armor-plate department was thrown open, an unusual courtesy. At the experimental coal mine at Bruceton a coal-dust explosion was fired.

The Subscription Dinner

In the evening was held a subscription dinner at the Hotel Schenley, the interest of which was enhanced by the presence of ladies. S. A. Taylor presided. Among the speakers after dinner were B. B. Thayer, Charles F. Rand and Bradley Stoughton, who referred especially to the work of the Institute. Mr. Thayer reported the present membership to be about 4700. Mr. Rand said that in spite of the increased revenue the expenses on account of more extensive publication and other activities had so increased that it was doubtful if the treasury would come out any better than even this year and intimated that in the near future the directors would propose to raise the annual dues to $15. This announcement did not apparently produce any chill in the meeting, but the festive character of the occasion probably prevented any real reflection of sentiment.

An unusual feature of the after-dinner speaking was the introduction of an address upon a technical subject. The presentation of a paper on the Mexican petroleum fields by that distinguished geologist, Ezequiel Ordoñez, had been postponed until Saturday in order to give Dr. I. C. White an opportunity to say something about it, but he being unexpectedly called away place was made for him in the after-dinner program. This proved to be an excellent idea, because Dr. White was so felicitous in his presentation of an interesting subject, avoiding all dry details, that his address, briefly given, was extremely entertaining to everybody. He spoke in the most appreciative terms of Señor Ordoñez whom he has known since 1897. He described the Mexican wells as being the greatest gushers ever known and told of the extraordinary difficulties that had been experienced in coping with their unexpected bursts of petroleum and the fate of the great well that is burning.

George Neilson, president of the Braeburn Steel Co., made some witty remarks that kept everybody laughing. The speech of the evening, however, was that of Edmund C. Pechin, one of the pioneers in iron-making in this country, and one of the four surviving charter members of the Institute. Mr. Pechin gave at some length a series of interesting reminiscences of early iron making in the Pittsburgh district, interspersing them with amusing stories. One of the best was his account of the celebrated Soho furnace, the prototype of modern blast furnaces which owed its design to a certain Bennett who was all his life a saloonkeeper in Pittsburgh. "He was a good saloonkeeper," said Mr. Pechin, "besides being a genius in the matter of blast furnaces." Mr. Pechin also told of his experience in giving his first account of this furnace at a meeting of iron masters at Middlesbrough, England. The audience would have liked to hear Mr. Pechin go on for an hour or two longer. However, the time was getting late, and Pittsburghers being in the habit of going to bed early, as Mr. Taylor said, adjournment was declared at 11:30 p.m.

Saturday Sessions

By Saturday morning the registration had risen to nearly 300 and the success of the meeting was fully established. In the morning there were further technical sessions, held in divisions as follows: Petroleum and gas, electricity and miscellaneous mining topics and iron and steel. The paper by R. H. Rice on turbine air compressors developed an animated discussion, the result of which was of course inconclusive, the relative merits of the turbine and piston compressors being a question that is not to be settled offhand.

In the afternoon there were excursions to a neighboring oil field and to the headquarters of the U. S. Bureau of Mines.

Chronology of Mining for September, 1914

Sept. 1—Calumet & Hecla passed quarterly dividend. Mine production curtailed and wages and salaries cut.—Resignation of Messrs. Kinzie, Kennedy and Lass from Treadwell group.—Martial law declared in Butte.

Sept. 7—Announcement of President Wilson's terms of settlement offered Colorado coal miners and operators.

Sept. 8—All but one (Davis-Daly) of Butte mining companies joined in declaration against closed shop.—Nevada Consolidated and Ray passed dividends; Chino cut.

Sept. 9—Frederick Thum, eminent metallurgist, died.—Muckie McDonald arrested in Butte.

Sept. 12—James B. Haggin died.—Announcement of gold strike north of Tonopah.

Sept. 14—Henry Bratnober, mining engineer prominent in Alaska and Yukon, died.

Sept. 16—Petition in bankruptcy filed in New York against Ohio Copper.

Sept. 17—Eleven men caught and killed by cave-in at Centennial-Eureka mine, Eureka, Utah.

Sept. 18—Three men killed by fall of ground in bottom of prospect shaft at Maiden Rock, near Butte.

Sept. 19—Interstate Commerce Commission reopened railroad-rate case.

Sept. 22—Anaconda cut dividend.—Job office of *Tonopah Bonanza* blown up.—Thomas Johnston Grier, superintendent of Homestake, died.

Sept. 23—Villa broke with Carranza.—New Texas School of Mines at El Paso opened.

Sept. 30—Announcement of first shipment to Canada by gold pool.

Purifications of Nickel Solutions

In a patent granted to H. L. Wells and the late Tom Cobb King (U. S. pat. 1,067,698) is described the method of purifying nickel solutions for electrolysis. The

solution is supposed to have been obtained by treating nickel matte with hydrochloric acid, and contains cobalt, iron and copper as the chief impurities. The solution is passed over crushed nickel matte, while an additional amount of sulphuretted hydrogen over that generated from the matte is passed in. This precipitates the copper. This solution is then freed of H_2S by boiling, or passing air or steam through it.

A sufficient amount of black oxide of nickel is then added to oxidize the ferrous to ferric compounds and sufficient ammonia or carbonate to throw down a basic ferric salt. The solution is then filtered, after which cobalt can be removed by treating with nickel oxide or its equivalent nickel compound or chlorine and a carbonate sufficient to precipitate the black oxide of cobalt.

Military Courts Suspended in Butte

SPECIAL CORRESPONDENCE

On Oct. 8 the supreme court of Montana in a habeas corpus test case, rendered a decision to the effect that the military court in trying and sentencing the defendant, Dan Gillis, acted without authority. At the same time the court held that the national guard was legally organized and effective. The defendant Gillis, who had been convicted in the military court at Butte of resisting an officer, was remanded to the military "to be dealt with according to law."

The court in effect holds that, "while the governor is authorized to detail the militia to suppress insurection, neither the governor nor the guard can lawfully punish for insurrection or violation of the law. The civil courts cannot be ousted by the agencies detailed to aid them, nor can their functions be transferred to tribunals unknown to the constitution."

This virtually means the suspension of the military courts in Silver Bow County. It further means that the trial and commitment of prisoners, arrested, convicted and sentenced by the military authorities were void and their detention thereunder cannot be upheld. While not entitled to release, they are entitled to trial in the civil courts. Accordingly, all persons now serving sentence and those now in jail pending trial, among them Muckie McDonald and Joe Bradley, will have to be tried in the civil courts. County Attorney McCaffery contemplates asking the district court for a change of venue in the case of these prisoners, so that they may be tried in the courts of some other county where a jury of an impartial character can be secured.

Flotation Process Litigation

Suit was commenced on Oct. 10 by Minerals Separation, Ltd., against the Miami Copper Co. in the U. S. District Court at Wilmington, Del., charging infringement of three patents by two different acts of infringement, one following the procedure of the licensees of Minerals Separation, Ltd., and the other being known as the Callow pneumatic flotation process. It is charged that these acts of infringement were carried on at Miami, Ariz., before the commencement of the suit. On Oct. 12, Minerals Separation, Ltd., entered orders in the same court dismissing its two former suits against Miami Copper Co. without prejudice. The two patents involved in the two suits dismissed are included in the new suit just commenced, together with a third patent No. 1,099,699, issued June 9, 1914. The application of Minerals Separation, Ltd., to the U. S. Supreme Court for a writ of *a certiorari* in the case versus James M. Hyde, recently decided at San Francisco, will be presented on Oct. 26. Answer is expected on Nov. 3.

St. Louis Engineers Visit Lead Belt

SPECIAL CORRESPONDENCE

The St. Louis Section of the American Institute of Mining Engineers made a two-day excursion to the disseminated lead belt in St. Francois County, Missouri, on Oct. 2 and 3. About 40 members of the Institute left St. Louis on a special car attached to the Iron Mountain train, reaching Bonne Terre at 10:30, and were at once conducted to the Bonne Terre mill, where the interest was divided between the large gas-engine power plant and the mill itself.

After dinner at the Bonne Terre Hotel, an interesting talk was given by H. A. Buehler, state geologist of Missouri, and by Oscar M. Bilharz, of Flat River, Mo., on the question of handling the water made by the mines in the district. The party was then taken in automobiles to Leadwood, where both the mine and the mill were visited. From Leadwood, the members went to Desloge, inspecting the mill, and paying particular attention to the air furnace, where the Desloge brand of lead is prepared for market.

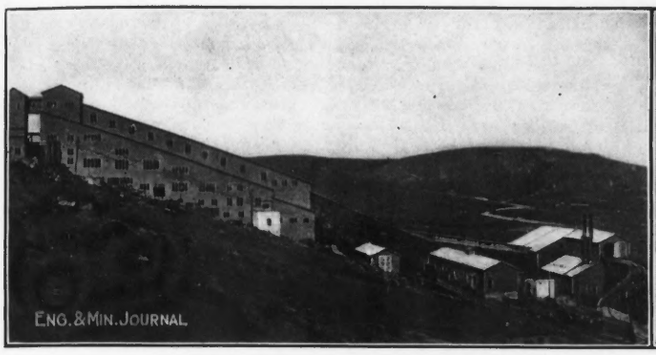
In the evening, an informal meeting and smoker were held at the Bonne Terre Club, at which talks were given by Messrs. Bilharz, Desloge, Comins, Ring, Adami, Delano, Buehler and others. The subject most dwelt on was that of the oil-flotation process, recently introduced and now in successful use in every mill in the district. The slimes, after leaving the tables, are run through an open tank, into which is poured a refined creosote oil, and the contents of the tank are agitated in different manners, the oil taking up the fine particles of lead ore, a recovery of about 1% being secured through this process.

On Saturday, Oct. 3, the party first went to the Federal Mine No. 11, where an electric shovel was the chief point of interest. After this the mills at Doe River and St. Francois, both mills of very modern construction, were inspected. The party took the train from St. Francois, reaching St. Louis Saturday evening. This was the second meeting of the St. Louis section of the Institute, and was voted a great success and a most interesting trip by all.

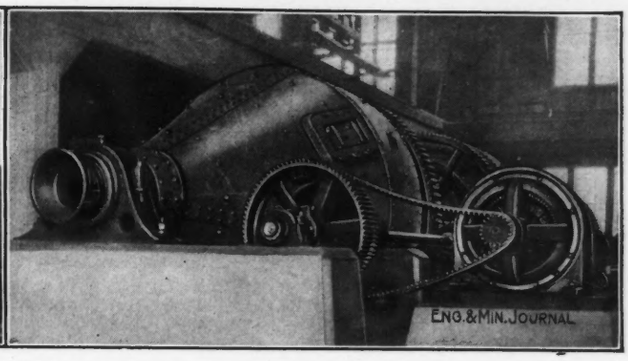
Queensland Mineral Output

The value of the mineral output of Queensland for 1913, according to the annual report of the Minister of Mines, was £3,857,881, a decrease of £317,474 from 1912. The decline in the gold yield from 347,946 oz. in 1912 (£1,477,978) to 265,735 oz. (£1,128,768) in 1913 is the most serious feature. Other items, arranged in order of descending value, are: Copper, 23,665 long tons; coal, 1,037,944; tin, 3197.35 long tons; silver, 604,979 oz.; lead, 3603 long tons; gems, £43,292; limestone, 161,165 long tons; wolfram ore, 358.75; iron ore, 40,838; molybdenite, 66.3; mixed bismuth and wolfram ores, 181.75 long tons; all else, £6095.

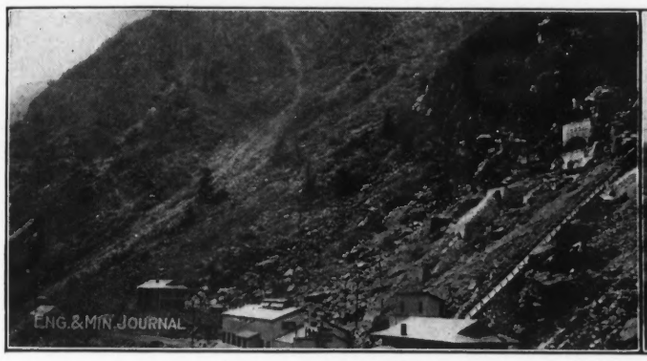
Photographs from the Field



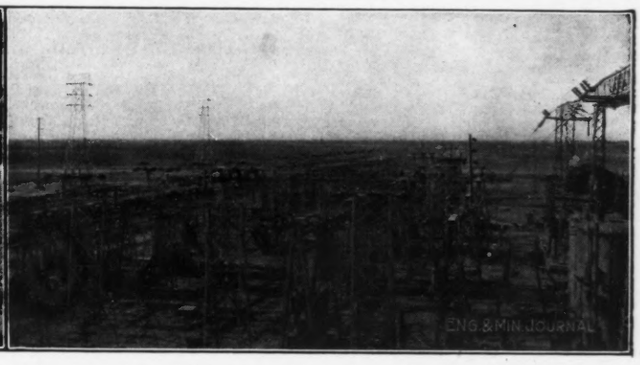
TIMBER BUTTE MILL, BUTTE, MONTANA



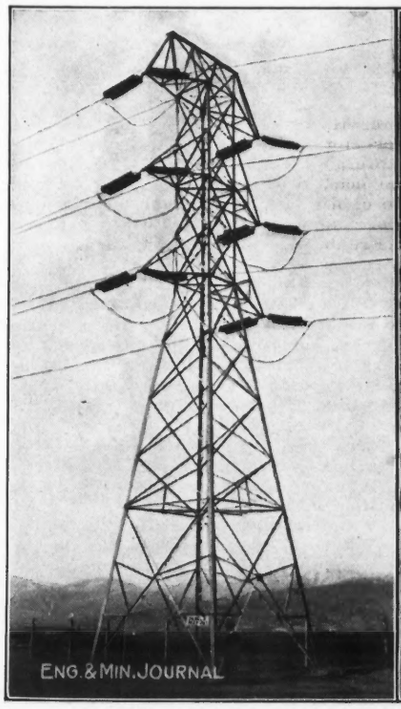
HARDINGE CONICAL MILL AT TIMBER BUTTE



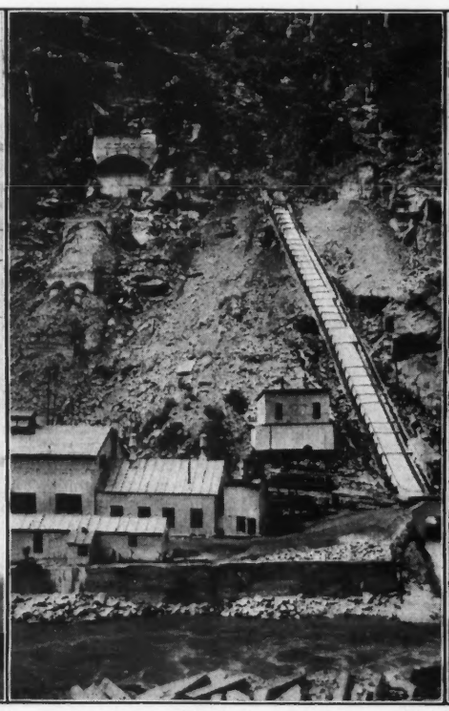
CENTRAL COLORADO POWER CO.'S PLANT, SHOSHONE



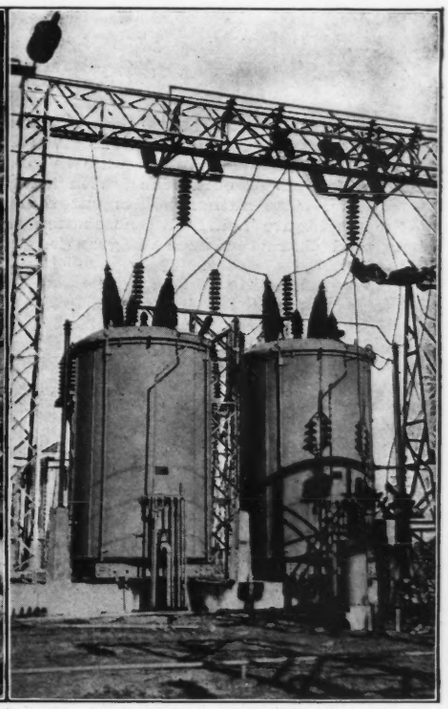
DISTRIBUTING STATION, UTAH LIGHT AND POWER CO.



TOWER ON 130,000-VOLT LINE OF UTAH POWER AND LIGHT CO.



CENTRAL COLORADO POWER CO.'S PLANT, SHOSHONE, COLO.



130,000-VOLT TRANSFORMERS, STATION OF UTAH POWER AND LIGHT CO.

NEW PUBLICATIONS

ELECTRICAL MINING INSTALLATIONS. By P. W. Freudemacher. 4¼x6, pp. 181, illus.; $1. D. Van Nostrand Co., New York.

MINERALS OF CALIFORNIA. By Arthur S. Eakle. Pp. 226. Bull. 67, California State Mining Bureau, San Francisco, California.

HANDBUCH DER MINERALCHEMIE. Vol. III, Part 4. By C. Doelter. 7x10, pp. 160, illus.; 6.50 marks. Theodor Steinkopff, Dresden, Germany.

THE PUBLICATIONS OF THE UNITED STATES GECLOGICAL SURVEY, JULY, 1914. (Not Including Topographic Maps.) Pp. 136. U. S. Geological Survey, Washington, D. C.

JAARVERSLAG DER BANKATINWINNING OVER HET EXPLOITATIEJAAR, 1912-1913. 6¾x9½, pp. 195, illus., paper. Dienst der Banka-Tinwinning, Muntok, Banka, D. E. I.

RECONNAISSANCE OF OIL AND GAS FIELDS IN WAYNE AND McCREARY COUNTIES, KENTUCKY. By M. J. Munn. Pp. 105, illus. Bull. 579, U. S. Geological Survey, Washington, D. C.

FORTSCHRITTE DER EDELMETALLAUGEREI WAEHREND DER LETZTEN JAHRZEHNTE. By Rolf Borchers. 6¾x10, pp. 153, illus., paper; 7.80 marks. Wilhelm Knapp, Halle a. S., Germany.

MINING DISTRICTS OF THE DILLON QUADRANGLE, MONTANA, AND ADJACENT AREAS. By Alexander N. Winchell. Pp. 191, illus. Bull. 574, U. S. Geological Survey, Washington, D. C.

THE PRE-CAMBRIAN GEOLOGY OF SOUTHEASTERN ONTARIO. By Willet G. Miller and Cyril W. Knight. Pp. 151, illus. Vol. XXII, Part 2, Report of the Ontario Bureau of Mines, Toronto.

GUIDE PRATIQUE DE LA PROSPECTION DES MINES ET DE LEUR MISE EN VALEUR. By Maurice Lecomte-Denis. Third Edition, Revised. 6½x10, pp. 610, paper, illus.; 25 fr. H. Dunod et E. Pinat, Paris.

PRACTICAL INSTRUCTIONS IN THE SEARCH FOR, AND THE DETERMINATION OF, THE USEFUL MINERALS INCLUDING THE RARE ORES. By Alexander McLeod. 4½x6½, pp. 114; $1.25. John Wiley & Sons, Inc., New York.

MEMORIALS OF HENRY FORBES JULIAN. By Hester Julian; with introductory notices by the Rev. J. O. Bevan and H. Livingstone Suiman. 6x9, pp. 310, illus.; $2.50. Charles Griffin & Co., Ltd., London; J. B. Lippincott Co., Philadelphia.

THE ORE DEPOSITS OF NORTHEASTERN WASHINGTON. By Howland Bancroft. Including a section on the Republic mining district, by Waldemar Lindgren and Howland Bancroft. Pp. 215, illus. Bull. 550, U. S. Geological Survey, Washington, D. C.

RECENT COPPER SMELTING. Edited by Thomas T. Read. 6¼x9¼, pp. 459, illus.; $2.50. Mining and Scientific Press, San Francisco, California. A compilation of articles which, with few exceptions, have appeared in the "Mining and Scientific Press" during the last four years.

NOTES ON RADIUM-BEARING MINERALS. By Wyatt Malcolm. Pp. 26, paper. Canadian Geological Survey, Ottawa.

This little work is intended as a guide to prospectors in search of radium-bearing ores. It gives a description of the minerals likely to contain uranium in commercial quantities and their modes of occurrence, with information as to tests for radium. The author points out that the chief deposits of the world are nearly all associated with igneous rocks of an acid character, such as granite, pegmatite dikes and quartz-porphyry dikes. They are found inclosed within the body of pegmatite dikes, or in veins cutting granite, or schists or slates intruded by granite or porphyry dikes. Powdery and crystalline minerals of a bright yellow to emerald green color, and heavy minerals of a dull or greasy luster should be tested. In the search for radium minerals the prospector should keep in mind the possibility of discovering others of economic importance. Any mineral considerably heavier than a piece of quartz or feldspar of equal size, is worth examination.

POOR'S MANUAL OF INDUSTRIALS FOR 1914—Fifth annual number. Manufacturing, Mining and Miscellaneous Companies, 6x9, pp. 2460; $7.50. Poor's Railroad Manual Co., 535 Pearl St., New York.

Poor's Manual of Industrials for 1914 (fifth annual number) contains about 300 pages more than any previous issue, of which 138 new pages are devoted to mining, making a total of 375 pages devoted to this subject. About 750 new companies have been added and many new income accounts and balance sheets. These tables are mostly in comparative form. Information is given, wherever possible, showing whether or not bond interest is payable without deduction for the normal United States income tax. In addition, the manual contains an appendix giving late information on the railroads and utilities, supplementing these two manuals.

The publication of this volume completed Poor's Manual for 1914. The three books together contain over 6500 pages, covering the entire field of corporate investment in America. They give statements of practically every corporation in which there is a public interest, and are noted for their accuracy, completeness, and thoroughness.

THE COPPER SMELTING INDUSTRIES OF CANADA. By Alfred W. G. Wilson. Pp. 184; with maps and illustrations. Canada Department of Mines, Mines Branch. Ottawa, Canada.

In Chapter I of this interesting monograph Dr. Wilson has traced the development of the copper smelting industry in Canada from the time the first plant was built in 1848 at the Bruce mines in Ontario. A full account is given of the earlier operations in Ontario, of those at the Eustis mine and elsewhere in Quebec, and finally of the various plants in British Columbia. Following this are six chapters, each describing one of the existing copper smelting plants now at work in Canada. These are the plants of the Canadian Copper Co.; the Mond Nickel Co.; the Consolidated Mining & Smelting Co. of Canada; the Granby Consolidated; the British Columbia Copper Co.; and the Tyee Copper Co. Chapter VIII is a general summary with general remarks on copper blast furnaces, copper converters and on the possibilities of establishing custom smelting centers at other points. Chapter IX contains some tables of statistics of the copper industry. The book is profusely illustrated with photographs and drawings, and gives several maps. It is provided with an adequate index.

LODE MINING IN YUKON. By T. A. McLean. Pp. 216; with maps and illustrations. Canada Department of Mines, Mines Branch, Ottawa, Canada.

This report is the result of an examination of the more important quartz deposits in the Dawson, Duncan Creek and Conrad districts of the Yukon, with a special view to ascertaining their probable or possible economic value. The examination was extended to some properties in the Whitehorse district and in the Windy Arm region of British Columbia, which adjoins the Yukon. Gold was first discovered in the Yukon in 1869, but did not attract much attention until the discovery of the Klondike creeks and their wonderful riches in 1898. The returns have been almost wholly from placer mining, however, and comparatively nothing has come from lode mining. Quartz claims, indeed, were staked out in the Klondike as early as 1899; but development work has generally been desultory, and little real mining has been done. At the present time quartz claims are located over wide areas in the Dawson, Duncan Creek, Conrad and Whitehorse districts. So far as development has gone the veins are numerous, but generally small and nonpersistent; no high values have been found and no veins sufficient to make a large mine at any one point. Mr. McLean has made careful examinations of many points where prospecting and exploration have been carried on, and he gives the results of his observations in a clear and interesting way. The book is well illustrated with maps and photographs and is provided with a good index.

METALLURGY OF COPPER. By H. O. Hofman, pp. 556. Illustrated. Price, $5. New York and London. McGraw-Hill Book Co., 1914.

This is the second of the great series of metallurgical treatises that Professor Hofman is doing, the first having been his "General Metallurgy" which was published in 1913. Coming are treatises on lead, gold and silver, and the minor metals. The magnitude of his task excites our wonder. His execution of it elicits our admiration. Here we are having such an exhibition as Bruno Kerl and John Percy gave us half a century ago, and more recently Carl Schnabel. It was high time that another metallurgical giant should have essayed the task. None but a giant could do anything of this sort. In the preface to his last book Professor Hofman says that his aim was to furnish something which will meet the demands of the metallurgist of today; to present the leading physical and chemical facts; and to give the details of the modern methods of operation. No other single treatise, not excepting the classics of Doctor Peters, covers the entire ground. Professor Hofman does it, and does it admirably. His product is satisfying. It is as nearly up-to-date as any such work can be, it is painstakingly accurate, and it is adequate in its presentation of details.

As to the last point, a noteworthy feature is the copiousness of the footnotes. What an enormous research do they exhibit! In this we are reminded of Kerl's famous Grundriss der Metallhüttenkunde, but that classic covered all the fields of metallurgy and apart from the footnotes the text was necessarily slender. In Professor Hofman's fat volume devoted to a single metal there could be an amplitude of text, and for those who desire minute study there are the footnotes to take them back to the original authorities. Praise of Professor Hofman's treatise on copper is as unnecessary as it would be to try to gild burnished gold. The appreciation of the metallurgical profession will come to him.

Correspondence and Discussion

"Successful Failures"

The editorial on "Successful Failures" in the JOURNAL of Aug. 29, is a subject that I have been thinking of for some years, and it is getting a stronger hold on me the more I think of it. It is one of the subjects that should be taken up by engineers, young and old, whether civil, mining, mechanical, electrical, metallurgical, etc. There are countless numbers who could give their experiences for the benefit of fellow workers.

This subject, of course, has appealed to me from a mining and metallurgical point of view, and having taught these subjects for a number of years and watched the progress along these lines, I am more and more convinced that engineers should know of as many of the successful failures in their profession as possible. If young engineers, and older men as well, could refer to these "successful failures" by the prominent men in their profession, they would not make the same mistakes and much time, money and humiliation would be saved. It has occurred to me that a book on such a subject as "Successful Failures in Mining and Metallurgy" might be compiled by someone, if the engineers of these professions would write of some of their experiences along that line. This work has been in my mind for some time.

The publishing of an article by any engineer could be confidential if he so desired it. If enough material could be collected, classified, etc., and published in book form, it would be a welcome addition to the literature on mining and metallurgy.

C. L. BRYDEN.

Scranton, Penn., Sept. 12, 1914.

Productive Importance of Sedimentary Iron Ores

In a recent communication to the JOURNAL (June 13, 1914), attention was called to two facts regarding the sedimentary iron ores. The first was that they were far more important than is commonly considered; the second, that this importance could be stated quite exactly in figures, so that it was possible to put the question on a purely quantitative basis. By making use of estimates of the known iron-ore reserves of North and South America and Europe, it was possible to arrive at the conclusion that sedimentary ores make up about two-thirds of the world's reserve of iron ores.

These results give some idea of the ultimate or prospective importance of the sedimentary ores, as compared with those derived from other types of iron-ore deposits, but it may be suggested that their present importance is far less than indicated by the figures deduced from ore-reserve tonnages. This, however, would be an error, as can be demonstrated when the same method of proof is applied to the ore tonnages shipped for use during recent years. In the present communication this last method has been adopted.

During 1912, almost 58,000,000 tons of iron ore were mined in North America—including the United States, Newfoundland, Canada and Cuba. The source of these tonnages, so far as type of ore deposit is concerned, is indicated in the table following:

NORTH AMERICAN IRON ORE OUTPUT, 1912

Type of Deposit	Tons Mined	Per Cent. of Total
Sedimentary basin deposits	5,145,621	9.0
Secondary concentrations	47,096,119	81.5
Residual deposits	1,564,531	2.7
Normal replacements	1,724,756	3.0
Contact deposits	544,475	0.9
Magmatic and doubtful	1,705,255	2.9
Total	57,780,757	100.0

The term secondary concentrations, as used here, includes the Lake Superior ores and others in which an original sedimentary ore bed has been raised to workable grade by later leaching and deposition. With this in mind, it can be seen that even in North America alone, the ores of sedimentary origin are of the first importance as present producers.

When the inquiry is extended to cover European ores, this fact becomes still more obvious, for all the important tonnage of Germany, France and Great Britain is from sedimentary deposits, only minor amounts being secured from deposits of other type. It is not possible to state the European results with absolute accuracy, for statistics from some countries are still missing, and in other instances it is not possible to place the ore according to type of deposit. But the results given in the table below will probably approximate fairly to the source of the European ore output during 1912.

EUROPEAN IRON-ORE OUTPUT, 1912.

Type of Deposit	Tons Mined	Per Cent. of Total
Sedimentary basin deposits	63,000,000	74.1
Residual deposits	3,000,000	3.5
Normal replacements	13,000,000	15.3
Magmatic and doubtful	6,000,000	7.1
Total	85,000,000	100.0

The two continents differ markedly, it will be seen, in the types of ore deposits from which their present iron supplies are being drawn. The local variations are reduced, however, when the American and European totals are combined and used as a basis for determining the relative rank of the different types of deposit. This has been done in the table below, to which a column reprinted from my earlier communication has been added for comparison.

IMPORTANCE OF TYPES OF IRON-ORE DEPOSITS

Type of Deposit	Per Cent. of Annual American and European Ore Shipments	Per Cent. of World's Known Ore Reserves
Sedimentary basin deposit	47.7	63.1
Secondary concentration	33.0	7.9
Residual deposits	3.2	13.3
Normal replacements	10.3	5.0
Contact deposits	0.4	4.4
Magmatic and doubtful	5.4	6.3
Total	100.0	100.0

The final results, it will be seen, substantiate everything that has been said concerning the immense relative importance of the sedimentary ores, and the very slight importance of those in whose origin igneous action played any serious part either directly or indirectly.

EDWIN C. ECKEL.

Washington, D. C., July 14, 1914.

Editorials

The Situation of the Metals

The war conditions have produced extraordinary disturbances in the markets for all the metals. The prices for antimony, quicksilver and platinum went up and have stayed up. Tin and spelter went up and came down. Lead and copper simply went down, without even any temporary rise to excite hopes. In all of the major metal industries the effect of the war up to date has been distinctly adverse.

The lead market was weakish during the first half of the year. An exportation of about 20,000 tons of domestic lead relieved the situation, however, and prevented the slump that there might otherwise have been, owing to the large production and the none too good consumption. Just before the war, the export demand having ceased, the selling agencies made overtures to the miners, especially those of the Cœur d'Alene, to curtail their production, but no heed was given to this advice. After the war began there was some hope that there might be a renewal of the export business, but while it has been possible to sell small quantities to Europe, there has not yet matured any great demand from there, which would relieve the situation here. The situation here has been that the refiners have been carrying large stocks of lead which they have not been able to sell in spite of offers at concessions, inspired by the general desire to have money rather than lead at a time when money is dear and burdens are great. The miners having refused to read the signs of the times and the smelters being unwilling to add to the load they were carrying, the market took the course that automatically regulates supply and demand. If the level of 3.5c. is insufficiently low, we may look for something lower yet.

The zinc smelters at the mid-year were in a desperate plight, carrying a stock of 64,000 tons, a far larger quantity than ever known before in the history of the industry in this country, while there was strong presumptive evidence that the galvanizers and brass-makers were themselves overbought. Here again, we were witnessing a maintenance of excessive production, but few of the smelters being willing to make any material curtailment, and the aggregate of their output being about the largest on record. In July, the price for spelter had fallen to about 4.7c., St. Louis, and pessimists were foretelling a decline to around 4c. Then came the war and the sudden realization that England was going to be cut off from her main supply of spelter. The same thing was realized in England, and buying of American spelter began from there, with the result that our market rose by leaps and bounds to about 6c. Probably about 20,000 tons was sold for export at this time, but England had for the moment overbought herself, wherefore the demand from there, in which speculative interests had played a part, suddenly ceased; and England being able a little later to obtain some spelter from Rotterdam, the price in this market declined in September about as rapidly as it had risen in August. Early in October, the price was back at about 4.70c., or just where it started at the beginning of August. August, and now it is at 4.5c.

The smelters by their recent sales, domestic and foreign, relieved themselves considerably, but all of them are still carrying large unsold stocks. Reports from most of the Western works tell of unsightly piles of the metal awaiting orders for shipment. Without a doubt, America is going to experience a further demand for spelter for export. Even now there are signs of interest from the other side. But the third phase of this business will probably be a sober one. Whereas in August England cabled "We want spelter, and we'll take it at whatever price you ask," now she writes, "We'll take some of your spelter if you will deliver it over here for £22½.

The copper situation has been so much discussed that it is unnecessary to go further into the details of it now. It may be remarked only that, whereas the producers of both lead and spelter have paid the penalty of excessive production, the producers of copper were not guilty of anything of that sort and are the innocent victims of an unexpected industrial chaos. There was nothing for them to do but to curtail their production. In general, the American producers have reduced by about 50%. It is to be feared, however, that the leaders among the producers have been unduly optimistic in thinking that a curtailment of 50% would be enough. Nobody can yet tell definitely about this market, for the reason that what there is of it is restricted by common consent of the sellers, but the failure of demand to develop indicates that we may yet see a level of price that will produce the necessary curtailment by extinguishment of production.

Fettling Reverberatory Furnaces

Some comments were made in these columns in March on the change that has taken place in the fettling of reverberatory furnaces. Data regarding the reverberatory practice at the leading smelting works of North America have been collected and are now presented in tabular form on p. 703 in this issue of the JOURNAL.

A decade ago, quartz was considered the most suitable material for protecting the walls of the reverberatory; today a majority of the smelters have abandoned it, or are using it sparingly. This change has come about largely through the development of a better method of placing the fettling. Most of the newer furnaces are fettled through the roof thus enabling the operators to place a much larger quantity of material on the walls without cooling the furnace unduly, as was invariably the case when the fettling material was shoveled in through the side doors.

At Anaconda, which was largely responsible for the revival of the reverberatory furnace, by reason of the great capacities obtained from the lengthened furnaces, preparations are now being made to fettle through the roof; roasted concentrates and flue dust will be the fettling materials, in place of crushed sandstone. Having

originally a superior fettling material in the "Dillon quartz," the Anaconda metallurgists encountered no difficulties in maintaining the side walls of their furnaces. The plants in the South and elsewhere could secure no similar high-silica material, and were hard put to maintain the lining of their furnaces; necessity forced them to adopt the new method of fettling, the essence of which is the dropping of sufficient cold material on the original fettling to keep the walls cool and hence prevent wear. It is noteworthy that in several plants it was found that fettling with sulphur-bearing ores or concentrates, instead of straight silica, had the advantage of increasing the tonnage materially, as it avoids the smelting of the highly refractory fettling unavoidably detached from the furnace walls.

Another important feature of the changes in progress at Anaconda is the decision to try coal-dust firing. This, like basic converting, seems to be coming in for increased use following half-hearted successes attained in the earlier period of its history; like most successful processes, it requires intelligent and efficient handling in every detail to assure success. At the Great Falls works of the Anaconda company, changes are also in progress. The gas-fired furnaces for which this plant has been noted are now being replaced by direct-fired furnaces. The fireboxes, however, are so large that they are in effect gas producers; the coal used at Great Falls is of inferior grade and is not well suited to the coal-dust firing that is being tried at Anaconda.

Cyanide Consumption in America

The question of cyanide supply for gold and silver extraction has already had much attention from those particularly interested, and the matter of available supply has come in for serious discussion. The greatest trouble has been to find out just what is the average yearly consumption in the United States. There are no definite statistics available, and any estimate is necessarily uncertain. We may, however, obtain a figure which will serve as an approximate guide by studying the statistics of gold and silver production. In the summary of the mineral resources of the United States for 1912, the U. S. Geological Survey provides a series of figures which will serve as a starting point for an estimate of cyanide consumed, and incidentally shows other interesting facts. Using these data, it appears that amalgamation was responsible for 1,003,470 oz. of gold, and 795,755 oz. of silver, these amounts being respectively 22.3% and 1.2% of the total production of gold and silver. By cyanide 1,386,526 oz. of gold and 11,213,159 oz. of silver were produced, 30.9% and 17.8% of the total output of gold and silver respectively. The rest of the gold production is accounted for by chlorination, 0.4%; smelting, 21.6%; and placer mining, 24.8%. Of the silver, 80.8% of the total was produced by smelters, and 0.2% by placer mines.

The total of ore treated in gold and silver mills is given as 9,667,360 tons. Of this, it is reasonable to suppose that the portion treated by amalgamation alone is small. For purposes of an approximation then, it may be assumed that cyanide entered into the treatment of all of it. Since the quantity of cyanide consumed in treating gold and silver ores is widely different, and there is no data of consumption of cyanide per ounce of metal, a division of the tonnage into that treated for gold and that treated for silver is required. A rough division shows about 7,643,551 tons treated for gold, and about 2,023,809 for silver. A reasonable estimate of cyanide consumption per ton of ore treated would be about $\frac{1}{3}$ lb. for gold ores and 2 lb. for silver ores. On this basis, the total consumption would be about 6,500,000 lb. yearly. While this approximation can by no means be called a close one, it will still serve as an indication.

The cyanide consumption on the Rand has already been given in the JOURNAL, and amounts to about 11,000,000 lb. It is probable that if the consumption in Mexico and Canada were added to the U. S. consumption, the total would be greater than that of the Transvaal.

The Southeastern Missouri Mine Managers Become Co-operative

The flotation process is now in successful use by all of the lead-mining companies of southeastern Missouri, having been introduced there by H. A. Guess, the general manager of the Federal Lead Co. Mr. Guess, with a characteristic display of broad-minded professional spirit, communicated his developments to his brother managers in the district. This was an important and noteworthy step in that district, which heretofore has been remarkable for the absence of coöperation among its mining companies and their managers.

In the early days of the district there were some rivalries in securing properties through which orebodies were supposed to extend, but in recent years the district has been a closed one, practically all of the lead-bearing lands of St. Francois County having passed into the hands of a small number of companies. Consequently, there was absolutely no reason for the further preservation of secrecy about information and operation. However, the old ideas prevailed, and one mine manager would not even venture to call upon another, not even in a social way.

A few years ago, some of the engineers in St. Louis invited the managers, their assistants, etc., of St. Francois County, to a dinner conducted under the auspices of the St. Louis Section of the A. I. M. E. This invitation was regarded rather suspiciously in some quarters, and the acceptance of it was not as general as it ought to have been. The next year, however, there was a better result, and after that the fellows in the lead district began to ask, "When is that next dinner coming off?" These meetings served to make the lead miners acquainted with each other, the ice had been broken, and the exchange of professional experiences followed as a matter of course. Thus, southeastern Missouri has become a modern mining district in spirit, as it had previously so become in practice.

South American Export Trade

The National City Bank, with its characteristic enterprise, has inaugurated the publication of a very well prepared magazine, "The Americas," the purpose of which is to assist in the upbuilding of trade between North America and South America. In its foreword it says that it hopes to create a medium which will be of assistance in bringing the business men of the United States and South America closer together. Much valuable work

has already been done by the Government, by the Pan-American Union and by other institutions and organizations, but much is yet to be done.

The National City Bank modestly refrains from referring to its own efforts, but we have an idea that they have been more direct and more practical than almost everything else put together. The foundation stones for international trade are banking facilities. When we have them directly between the United States and the South American countries, we shall have an increase of our export business. The fact that the City Bank has already opened some South American branches is the most encouraging news.

International Congress

Information has been received that the International Congress of Mining and Metallurgy that was to be held in London in 1915 has been abandoned, of course, on account of the upset in conditions produced by the war. The proposed holding of this congress in the same year with the International Engineering Congress in San Francisco was always annoying. A good many persons would have liked to attend one of these congresses in one year and the other one the next year, but not both in the same year, neither time nor money permitting. Abandonment of one of these congresses is consequently a relief. However, we do not see how an International Congress is going to be conducted any more successfully in San Francisco than in London. We understand that the directors of the American Institute of Mining Engineers have recommended that the San Francisco congress be abandoned. An engineering congress may, of course, be held in San Francisco next year, but it cannot be truly international.

Some reference was made recently to the shortage in the supply of potash salts and other raw material which we have been importing for use as fertilizers. That this will be only a temporary inconvenience is altogether probable. Even the inconvenience will be partly diminished by the fact that the South, which is the heaviest buyer of manufactured fertilizers, will of necessity be a light buyer this year. The sufferers will be the manufacturing companies; that is, the two or three large corporations which control this trade.

BY THE WAY

Our mail from Germany shows that our esteemed contemporary, *Metall und Erz,* continues its publication in spite of the war, although its fortnightly issues are thinner than formerly. From its uews pages we learn that the following prices were established in Berlin on Aug. 29: Spelter, 50 to 51 marks; lead, 44 to 46; tin, 355 to 365; copper, 165 to 175; antimony, 85 to 90; aluminum, 212 to 220. The Sheet Copper Association raised the price for sheet copper from 159 to 191 marks. The Sheet Zinc Association, on Aug. 26, raised the base price of sheet zinc from 51.2 to 54.2 marks. We are interested to learn from the advertising pages that the Bergakademie, at Clausthal, in Harz, makes its usual announcement respecting its forthcoming semester, viz., from Oct. 16, 1914, to Mar. 15, 1915, and most of the well known names of its faculty appear in the advertisement.

A subscriber in Mexico, requesting a new change of address, remarks: We hope that we shall not again worry you with further changes; most of us are tired of it ourselves. We have spent the summer watchlessly waiting with Woodrow, and the American occupation of Mexico is becoming a fact again, but we are simply here to straighten up affairs and to endeavor to stop the pillaging that has been going on for some months. Some companies can work, if they have cyanide. All materials are scarce, laborers are cocky even if they are hungry; and the outlook is that we are to have some more of the "same," but we have a sneaking idea that we can somehow weather the storm without having to beat it as we did before. We wonder what the next stunt of the American government will be to get the Americans out of Mexico and turn over the commerce of the country to the Germans and the English; there are no more Vera Cruz's to occupy.

An E. M. was Sherlocking around New York to find a certain trained nurse, and found her in an upper-West-Side apartment, washing a sturdy infant. The father, after a brief introduction, asked the E. M. whether during his travels he had ever run across a prospector named So-and-so. Receiving a negative answer, he explained as follows: "About three years ago, before I married, I boarded at a swell place over in Brooklyn. There was quite a jolly crowd of bank clerks, bond salesmen and others; and one day a mining man came to board at our place. He never let on much about his business for a couple of weeks. Just got to be good friends with everybody, and he seemed a first-rate square sort of a fellow. One night he got to talking about his experiences in different mining camps and of the fine chances he knew of down in Mexico, and how his rich uncle in Denver was going to stake him for a trip in the spring. The upshot of it was that somebody proposed that we get up a little syndicate and send this experienced man down to prospect for mines in Mexico. At first he acted as if he would rather wait for his uncle's cash, but finally consented to a scheme by which 12 of us were to put up 50 dollars a month each, for about a year or less. The prospector showed how he could give us big returns on our money, and that maybe he'd be sending money to *us* before the year was up. Said he would have to travel around pretty much at first, locating the best ground, and that it would be a good idea to have the first six months' installments at the start so he could get a good outfit and hire enough Mexicans to get quick returns from the mines. We came across with $300 each and began to figure how soon we could throw up our jobs and live on Easy Street. But, don't you know, that fellow never sent for the rest of the money and we cannot imagine where he is." That night the E. M. figured it out on the back of an envelope.

GROSS RECEIPTS		
12 suckers, at $300 each		$3600
EXPENSES		
Three weeks' board, at $20	$60	
Theater tickets, about	30	
Taxis, about	15	
Flowers and candy for the ladies	25	
Drinks and cigars	20	
		150
Net profit		$3450

PERSONALS

Carl Johnson has removed from Cripple Creek, Colo., to Denver.

Daniel L. Beck is now head assayer for the Tomboy Gold Mines Co., at Smuggler, Colo.

George H. Heitz, of Leadville, Colo., was married Sept. 2 to **Miss Winogene Nelson**, of Durango.

R. B. Lamb has removed his office to rooms 501 and 503, Traders' Bank Building, Toronto, Ontario.

C. T. Van Winkle has returned to Salt Lake City, Utah, from Arizona, where he has been for some time.

George H. Garrey has returned to New York after making an examination of zinc properties in Tennessee.

Chester A. Fulton has gone to Venezuela as assistant manager of the Compañia Minera lo Increéble in the Yuruari district.

A. J. Eveland leaves New York this week for Pachuca, Hidalgo, Mexico, where he will join the staff of the Compañia de Santa Gertrudis.

J. Parke Channing, who has been recovering from an operation for appendicitis, has left the hospital, and is now at Great Barrington, Massachusetts.

Charles W. Burgess, who has been in Denver several months on account of ill health, has returned to Webb City, Mo., where he has charge of the S. V. D. mine.

J. E. Johnson, Jr., of New York, delivered a lecture on "Recent Developments in Cast Iron Manufacture" on Oct. 8, before the Franklin Institute in Philadelphia.

C. S. Newcomb will return to Mexico on Oct. 15, after several months' stay in the United States. His address will be La Mutua 414, Mexico City, D. F., Mexico.

William M. Brewer has been visiting the Skeena Mining district and Graham Island in the Queen Charlotte Group, and will report on those districts to the Mines Department of British Columbia.

Charles F. Rand has resigned as president and director of Consolidated Coppermines Co., and its subsidiaries, in order to devote his entire time to his Cuban interests. The directors meet Oct. 20 to elect his successor.

Among British Columbia mining engineers who are now serving in the British Army are Captain A. Fournier, of Kaslo; Lionel E. Hill, of Rossland; Lieutenant-Colonel R. G. Edwards Leckie, of Vancouver, and Major J. E. Leckie, of Victoria.

C. A. Buck, vice-president Bethlehem Steel Co., has returned from an extended stay in Chile, where extensive work is in progress in the development of the Tofo iron mines of the company and in providing ore-handling and shipping facilities.

Chester D. Tripp has resigned the presidency of the Rogers-Brown Ore Co., operating the Kennedy, Armour No. 1, Armour No. 2, and Meacham mines, on the Cuyuna range in Minnesota. Charles A. Stillman has been named as his successor.

Wm. E. Dickinson, former superintendent of the Florence and Bates mines of the Florence Iron Co., Menominee range, is temporarily filling the chair of mining in the University of Kansas at Lawrence. He will serve until Feb. 1, to which date leave of absence granted the permanent instructor will extend.

R. B. Shover, formerly general superintendent of the open-hearth plant of the Brier Hill Steel Co., Youngstown, Ohio, but who resigned several months ago, has been appointed general manager of the Tata Iron & Steel Co., Sakchi, India, whose plant consists of two blast furnaces, an openhearth steel works, a rail mill and two merchant bar mills. He expects to start at once for India to take up his new work. He was with the Ohio Steel Co. and the Carnegie Steel Co., before going to the Brier Hill works.

Richard Blackstone, for 10 years assistant superintendent and at present in charge of the Homestake mine, since the death of T. J. Grier, is one of oldest employees, in point of service, now with the company. He went to work as surveyor in 1878, later was made chief engineer. For many years he has had direct personal charge of construction. Under him were built Spearfish water system, hydro-electric plants, Recreation Hall and many other lesser installations. He also constructed Black Hills & Fort Pierre R.R., a Homestake subsidiary, tapping timber country south and east of Lead, and after construction was superintendent of it until its sale. For some years he was superintendent of north-end properties of Homestake, which included Caledonia, Deadwood-Terra and Father DeSmet, and was later made assistant superintendent of all the company's properties.

After a service of more than 40 years, Captain John Trebilcock has retired from the employ of the Steel Corporation on Marquette range and has been placed on the pension roll. He was at the Section 21 property at Winthrop for 32 years, most of that time as mining captain, and when that mine was closed a decade ago he was tranferred to a similar position at the Lake Superior Hematite and Hard Ore mines at Ishpeming, of the underground operations at which he had since been in charge. It is from this post that he has now retired.

OBITUARY

Charles Wesley Kennedy died in Brooklyn, N. Y., Oct. 12, aged 80 years. He was born in Paterson, N. J. He was well known among mining men, having been for many years a dealer in black diamonds, or bort, used in drilling work.

Edward Riley died at Marlowe, England, Sept. 12, aged 83 years. He was a distinguished steel chemist, and was a prominent figure in the early days of the bessemer process. Until a short time ago he took an active interest in the affairs of the Iron & Steel Institute. Mr. Riley was a chemist at Dowlais Iron Works when he made the first experiments in the bessemer process. At the time of his death he was a director of the North Eastern Steel Co., Ltd., as well as of Alfred Hickman, Ltd. Many years ago, the Carnegie gold medal of the Institute was presented to him.

Edmund Benjamin Preston, determinative mineralogist of the California State Mining Bureau, died at Santa Rosa, Calif., Sept. 27, aged 76 years. Mr. Preston was born of English parents at Calcutta, India, Oct. 17, 1838. His early education was obtained in the Royal Polytechnic Academy at Dresden, Saxony, where he spent four years; from there he went to the Freiberg School of Mines, where he spent 3½ years. He supplemented this with one year at the Leoben School of Mines. He went to California in the early sixties and for several years was engaged in mining in northern California, chiefly at Hayden Hill, Lassen County. In September, 1889 Mr. Preston was appointed a field assistant to William Irelan, Jr., then state mineralogist. He served in that capacity under other administrations for a total of 11 years. For the past 14 years he has steadily held the position of determinative mineralogist in the mining bureau and is credited with having made more than 70,000 determinations of mineral samples. During the period of his active field service Mr. Preston wrote Bulletin No. 6, "California Gold Mill Practice." This bulletin was issued in September, 1895, and was the most important contribution to the metallurgy of gold ores up to that time that had been published regarding the practice in California. Close confinement to his duties as determinative mineralogist prevented his carrying out other intended work along the same lines. Mr. Preston's field work and laboratory work combined gave him an acquaintance with mining men and the mining industry of California which probably excelled that of any other individual in a similar situation. He had been ill a year or more although he had been absent from his duties only twice for brief periods. His death resulted directly from pneumonia.

SOCIETIES

New Mexico School of Mines—This school at Socorro starts its winter term with an increase of 20% in registration and attendance.

American Institute of Mining Engineers—The October meeting of the Montana Section was to be held Oct. 16, at the Silver Bow Club, Butte. A technical session was to be held immediately after the dinner. The following papers were to be read and ample time provided for discussion: 1 "Coal-dust Fired Reverberatories at Anaconda," by L. V. Bender. 2 "Mining Claims within the National Forests," by E. D. Gardner, with discussion by F. A. Silcox, district forester for Montana and Northern Idaho.

Editorial Correspondence

SAN FRANCISCO—Sept 30

Polluting the Waters of the American River is charged against dredge operations on the Middle Fork, above Auburn. There are two dredges operating, one belonging to the Pacific Gold Dredging Co., and the other to the El Dorado & Placer Dredging Co. The discovery that the water of the river at Fair Oaks and Orangevale and other sections has been polluted and is carrying disease is quite recent. There has been dredging on the river for years. Of course the two boats now operating are handling a much larger amount of gravel than was handled heretofore, and are operating below Rocky Chucky Cañon which it has been suggested served as a filter for the tailings from the old Cache Rock dredge. It is possible that the tailings from these river dredges have interfered somewhat with the purity of the water, but it is not likely that any great amount of damage is done from this cause as far down stream as Fair Oaks.

North End Comstock Mines are still furnishing reasons for encouraging reports. Union crosscut toward west is being driven ahead and is entering interesting ground. The face is several hundred feet east of the old workings and ore discovered at this point it is said would be of great importance. A station is being cut on the 2650-ft. level of the Mexican winze. This work is below the water level of the old workings and requires much skill and caution. A surprising amount of low-grade ore is being exposed in the Belcher and Crown Point. The electric pumps in the Yellow Jacket are throwing more than 1,000,000 gal. of water per day into the Sutro tunnel, and it is believed when the Yellow Jacket is unwatered and explored, development will prove a good orebody. The pumps were designed by Whitman Symmes. Two of them have been installed on the 2500-ft. level; the other two are waiting installation.

California Industrial Accident Commission is arranging for a meeting on Nov. 5, which owners of both large and small mines are invited to attend. The purpose of the meeting is to consider the bettering of facilities for covering at actual cost the liability of mine owners under the Workmen's Compensation, Insurance and Safety Act. It has been suggested that the commission might be of service in devising and proposing legislation which would tend to relieve the situation complained of by mine owners. While the commission has undertaken the insuring of other industrial operators who are liable under the act, it has never undertaken the insurance of mines except for a maximum policy of $10,000. But unlimited insurance is sold by private companies covering mine accidents. The fact is that when the commission was organized and a fund provided for the establishment of insurance, this fund was not large enough to enable the commission to offer such relief as the mine operators required. There are features in the act that were in fact effective in retarding the industry. There is no doubt that this law should be revised. But it is only fair to the commission to say that it has been conducted in every way for the best interests of the industrial public generally, so far as the law itself would permit. A notable instance is in the carrying out of the work of mine inspection which is done in connection with the U. S. Bureau of Mines. The mine operators of the state are pretty thoroughly advised now as to the purpose and plans of the commission. It will no doubt aid them greatly in coming to some conclusion regarding a plan of mutual insurance if they will attend this meeting and exchange views and hear what the commission has to present. One thing is certain that since the inspection of the mines has been in progress there has been developed a better feeling amongst mining men.

DENVER—Oct. 8

At the Atlas Mine, in the Sneffles Range, the reported successful results of oil flotation for the mixed ores have aroused interest in the availability of this special treatment for other mines in the locality having similar ores. The Atlas test was on an operating scale and, after adaptation, the process seems to meet all expectations both as a means of direct concentration of the sulphide ores and slimes from the gangue and as an agency for selective separation within limits. Heretofore the attempts at solving the "complex" ore problem in this camp were mostly confined to the application of refinements and adaptations of the regular wet table methods. Some application of the electrostatic method has been made with good results but in general this method did not entirely seem to meet the operating conditions. A customs electrostatic plant at Ouray has done satisfactory work from a technical standpoint but companies have not largely availed themselves of the facilities of this plant. One reason is that the smelters have been letting down the bars on the zinky ores recently and the companies are not confronted with the zinc penalty "bugaboo" as formerly. It is reported that some of the special contracts accept 15% zinc in the ore without penalty. There remains however, the loss of the zinc and the freight cost on the zinc in concentrates is serious.

The Leadville District was dazed by the demoralized metal-market conditions at the outbreak of war. Commendable attempts to maintain operations were evidenced by all companies and a good number of them—including the Iron-Silver, Yak, Wolftone, Col. Sellers, New Monarch and Dinero—have succeeded thus far. Many small projects, especially leases, succumbed. Still, a survey of the present situation shows that the camp is weathering the troubles well and, in fact, has utilized the low-market period to make improvements that will enable the mines to do better than ever when satisfactory conditions return. Men have been kept steadily employed and the community thus far is thriving. Better still, a few new enterprises are starting up. The Nisi Prius, on Rock Hill, is under a new lease; the Davis, on Fryer Hill, is pushing its new shaft; the Peggy McCullom, on Breece Hill, along the extension of the President vein, has been taken under lease by Robert Bell, et al., who are installing hoisting machinery and preparing to reopen the old shaft; the New Winnie, on Breece Hill, has started a new shaft; the Double Decker is opening new ground; the Big Four, now under control of the Big Five Operating Co., is doing a lot of development and equipment work; the Ibex or Little Jonny, operating under numerous leases, has been opened up in many new places, and shows up splendidly. Railroad shipments to smelters outside this district, during September, amounted to 895 carloads or 85 carloads better than during September, 1913; while the Arkansas Valley plant is running at normal capacity.

In the Mineral Point Section of the San Juan District at the head of Uncompahgre Cañon, operations are mostly confined to explorations on a limited scale. The one time famous Polar Star on Engineer Mountain is reported to be under negotiation to English interests represented by a Denver engineer. This property under the regime of John J. Crook was a large producer of gold. A plan to explore the deep levels by a tunnel is being considered. The consummation of the plans for this property await the adjustment of title matters. The Richter tunnel is being driven to cut some of the Polar Star veins on their extension. The San Juan Chief near the Polar Star is now controlled by James E. Hill, of New York. It was expected last summer that plans to operate it would be realized but so far nothing has been announced. The Ben Butler near this property is idle. This property carries heavy zinc with gold. It was formerly operated by Thomas Walsh. At the Des Ouray group on the extension of the Old Lout vein the Wahnaka company of Ouray is doing some development and good results are reported. The only work on the Bagley tunnel, Houghton Mountain, is on the Red Cloud vein from which ore is being taken. The Columbus property near the Bagley tunnel and in the Animas Forks section has suspended work for a time. A tunnel is being driven to cut the Columbus vein. W. M. Johnston, of Chicago, has a contract on this property.

In the Poughkeepsie Gulch Section work has been done on the Old Lout mine by a New York company. The tunnel has been opened and some ore taken from the stopes. A reorganization of the company and the consolidation of an important group of adjoining properties is now under way. F. M. Jackson is in charge. The company expects to acquire the Maid-of-the-Mist and the Forest properties for operation through the Lout tunnel which is driven over 1800 ft. and cuts the Lout and other veins. The Maid-of-the-Mist is an extension of the Lout vein and is one of the oldest operations in the Gulch. The Lout operators expect to lease the Mickey Breen mill in Uncompahgre Cañon and install a

flotation unit for the initial operation of the Lout mine. H. L. Damshroder of Ouray is developing the old Poughkeepsie mine at the head of the Gulch.

BUTTE—Oct. 7

Labor Situation—Mayor Duncan and Sheriff Driscoll have been removed from office, as reported last week, by an order of Judge Ayers, issued Oct. 6. As soon as the court entered this order, the attorneys for the two officials announced their intention of taking the matter before the supreme court for review and urged that the court grant a stay of execution for ten days in each case. This was denied. Thereupon the county commissioners appointed John Berkin, an assistant provost marshal under Marshal Conley, county sheriff. The city council in special session appointed Alderman Clarence Smith to the position of mayor.

Being asked his opinion of the verdict, Mr. Duncan declared that his removal was the result of capitalist conspirators against the rights and liberties of the working people; that he had been ousted, not because he failed in his duties but because he had the courage to act by a higher and humaner principle than is approved by the capitalist class. "I can," he said, "better afford to receive this treatment at the behest of the tyrannical masters who inflict it, than they can afford to have brought this upon me. The fight has just begun and I shall fight till either the capitalist system which enslaves my brothers and sisters is dead, or I am dead." He blames the Amalgamated for his undoing, it being popular to blame the Amalgamated for about everything, including the war in Europe. Duncan is socialist nominee for Congress and thinks his treatment will help him.

Mr. Driscoll made the following comment: "If I had to kill a thousand men to hold the job, I don't want the job." The gist of the defense of both officials had been that under the circumstances they did the best that could be done and that to have used more forceful means would, in their opinion, have caused wholesale bloodshed. This opinion is shared by many citizens who have no personal objects in either defending or finding fault with the attitude of the mayor and the sheriff.

The court, however, took the position, shared by an equal if not greater number of citizens, that order should have been maintained and the law enforced at any cost.

On the morning of Oct. 3 both military courts were suspended peremptorily by order of Major Donohue. As no reason was made public, speculation was rife as to both cause and effect of the order and the "Butte Socialist" immediately issued an extra, containing inflammatory and untrue statements in respect to the military regime, and an alleged explanation of the suspension of the military courts. The gist of this was that the supreme court would show Montana to be entirely without military law; that the assumption of authority by the military was illegal and would result in damage suits, aggregating millions of dollars; that the Daly bank, an adjunct of the Amalgamated company, would be "stuck" for more than $100,000 paid on alleged illegal warrants issued for military expenses, etc. To celebrate the suspension of the military courts which was wrongly supposed to have been ordered by Governor Stewart, the socialists arranged for a street parade on the night of Oct. 3. This, however, was abandoned when Major Donohue issued an order forbidding the parade as purposely designed to cause disorder. The "Butte Socialist" plant was closed by Marshal Conley and an order for the arrest of Mayor Smith, joint editor with Duncan, was issued. Smith hid Saturday night to avoid spending the night in jail and then gave himself up at military headquarters Sunday noon. He was ordered by Major Donohue to submit all copy of his paper to the military censor thereafter. He decided that he would not publish his paper under the restrictions and so notified Major Donohue, but later changed his mind and decided to publish. The Major stated that the restrictions imposed on the "Socialist" rested upon all the other newspapers of Butte, which were free to publish the truth but not untruthful, misleading and seditious statements or comment.

Whatever may have been the reasons for the temporary suspension of the military courts, ordered on the morning of Oct. 3, the order was revoked on the morning of Oct. 5. Among the principal cases to come up before this court are those of Muckie McDonald and Joe Bradley, charged with evading the service of warrants for arrest. Other charges may be preferred against them, including that of kidnapping and deporting men.

The plans for reducing the force of militia were put into effect Oct. 2, when 242 officers and men left for their homes, 351 men and 16 officers remaining. How long they will stay will depend on future events. Just now a marauding band of men calling themselves I. W. W.'s are headed for Butte where, according to the leaders, they intend to join an I. W. W. concentration from all parts of the West to defend the rights of their fellows "who have been subjugated in that city by the state militia of Montana." The army committed numerous depredations in the settlements along the Great Northern on the southern end of the Fort Peck Indian Reservation. They held up and robbed threshing crews at the revolver point and set fire to several threshing outfits. Efforts to resist their depredations resulted in the killing of a Great Northern civil engineer and several other persons. Reports received at this writing are to the effect that the army, estimated at from 1500 to 3000, all heavily armed, is headed for Butte from various directions. Wherever opposed they have destroyed property, burnt bridges, looted railway stations, shot and injured trainmen and committed depredations of every description. Should they make their appearance in Butte they will, no doubt, meet with the same effective treatment meted out to other lawbreakers since the arrival of the troops.

SALT LAKE CITY—Oct. 7

The Daly-Judge is to Use Flotation in its mill for the treatment of tailings. This company has obtained the best concentration and extraction possible with gravity equipment, and experiments with flotation have been carried on to effect a further saving on the fine material and slimes. The experiments show that this will pay, and that a good saving can be made on the tailings which will pass 60 mesh; the coarser material must be reground. Work has been under way for some time with the Callow process, using compressed air at low pressure for agitation. The laboratory tests have been sufficiently good to justify the installation of a portable experimental plant at the mill to treat 30 to 40 tons of tailings daily. This plant has been ordered, and will be installed in about two weeks. Flotation experiments will probably be carried on in treating the table feed direct from the classifiers. This material comes from the Huntington mills after being classified. The Daly-Judge mill is treating 150 tons of ore daily, and makes about 100 tons of tailings. In these more than 80% of the lead, silver, etc., and from 50 to 60% of the zinc is finer than 60 mesh. Experiments are being carried on with regrinding the coarser part of the tailings. The saving by flotation in the latter class of material, according to General Manager George W. Lambourne, has as yet not been so successful as on the fines, probably on account of the more intimate admixture of the sulphides with silica, lime, alumina, etc. The concentrates from the flotation process are treated on Wilfley tables, and two products, a lead and a zinc, are made. The zinc concentrate carries 40 to 50% zinc. The lead concentrate carries most of the silver, the iron, and also the copper, which is usually low. The 40-ton experimental plant will be installed on the table floor. This plant is owned by the General Engineering Co., and if it works out as well in practice as in laboratory tests, the Daly-Judge will install a similar plant to treat all of the tailings.

SEATTLE—Oct. 6

Alfred H. Brooks has just completed a complete tour of Alaska and reports that in his opinion a larger output in all minerals will probably be taken from Alaska this year than last. There has been an abundance of water in the Nome region and many plants that lay idle last year have been in full operation all summer, while the gold output has been materially increased by the opening up of a number of small quartz mines. Next year the production of gold should be still greater, for, by that time many big plants which are now being installed at Juneau and smaller plants in other places will be in operation. This will be Alaska's greatest year in copper production; the shipments of ore to Puget Sound are estimated at more than 350,000 tons. Notwithstanding the decrease in the price of copper, owing to the European war, several of the Alaskan mines will continue to operate.

TORONTO—Oct. 10

Leasing of the Right-of-Way at Sesikinika for mining purposes has been decided on by the Timiskaming & Northern Ontario Ry. Commission. The ground to be leased extends from mile post 175 to post 178; tenders are now being called for this parcel. The section includes about 36 acres on both sides of the track. The term of the lease is for 999 years, and the royalty will be 10% of the gross output, as is the case with the Cobalt mines working on land owned by the railway. This is the first section of the right-of-way to be leased north of Cobalt, and is the result of the recent discoveries at Sesikinika, where gold ores in narrow but rich veins have been found. So far no discoveries have been made on the right-of-way, but the T. & N. O. Commission is not the one to stand back when there is any possible chance of making an honest dollar.

The Mining News

ALASKA

COAL LAND LEASING BILL likely to be held up and not passed this session of Congress; was returned to conference committee by Senate, Oct. 10.

BIG MISSOURI—Group on Salmon River at head of Portland Canal reported bonded by Dan Linlerborg and associates, through E. C. Howard to Alaska Gastineau company.

ARIZONA

Cochise County

SHATTUCK (Bisbee)—Denied by Thomas Bardon, president; L. G. Shattuck, managing director, and H. L. Mundie, member of board, that negotiations are under way to consolidate with Calumet & Arizona; denial repeated by C. & A. officers.

Graham County

DETROIT (Morenci)—In addition to suspension of work on each Sunday and Wednesday, company has lately put into effect five-hour shifts for remaining days of week.

Pinal County

LAKE SHORE—Operations at this copper property discontinued by Frank Leonard, new owner. Considerable new equipment was added after change in ownership, and development work will be resumed as soon as situation justifies.

MAMMOTH (Mammoth)—This gold mine 60 miles north of Tucson closed down pending better conditions for development. Property taken under bond about a year ago by Young Bros. who installed uptodate equipment and did large amount of satisfactory development work.

SILVER REEF (Casa Grande)—This group being opened by Mississippi capitalists under company name of Forbach & Co. William Forbach in charge of operations. Considerable tonnage of low-grade silver ore said to be developed and all-slime cyanide plant, about 50 tons capacity, being installed.

VEKOL (Casa Grande) — The 90-ton concentrating plant nearing completion. Designed principally to handle low-grade dump ores, but milling ore from mine will also be treated. Raise from 120-ft. level of shaft No. 1 being made to catch faulted orebody. Mining operations, direction of Capt. William McDermott.

Pima County

GOLD HILL (Tucson)—Surface and underground survey of this group in Little Ajo Mountains completed by M. M. Carpenter. Property carries gold chiefly. Further development and erection of small mill contemplated by C. A. McEuen, principal owner.

Yavapai County

NELSON (Crown King)—Nelson Short Line which connects mine and Crown King completed; standard gage, laid with 53-lb. rails. Road equipped with gasoline motor and will be used in handling supplies and materials.

A & A (Jerome) — Drifting continues on 1650-ft. level. Drift now in over 500 ft. After passing through north-south fault, nearly 200 ft. was driven through spiling ground. Face shows some ore at present. Three shifts being worked in mine and about 20 men on the surface.

CALIFORNIA

Amador County

COARSE GOLD GULCH (Volcano)—Property reported sold to Bert Shuttleworth of Drytown. Active development work will be prosecuted.:

Butte County

PACIFIC GOLD DREDGING CO. (Chico)—New dredge on Butte Creek put in commission.

Calaveras County

SHOTGUN (Fourth Crossing)—Property bonded by M. M. McLain. Will be developed by shaft.

Kern County

ALAMEDA (Randsburg)—Property leased by H. J. Crawford and J. C. McCormack, who will prosecute development work.

Placer County

GARDELLA DREDGING CO. (Lincoln)—Material being assembled for construction of new gold dredge.

HERMAN (Westville)—New electric power plant installed. Power transmitted from Towle, 13 miles. E. B. Quigley, superintendent.

San Bernardino County

SEARLES LAKE POTASH MINES CO. (Searles Lake)—Plant to start Oct. 16, cost $15,000. Property covers about 10,000 acres. J. V. Kelly, president of company. M. G. Sullivan, general manager.

Shasta County

NOBLE ELECTRIC STEEL (Heroult)—First electric furnace to manufacture ferromanganese started; second to start Nov. 15; total capacity, 40 tons per day. Company has two high-grade deposits, one in Mendocino County one in Calaveras. Should high price for ferro continue, company will surely build another furnace to increase capacity to 100 tons.

Tuolumne County

TUOLUMNE RIVER PLACER CO. (Jacksonville)—Preparations made for mining in river bed. Concrete dam for diverting flow of river and 450 ft. of flume to be constructed. E. Wierck, superintendent.

Trinity County

DRILLING OPERATIONS being carried on in Eastman Gulch near Lewiston. Property formerly worked by hydraulic methods and prospecting is with view to installing dredge.

COLORADO

Boulder County

UP-TO-DATE (Cardinal)—Vein exposed in adit and shows supposed extension of shoot opened in shaft up the hill. Owing to altitude of property, further work postponed for season.

WOLF TONGUE (Nederland)—New compressor house under construction at portal of Clyde tunnel through which development work will be resumed in near future. Lilly and Red Spruce veins will be thoroughly opened by drifts. To encourage development work, company is paying lessees $3 per ft. for drifting and $7 for sinking.

Clear Creek County

DOCTOR-TOWN (Empire)—For testing purposes, 20-ton lot of complex, low-grade ore mined. Suitable plant will be erected.

Dolores County

PRO PATRIA MILL (Rico)—Rico Mining Co. preparing to start up to treat custom ores.

Gunnison County

BRANT INDEPENDENT (Pitkin) — Hydro-electric plant nearing completion. Includes two horizontal 100-hp. turbines under 110-ft. hydraulic head, connected to 2300-volt a.c. generators. Voltage stepped up to 6600 volts in oil-cooled transformers and transmitted two miles to Camp Bird mine where it is stepped down to 440 volts. Power will be used in this mine and to drive Copper Mountain adit.

Lake County

WESTERN ZINC MINING & REDUCING CO. (Leadville)—New smelting plant, after few weeks' close-down due to market scare, has resumed full capacity. E. J. Jones now controls company. A. B. Augustine having withdrawn.

Ouray County

WESTVIEW (Ouray)—American Gold will drive new adit below old one to explore American Nettle "contact" at greater depth.

Pitkin County

SMUGGLER (Aspen)—Fire that smoldered in this and adjoining mines for 20 years broke through bulkheads, Oct. 5, and threatened lives of entire underground crew. Supt. Dougald Matheson was most affected as he took risks in endeavoring to save men and, in addition to inhaling much deadly gas, broke one leg. Of 150 men in workings, about 20 were nearly overcome but none completely. Fire started spontaneously in carbonaceous shales associated with silver-lead orebodies and has defied all known methods of extinguishing.

San Juan County

HAMLET (Middleton)—E. A. Ritter, consulting engineer, has issued instructions for addition to mill to bring capacity up to 100 tons. Connections driven to permit handling ore from higher levels through adit opening into mill building, thus obviating use of old jig-back tram that became blockaded every winter.

San Miguel County

BRICKSON (Telluride)—Contract for 100 ft. of development finished and Liberty Bell has taken group under bond and lease.

Summit County

REILING PLACER (Breckenridge)—Boat digging bank 50 ft. deep, in channel 400 ft. wide, and recovering about $30,000 in gold per month.

TONOPAH PLACERS (Breckenridge)—Bullion bricks sold to Denver mint from middle-of-September cleanups are reported as bringing more than $40,000.

Teller County

FREE COINAGE MILL (Altman)—Operations resumed after shut down for repairs and alterations.

VINDICATOR (Independence)—New concentrating mill to be in operation by Oct. 15. Low-grade ore will be crushed, screened and washed.

GRANITE (Victor)—Upper workings leased to Victor Mining & Leasing Company, recently incorporated by Nelson Franklin, Thos. A. Tallon, K. C. Knudesen and F. L. Wilcox.

PRINCE ALBERT (Cripple Creek)—Raise being extended from Iland tunnel level on Beacon property. About 35 ft. from tunnel level, pay streak opened assaying $20. Work will soon be resumed in winze sunk from tunnel level on this vein.

PORTLAND (Victor)—A 3-ton Jeffrey storage-battery locomotive installed on 1750-foot level. New change-room be-

ing built, to accommodate 500 men. Will contain lockers, shower-baths and wash-rooms, also offices for shift-bosses, and first-aid room. Mr. Fred Jones, formerly mine surveyor, appointed superintendent.

GOLD DOLLAR CON. (Victor)—Encouraging surface discoveries on Beacon Hill. In sinking on Arequa townsite, lessees opened promising shoot of pay ore in well defined vein. At point south of Mable M. shaft shoot of ore opened at surface assaying 1 oz. Active operations will be resumed by Gold Dollar Leasing Co. through Mable M. shaft. A. Campbell, manager.

IDAHO

Coeur d'Alenes

H. E. M. MINING CO. (Wallace)—Directors authorized construction of first 100-ton unit of concentrating plant, to cost about $50,000.

STEWART (Wardner)—Preparing to sink shaft from 400-ft. level to 1000-ft.; workings being unwatered now. No. 4 level closed last June, and since then product handled through 200-ft. level. Practically all ore taken from mine has come from workings above 600-ft. level; but said entirely new orebody was discovered in lower workings last June; shaft is to develop this shoot and explore unworked portions of property.

KANSAS

SAMUEL MOSS OF BAXTER SPRINGS made one of best strikes in district, while drilling on his land. Struck run of lead ore at 70 ft. continuing down to 120 ft. making 50-ft. face assaying aout 10% galena. First hole put down in immediate vicinity. Still drilling in good ore and extent of new find cannot be guessed at.

N. J. RYAN LAND (Galena) — Company of Galena men opening fine silicate prospect on this land at Happy Hollow, north of Galena. Have had trouble sinking, lost two shafts, ground being soft and surface water strong. Third shaft sunk to 80 ft. through the ore. Ore will assay about 25%; there is about 12-ft. face.

HORNADAY & CO. (Galena)—Lease taken on Peacock mill and mines on Illinois Lead & Zinc land. Pumping expected to start in few days. Already two good mines on tract, but best run of ore cannot be mined on account of water. Hornaday people expect to drain ground, sublease it to miners, and clean their dirt in mill. This will open large tract of land idle for a long time, and will give employment to large number of miners.

MICHIGAN

Copper

VICTORIA (Victoria)—Operations continue unabating and generally successful. Sales of copper made entirely to domestic consumers. Company well sold up and is continuing operations for present unimpeded by general business conditions. Twenty-sixth level now reached and a crosscut under way, following cutting plat. Best copper again showing in footwall. Copper output for September will show better than 120 tons.

AHMEEK (Ahmeek)—Operations now confined to Nos. 1 and 2 shafts since curtailment went into effect. Ahmeek in better position than any mine in Lake Superior district to withstand long period of low prices, owing to richness of rock and efficiency of working force and management. Two shafts continue to produce grade of rock comparable to best that Wolverine did in palmiest days on Kearsarge lode. Newer shafts could increase Ahmeek's production by approximately 40% at any time. In meantime rock is running close to 24 lb. in copper.

BALTIC (Baltic)—No. 3 shaft, now sinking to 20th level. Close to 1000 ft. of well mineralized ground opened in south drifts at both 26th and 27th levels. No. 4 shaft sinking to 27th level, operations having been resumed after close down for repairs. No. 2 shaft maintaining reputation for good ground; raise from 25th level of No. 3 and winze from No. 2 at twenty-third now connected. West vein showing up some good rock in No. 5 shaft, bottomed at 18th level. This shaft has about served usefulness; situated less than 900 ft. north of No. 4 and its territory can be mined just as economically from No. 4, long trams being easily handled by electrical haulage system.

Iron

EXPLORATORY OPERATIONS begun in Crystal Falls district on Sheldon lands, west of city. Drilling by Cole & McDonald, of Duluth.

JUDSON (Alpha)—Machinery and other equipment formerly in use at Allen mine of Morris Iron Co., Virginia, Minn., purchased by Longyear interests for Judson mine.

INDIANA (Iron Mountain)—Shaft unwatered; workings opened to depth of 250 ft. and found in excellent condition. Mines idle 30 years. Thomas Furnace Co., of Milwaukee, conducting present operations, having recently taken over tract as result of exploratory work.

MINNESOTA

Cuyuna Range

BRAINERD-CUYUNA (Brainerd)—New timber drop shaft going down 2 ft. per day; 38 ft. already gained.

ADAMS (Oreland)—After several weeks' effort to unwater, operation abandoned until next season.

CUYUNA-SULTANA (Ironton)—Shaft No. 2, a 6x8½-ft. "lath" shaft, started Sept. 24, now down 26 ft. Considerable tonnage claimed; this shaft, while large enough for limited mining, is only exploratory.

HILL CREST (Ironton)—Orebody in Sect. 9, 46-29, adjoining Pennington mine, will be stripped and operated as openpit by Roger Hill, owner, name of the operation being Hill Crest Mine. Construction of buildings begun.

BARROWS MINING CO. (Barrows)—Drilling near N. P. station, in town of Barrows, recently developed ore analyzing over 65% iron. Company contemplates sinking concrete and steel shaft if tonnage warrants. Considerable body of ore shown by previous drilling.

Mesabi Range

AFTER PUMPING WATER FROM CARSON LAKE, preparatory to mining iron ore below, Oliver Iron Mining Co. is filling considerable part of depression with solid material to keep in place large deposit of muck in lake bed. To drain water from this muck, "drop shaft" being sunk into it; now nearly 50 ft. deep, has penetrated body of clay, and will be continued until the capping of orebody is reached. Then, by continuous pumping, hoped to drain muck sufficiently to settle it permanently. Overburden from Sheridan pit, new property of the Oliver company to west of Mahoning pit, being used for the filling. Planned to sink permanent shaft through this at point near westerly shore of the lake, where there is no muck. Sheridan will be ready to produce in early spring.

HAWKINS (Nashwauk)—Erection of steel machine shops started.

QUINN-HARRISON (Nashwauk)—Plans being perfected for washing plant to be constructed this winter. Three shovels working in pit.

HILL ANNEX (Calumet)—Two shovels now at work stripping. Property is one of most valuable of Great Northern Ore Co.'s holdings. Guthrie Contracting Co., stripping contractors, estimate several years for completing removal of overburden. Making extensive preparations for work. Bunk houses to accommodate 250 men erected, equipped with bath, reading room and individual beds; model stripping camp of district.

Vermilion Range

ONAHMAN (Ely)—Management seriously considering drilling instead of going ahead with pit work, which is slow. One shaft going down and will not be stopped.

MONTANA

Lewis & Clark County

PIEGAN-GLOSTER (Marysville)—Speaking of progress at these mines of Barnes King Development Co., President Goodale says that equipment of mill now being installed will include crusher, three chilean mills, concentrating tables, classifiers and cyanide tanks. Large part of new equipment now on ground; mill expected to be ready for operation within three or four months. Capacity will be 100 tons per day. If Montana Power Co.'s line from Great Falls is finished in time to furnish power by January, it will be used. Otherwise, boilers and engines left by old company will be put in shape and mill run by steam until electric power is obtained. When property was taken over, old mill building found in good shape, although closed for about 25 years, and no repairs made in that time. Equipment of Gloster mill during time of running, 1880 to 1888, consisted of 60 stamps with amalgamating plates, pans and settlers; with exception of boilers and engines, was sold when mill was dismantled in 1888. Ore was brought from main shaft of Gloster by a surface tramway 2500 ft. long. Under new plans, ore will be brought 1700 ft. from Norman tunnel to mill, by aërial tramway. Old three-compartment shaft had caved around the surface to a depth of nearly 150 ft.; now cleaned out and retimbered down to Norman tunnel, present water level. Soundings show shaft clear at least 250 ft. below. As soon as electric power is available, hoist will be placed and mine unwatered by balling. When 500-ft. level is reached, electric pump will be installed there for permanent drainage. Meanwhile, Norman tunnel, 300 ft. below lower Piegan tunnel, being driven to develop Ophir and Piegan claims; now about 110 ft. beyond Gloster shaft, advancing about 100 ft. per month.

NEVADA

Elko County

ELKO PRINCE (Gold Circle)—Reported mill will be built.

GOLD STRIKE WEST OF TUSCARORA made recently by woman. Two-foot shoot said to assay $70 to $100 per ton.

WINER MINING CO. (Contact)—Articles of incorporation filed. Capital stock, $100,000; par value, $1, of which $75,000 reported already paid up.

EASTERN STAR (Gold Circle)—Grading for new 50-ton mill under way, lumber being hauled and machinery ordered. Development work progressing with satisfactory results.

Humboldt County

GOLD CROWN (Adelaide)—A 4-in. shoot high-grade ore, showing free gold, struck recently.

NEVADA PACKARD (Rochester)—Five cars shipped in September, three by company and two by Kromer-Hampton lease. Settlements for first two cars were $2011 and $1937.

Lander County

ABEL (Battle Mountain)—High-grade gold ore reported struck in Lewis Cañon. Other mines working in district are Starr & Grove and Dean.

Mineral County

AURORA TOWNSITE CO. (Aurora)—A 10-stamp mill being built; will treat custom ores exclusively. About 20 sets of lessees working in district and considerable good-grade ore developed.

AURORA CONSOLIDATED (Aurora)—New mill now treating 350 tons daily. Expected within 30 days will be running to capacity. Last filters being installed. Development work being done on 100-, 200-, 300- and 400-ft. levels. Stated 600,000 tons ore, assaying $4.81, developed above 300-ft. level. Thirty 4-, 5- and 6-room cottages being built.

Nye County

NORTH STAR (Tonopah)—Milling will be resumed soon.

JIM BUTLER (Tonopah)—Wandering Boy shaft being retimbered and enlarged. A 7-ft. shoot of good-grade ore opened in south vein on 700-ft. level of Desert Queen workings, and drifting under way in shoot of rich ore in eastern extension of MacNamara vein on 700-ft. level of Wandering Boy shaft.

Ormsby County

L. P. L. RECOVERY CO. (Brunswick)—Old tailings in Carson River being successfully re-treated for amalgam and

quicksilver. Crew of 14 men employed, and may be increased soon.

Storey County

WORK ON COMSTOCK LODE greatly reduced in amount recently, about one-half usual number of men being employed. Chief work in Gold Hill district, where considerable development work is under way and regular production made; Sturgis mines milling 1100 tons weekly, and Duval lease on Chollar, 200 tons daily.

SIERRA NEVADA (Virginia City)—Control changed. Herman Zadig resigned as president and A. F. Coffin and W. H. Moise resigned from board of directors. W. J. Morrow was elected president; James Newlands, Jr., and W. E. Sharon, directors. W. E. Sharon will succeed F. E. Julihn as superintendent. This regarded as important step toward resumption of development work and mining on lower levels.

NEW MEXICO

Grant County

GUDGER & McSHERRY (Silver City)—Thirty-four-pound silver nugget 60% native silver taken from stope in Silver Cell mine. Development work being pushed.

STAUBER & WRIGHT (Pinos Altos)—High-grade gold ore being taken from Pacific vein and deposited in Silver City bank prior to shipment to California refinery.

SILVER HILL MINE (Pinos Altos)—Company to be incorporated by J. W. Bettes and T. B. Fisher, for $50,000. Lower workings under lease to Frantom & Templeman.

CHINO (Santa Rita)—Additional ore train put into schedule between mine and Hurley mill. Pumping plant at Apache Tejo again in operation; 600,000,000 gal. water per month consumed by company.

PHELPS, DODGE (Tyrone)—New flotation unit to be installed in experimental mill. Three churn drills in operation. First of two Diesel engines successfully started at power plant. Second engine will be started in a few weeks, it is hoped.

Sierra County

OVERLOOK MINE (Kingston)—Twenty-five burros transporting silver ore 18 miles from mine to railroad at Lake Valley.

LAS ANIMAS PEAK GOLD MINES CO. (Hillsboro)—Company took over seven claims formerly property of Hillsboro Consolidated Mines. Intended to begin systematic shaping of property for operation as soon as possible. Company incorporated in Arizona for $1,000,000. General offices, Dallas, Tex.

NORTH CAROLINA

Union County

HOWIE (Waxhaw)—Eight men at work remodeling mill and power plant. Rolls to be discarded as unsatisfactory for this ore and stamps will be put in their place, 10 now, and 10 more later. Slime filter to be installed, Dorr agitators to take place of present air-jet agitators, and eventually another tube mill to be added, increasing capacity to 75 tons, according to statement of management. Main shaft to be sunk 125 ft. deeper, which will give two additional levels, as there is now sump 85 ft. below 255-ft. level. Another shaft to be sunk 100 ft. deeper.

PENNSYLVANIA

PITTSBURGH MANGANESE (Pittsburgh) — Company at 345 Fourth Ave. offers manganese ores mined near Elkton, Rockingham County, Va., where company owns site of 150 acres and controls 229 additional acres of ore lands. Mine has shaft and washing plant and has been producing 100 tons weekly. Analyses show 46.3 to 48.9% manganese, 0.155 to 0.185% phosphorus and 6 to 7% silica.

UTAH

Beaver County

KLONDIKE (Newhouse)—Copper ore carrying iron opened short distance from surface. About 12 tons taken out. Claim surrounded on three sides by Cupric ground.

MAJESTIC (Milford)—Hoosier Boy property recently visited by J. M. Dick, president of company. Good showing on 200- and 400-ft. levels. Probable work will be resumed soon.

CUPRIC (Newhouse)—Company owns 225 acres of patented claims south of Newhouse. Shaft down about 400 ft., and drifting is being done in mineralized ground on levels above. Iron "blowouts" on surface carry bunches of copper.

SHEEP ROCK (Beaver City)—Lessees have ready for shipment gold ore, mined from 300 level. Marketing delayed, pending agreement between lessees and the company as to settlement terms. Company has let contract for sinking new shaft. In meantime, work through old shaft will continue.

Juab County

MAY DAY (Eureka)—Orebody followed in Chief ground holds out well. Twelve cars shipped in September, and earnings for month stated about $25,000. Talk of 3c. dividends being declared. Zinc orebodies turned over to lessees, and four blocks of ground being worked.

KNIGHT-CHRISTENSEN MILL (Silver City)—Work resumed Oct. 2 at this plant, closed a short time for changes. Two shifts employed, later to be increased to three, bringing output up to capacity, or 100 tons daily. Ore from Iron Blossom, Black Jack, Dragon Consolidated has been treated; Iron Blossom ore being milled at present.

EAGLE & BLUE BELL (Eureka)—September output, 1600 to 2000 tons; during first six months of 1914, 12,000 to 15,000 tons shipped. When shaft, now down 1625 ft., reaches 1700, drifting will be done; and as soon as connections with 100-ft. winze from 1550 are complete, all ore will be dropped to 1700, and from there raised to surface. Annual stockholders' meeting held Oct. 3, and directors in office reëlected. J. P. Graves, of Boston, president.

Salt Lake County

OHIO COPPER (Bingham)—F. Augustus Heinze directed to appear before Special Master Alexander Gilchrist, Jr., in New York, to give testimony regarding bankrupt company. Receivers says they have had difficulty in securing sufficient information to proceed with collection of company's assets, and believe Heinze has information of value to them.

Summit County

NEW YORK BONANZA (Park City)—Henry Fares, assignee, has issued notice to creditors to file claims against company with him at Park City, Utah, within three months from Sept. 19, 1914; claims must be sworn to before they can be properly entered.

DALY WEST (Park City)—Machinery for new mill being installed. Steel headframe going up and compressor expected shortly. Expected to have mill in condition for tryout by middle of October, and within month to have normal force of 250 to 300 men at work. Operations at first will be carried on with one shift, treating 200 tons of ore daily.

MINES OPERATING (Park City)—About 150 tons treated daily. Holt-Dern roasters to be installed throughout, and while this work is in progress, no ore will be treated. Present costs will be reduced about $1 per ton by new roasters. Experimental furnace has been in operation some time, and accurate data got. Roasters are automatically fed and shaken down, and roasted ore automatically discharged. Losses in dust and by volatilization reduced.

SILVER KING CONSOLIDATED (Park City)—September output, the largest in history of company, was 1770 tons of first-class ore, as compared to 1033 tons in August. New orebody followed from 1500- to 1700-ft. level, 800 to 1000 ft. on dip of beds; being developed away from fissure to north and south. About 45 tons daily being produced from development. Pipe line being laid from old Comstock mine in Thaynes Cañon, to furnish adequate water supply; distance somewhat over a mile.

WASHINGTON

Ferry County

LAST CHANCE (Republic)—Mine passed into possession, under lease and bond, of Western Union mines, recently organized by J. L. Harper, Spokane associates and West Virginia capitalists. Consideration, $187,500, first payment of $8000 made, remainder to be paid on graduated royalty basis, depending upon value of ore extracted. Owners of Last Chance are Charles P. Robbins, Charles Theis and other Spokane men. Western Union mines plans to take over all important properties in Republic; already in control of Lone Pine, Pearl and Surprise, formerly held by the Republic Mines Corporation, and mine and mill of San Poil Consolidated. Negotiations under way for acquisition of other Republic mines, according to members of company, who say they have sufficient capital available to carry plans through successfully. First bar of bullion turned out by San Poil mill, now under supervision of Harry W. Newton, formerly superintendent of North Washington Power & Reduction Co.'s plant at Republic, passed through Spokane last week, en route to Selby refinery at San Francisco. Contained approximately $5000 and came principally from ore of San Poil mine, averaging about $6.50 per ton. From this grade of ore, San Poil mill recently has been producing about $15,000 to $20,000 monthly, but milling low-grade product is to be discontinued until Western Union Mines has constructed 1000-ton plant which it plans. Arrangements now being made to treat high-grade output of Surprise, Last Chance and lower workings of Lone Pine at San Poil mill. Pending installation of large crude-oil-burning power unit at Republic, to furnish light and power current for entire district, Western Union Mines company piped air into Surprise and Last Chance mines from the San Poil compressor, both properties now being unwatered. Diesel engine installed several months ago at Republic mine purchased by new corporation and will be moved immediately to Surprise shaft to drive tandem compressors placed there, and electric hoist is being put in underground to lift Lone Pine and Last Chance ores.

Okanogan County

PEACOCK (Conconully)—Operations by water power will commence shortly, according to R. A. Hutchinson, of Spokane, chief owner. Power will serve to handle all work.

CANADA

British Columbia

GRANBY CONSOLIDATED has divided properties into four operating units: Southeastern British Columbia, British Columbia coast, southwest Alaska, from Skagway west, and southern Alaska. Each district will have a local superintendent. Policy of expansion, adopted several years ago, will be continued. In addition to acquisition of Midas, Mamie and Dean mines and working option on It mine, near Dean, company has other properties under examination, some expected to develop satisfactorily. Midas and Mamie mines could have been prepared for shipments by Oct. 1, but work was suspended pending improved copper conditions.

Ontario

NORTH DOME (South Porcupine)—G. T. Clarkson, Toronto, appointed liquidator to wind up company affairs. Assets to be distributed.

PORCUPINE PET (Porcupine)—A. C. Palley, formerly manager of Cobalt Townsite and Townsite Extension mines, placed in charge of this properly, formerly known as Little Pet.

HOLLINGER (Timmins)—Regular four-weekly statement for period ended Sept. 9 shows gross profits of $152,821 from treatment of 19,456 tons; approximate extraction, 93.1%. Working cost per ton milled, $3.86, compared with $4.16 for preceding period. Grade of ore treated lowest since milling began. Manager Robbins reports company successful in providing against shortage in chemicals and other foreign-made supplies; good stocks of all necessaries on hand. As soon as three new 4500-cu.ft. compressors are in operation, present force of 700 men will be largely increased.

The Market Report

METAL MARKETS

NEW YORK—Oct. 14

Declining prices and depression of sentiment have been the characteristics of the metal market all around during the last week.

Copper, Tin, Lead and Zinc

Copper—Sales have been made at 11.50@11⅜c., regular terms, during the week, but business has been erratic and prices uncertain. Early in the week there was some hopefulness about the development of a good domestic demand, but this petered out, and during the latter part of the week everything was shrouded in doubt and pessimism.

The London Metal Exchange has ruled that no forward delivery contracts for standard copper are permitted, either privately or publicly, for more than 14 days, except in the case of continuations of existing contracts.

Base price of copper sheets is now 17c. per lb. for hot rolled and 18c. for cold rolled. Full extras are charged and higher prices for small lots. Copper wire is quoted at 13¾c. per lb. for carload lots at mill.

Exports of copper from New York for the week were 3040 long tons. Our special correspondent gives the exports from Baltimore at 946 tons copper.

Visible Stocks of Copper in Europe on Sept. 30 are reported by Henry R. Merton & Co., of London, as follows: Great Britain, 18,610; France, 5536; Rotterdam, 950; Hamburg and Bremen, 3973; other European ports, 500; total, 29,569 long tons. The estimates for German ports are based on stocks there at the opening of the war. In addition to the stocks above, 475 tons are reported afloat from Chile and 5050 tons from Australia, making a total of 35,094 tons.

The official average price of best selected copper in London for September has been fixed at £58 7s. 2⅜d. per ton.

Brass Prices, Base, are announced by the American Brass Co. as follows, dating from Oct. 1: Sheets, high brass, 14c. net per lb.; low brass, 15⅜c. Wire, high brass, 13¾c.; low brass, 15⅜c. Rods, high brass, 13¾c.; low brass, 16⅛c. Tubes, both brazed and open seam, 18¼c. Angles and channels, 18¼c. Scrap allowances are 8½c. net per lb. for high brass and 9⅜c. for low brass.

Tin—This metal weakened owing to a disappearance of demand and the anxiety of some sellers to move quantities.

DAILY PRICES OF METALS

NEW YORK

Oct.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc	
			Electrolytic, Cts. per Lb.	Cts. per Lb.	New York, Cts. per Lb.	St. Louis Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.
8	4.9650	52⅛	*	30½	3.50	3.35	4.75 @4.80	4.60 @4.65
9	4.9688	51¾	*	30¼	3.50	3.35	4.70 @4.75	4.55 @4.60
10	4.9650	51¾	*	30¼	3.50	3.35	4.70 @4.75	4.55 @4.60
12	.....	...	*	...	....	3.35	.....	4·50 @4.55
13	4.9650	51⅜	*	30	3.45 @3.50	3.30 @3.35	4.65	4.50
14	4.9675	51⅛	*	29¾	3.45 @3.50	3.30 @3.35	4.65	4.50

*No quotations.

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.

Some current freight rates on metals per 100 lb., are: St. Louis-New York, 15½c.; St. Louis-Chicago, 6c.; St. Louis-Pittsburgh, 12½c.; Chicago-Baltimore, 10½c.; Chicago-New York, 13½c.

London reported that trading on the Metal Exchange for spot delivery has been permitted. This tended to weaken the market, as it is feared that some weak contracts will have to be closed out.

Visible Stocks of Tin on Sept. 30, including tin afloat, were: London, Straits and Australian, 4006; other kinds, 2744; afloat. 3555; total, London, 10,305; Holland, 375; United States, excluding Pacific ports, 3933; total, 14,613 long tons, an increase of 161 tons during September. Shipments from the Straits and Australia in September were 5023 tons. Total deliveries to England, Holland and United States were 6351 tons.

Lead—The reduction in price to 3.50c., New York, which occurred last week, failed to develop any greatly increased volume of business. Consequently, independent interests began again to shade the price.

Spelter—The market has declined steadily during the week, finally reaching the point where some producing interests themselves turned buyers. Spelter was offered in large tonnages for export at £23, c.i.f., but England bid only £22½@22¾, and no business in ordinary spelter materialized so far as we know. However, there were some export sales of brass spelter and intermediate grades.

Other Metals

Aluminum—There is more inquiry reported, but it has not resulted in much actual trading. Quotations are still 18@19c. per lb. for No. 1 ingots.

Antimony—Business has been moderate, but the position is strong and supplies are decreasing. Ordinary brands are selling around 11c. per lb., while 13c. is asked for Cookson's.

Quicksilver—The market is steady and rather strong. The New York quotation is unchanged at $55@60 per flask of 75 lb. The latest London quotation is £9 per flask.

Nickel—Shot, blocks or plaquettes are 40@45c. per lb. Electrolytic is 5c. per lb. higher.

Minor Metals—Quotations for **Bismuth** are $2.85@3 per lb. —**Magnesium,** $1.50 per lb., New York.—**Selenium,** $3@3.25 per lb. for lots of 100 lb. or over, $5 per lb. for small quantities.

Exports from Baltimore for the past week included 110 lb. selenium to London.

Gold, Silver and Platinum

Gold — The export of $4,420,500 gold to Ottawa, Canada, was made Oct. 9, and more is ready for shipment by the Gold Pool, as required.

Gold in the United States, Oct. 1, is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $973,777,869; in Treasury current balances, $230,116,202; in banks and circulation, $657,944,193; total, $1,861,838,264, an increase of $17,235,582 during September.

Platinum—Conditions are unchanged and the market is still uncertain. Quotations continue $50 per oz. for refined platinum and $57.50 for hard metal; but these prices are largely nominal.

Our Russian correspondent writes that no business can be noted on the home market. The export of platinum has ceased for the present. The platinum mines have generally stopped working except the dredges, which continue in operation. In default of business at Petrograd no quotations can be given. From Ekaterinburg it is reported that small lots have been offered at 9 rubles per zolotnik—$33.84 per oz.—for crude metal, 83% platinum, and even lower; but there are no buyers at the reduction.

Silver—The market continues very quiet. Owing to the war conditions, there is no widespread demand for silver on the Continent or for India. If the opportunity offered, it is thought there would be a good demand for the metal.

The official London quotations for silver for the week were: Oct. 8, 23 1/16d. per oz.; Oct. 9, 23⅝d.; Oct. 10, 23¾d.; Oct. 12, 23⅝d.; Oct. 13, 23½d.; Oct. 14, 23½ pence.

Coined silver in the United States, on Oct. 1, is estimated by the Treasury Department as follows: Standard dollars, $565,878,478; subsidiary coins, $183,059,092; total, $748,937,560. Of the silver dollars, $493,367,000 are held in the Treasury against silver certificates outstanding.

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

	1913	1914	Changes
India	£6,189,000	£4,521,500	D. £1,667,500
China	652,000	42,000	D. 610,000
Total	£6,841,000	£4,563,500	D. £2,277,500

Shipments to India continue on a very limited scale, and no business is being done with China.

Zinc and Lead Ore Markets

JOPLIN, MO.—Oct. 10

Blende, high, $42; assay base, $35@40; metal base, $35@36 per ton of 60% zinc. Calamine base $20@22.50 ton of 40% zinc. Average, all grades of zinc, $37.20 per ton. Lead declined $6 to a base of $40 per ton of 80% metal content. As fully half the ore shipped was on the previous week's purchase the average of all grades is $43.18 per ton. Base offerings of $40 were made Thursday, dropping to $38 by evening and still dropping to the week-end.

SHIPMENTS WEEK ENDED OCT. 10

	Blende	Calamine	Lead	Value
Totals this week	8,643,040	524,660	2,051,120	$214,790
Totals this year	408,810,960	30,690,060	70,933,140	$10,147,550

Blend value, the week, $163,650; 41 weeks, $8,113,640.
Calamine value, the week, $6860; 41 weeks, $358,290.
Lead value, the week, $44,280; 41 weeks, $1,675,620.

PLATTEVILLE, WIS.—Oct. 10

The base price paid this week for 60% zinc ore was $40 per ton.

SHIPMENTS WEEK ENDED OCT. 10

	Zinc Ore, lb.	Lead Ore, lb.	Sulphur Ore, lb.
Week	3,552,400	80,000	1,033.700
Year	124,862,000	4,120,700	27,485,570

Shipped during week to separating plants—3,135,780 lb. zinc ore.

IRON TRADE REVIEW

NEW YORK—Oct. 14

The iron trade continues to report unsatisfactory conditions. New orders for finished steel are not plenty, and there are no signs yet of an immediate increase.

There is plenty of talk of export trade, but the actual results so far are not large. The many difficulties in the way are being gradually smoothed out, however.

The United States Steel Corporation reports unfinished orders on its books on Sept. 30, at 3,787,667 tons of material, a decrease of 425,664 tons during the month.

Pig Iron Production in September showed a marked decrease. The reports of the furnaces, as collected and published by the "Iron Age," show that on Oct. 1 there were 176 coke and anthracite stacks in blast, having a total daily capacity of 60,450 tons; a decrease of 3850 tons from Sept. 1. Making allowance for the charcoal furnaces the estimated make of pig iron in the United States in September was 1,911,600 tons; for the nine months ended Sept. 30 it was 18,297,600 tons. Of the total 12,959,400 tons, or 70.8%, were made by furnaces owned or operated by steel companies.

PITTSBURGH—Oct. 13

The Steel Corporation's statement of 3,787,667 tons of unfilled business at the close of September indicates a loss of 425,664 tons during September, the second month of the war, against an increase of 54,742 tons in August, the first month. The buying during the war scare early in August must have been of considerable proportions. The September loss in unfilled business was equivalent to about 38% of the capacity for the month, and estimating shipments at 62% of capacity the bookings appear to have been about 24% of capacity. The bookings considered, however, are of contracts rather than of specifications against contracts.

The past week has been the dullest the steel market has seen for many years. In plates, shapes and rails there has been scarcely any business. In tubular goods, wire products, merchant bars and sheets there has been scarcely any new business, but there has been specifying against old contracts to an amount equal posibly to 35 or 40% of capacity.

Steel mill operations are dropping below 50% of capacity; the few mills that have been operating at above that rate having practically no hopes of maintaining the gait. Pig iron production is at the rate of about 22,000,000 tons a year, the best rate in the past having been 34,000,000 tons, while the best year's production was 31,000,000 tons. The pig-iron rate is certain to decrease as it is proportionately too high for the rate of finished steel production, and that is decreasing.

An improved demand is reported for steel products among some manufacturers of goods for export, including agricultural implements, but in direct iron and steel export trade there is no improvement.

In most steel products there is hardly enough business being done to establish market prices, the limited tonnage booked being almost entirely against old contracts. Quotations have shown no important change in the past week or two, bars, plates and shapes being 1.15c. to 1.20c., black sheets 2c., wire nails $1.60 and tinplates about $3.25 per box.

Pig Iron—Production of pig iron by merchant furnaces is at the lowest rate since the middle of 1911, and the trend is distinctly downward as many furnaces are accumulating iron. Fresh sales are extremely light and against old contracts buyers are taking less than the tonnages involved. The market may still be quoted as follows: Bessemer, $14; basic, $13; No. 2 foundry and malleable, $13@13.25; gray forge, $12.50@12.75, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—The market is very quiet both as to resale and as to contract material. The English makers continue to quote $68, Baltimore, for contract material, with $2.16 freight to Pittsburgh.

Steel—The turnover in sheet bars in the past two or three weeks has been very light. As noted a week ago, some Youngstown mills would sell sheet bars down to $20.50 at mill, and this week sellers have appeared at the same figure at Pittsburgh mill. We quote billets at $19.50 and sheet bars at $20.50, maker's mill, Youngstown; billets at $20 and sheet bars at $20.50, maker's mill, Pittsburgh. Rods are $26, Pittsburgh.

COKE

The Connellsville coke trade for the nine months ended Sept 30, according to the figures collected by the "Courier" reached totals of 15,602,569 short tons in 1913, and 11,302,541 tons in 1914; a decrease of 4,300,028 tons, or 27.6%, this year.

Anthracite Shipments in September were 6,246,192 long tons, an increase of 673,913 tons over September, 1913. For the nine months ended Sept. 30, the total shipments were 51,281,885 tons in 1913, and 50,067,581 in 1914; a decrease of 1,214,304 tons, or 2.4%, this year.

Export Fuel Trade of the United States eight months ended Aug. 31, in long tons:

	1913	1914	Changes
Anthracite	2,847,443	2,666,969	D. 180,474
Bituminous	11,834,511	9,045,260	D. 2,789,251
Coke	607,767	456,661	D. 151,106
Breaker coal	5,079,189	5,027,956	D. 51,233
Totals	20,368,910	17,196,846	D. 3,172,064

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

CHEMICALS

NEW YORK—Oct. 14

The general market is quiet and business is on rather a moderate scale in most lines.

Arsenic—The market is still very quiet. Quotations remain at $4.50 per 100 lb., but that price is largely nominal.

Copper Sulphate—The market is quiet, but steady, on a moderate business. Quotations are unchanged at $4.50 per 100 lb. for carload lots and $4.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Business continues quiet, with only moderate sales. Quotations are 1.87½c. per lb. for spot and November-December; 1.90@1.92½c. for 1915 deliveries.

Pyrites—Imports at Baltimore for the past week included 6014 tons pyrites from Huelva, Spain.

Imports and Exports of Chemicals in the United States eight months ended Aug. 31, in pounds:

	Imports		Exports	
	1913	1914	1913	1914
Arsenic	5,301,887	2,861,891	66,000	700
Bleach	42,861,542	27,004,166	13,260	12,654
Potash salts	34,166,934	24,732,795	950,499	459,302
Acetate of lime	.....	.....	52,159,647	39,946,187

Exports include reëxports of foreign material. Imports of soda salts are not given in quantities; values were $222,306 in 1913, and $436,705 this year.