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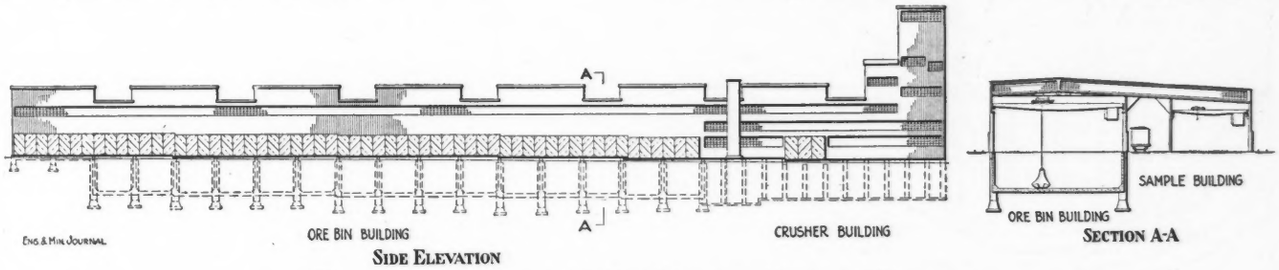
The New Zinc Smeltery at Langeloth

By W. R. Ingalls

SYNOPSIS—A description of a new zinc-smelting works near Pittsburgh, Penn., that is about ready to be put in operation. The plant is built right over a coal mine which supplies the fuel. The gas producers, roasting furnaces and smelting furnaces are of the Hegeler type. The methods of handling material in the works are chiefly mechanical.

The American Zinc & Chemical Co. is about completing a new zinc-smelting works at Langeloth, Penn. The American Zinc & Chemical Co. is a subsidiary of the American Metal Co., Ltd. The works have been designed and built by Nicholas L. Heinz, general manager of the company. Mr. Heinz was formerly with the Matthiessen & Hegeler Zinc Co., at La Salle, Ill.



SIDE ELEVATION SECTION A-A

PROFILE AND SECTION OF ORE BIN AND CRUSHER BUILDING

The zinc-smelting industry during the last 10 years has steadily been marching eastward. Several large works have lately been erected in the Illinois coal field. The Grasselli Chemical Co. has been operating at Clarksburg and Meadowbrook, W. Va., for a good many years, using natural gas as fuel. The American Zinc & Chemical Co. is the first concern to come so far east as Pittsburgh and build a works to use coal as fuel.

Langeloth, which is a new town, is situated a few miles from Burgettstown, about 30 miles west of Pittsburgh, on the Panhandle railway, one of the Pennsylvania lines. The Pennsylvania has built a branch to Langeloth, known as the Langeloth branch, and it is understood will continue this branch farther, making connection with Wheeling, W. Va.; therefore, Langeloth is expected soon to be on the main line from Pittsburgh to Wheeling.

The industrial regions in the vicinity of Pittsburgh and Wheeling constitute the largest center of spelter consumption in the United States. In this region, also, there is a large demand for sulphuric acid, which is required by the galvanizers and tin-plate makers for their pickling liquor, and also is needed by the refiners of petroleum. There is, furthermore, a good market for lead in this vicinity, and lead-smelting facilities are already available, while additional facilities are to be found on the Atlantic seaboard; therefore lead- and silver-bearing residuum can be marketed without incurring any unnecessary carriage. It is as cheap, perhaps cheaper, to bring zinc, lead and sulphur to Pittsburgh in the form of ore as in the form of finished products. The determinative factor is, of course, the existence at Pittsburgh of a high grade of bituminous coal.

The Langeloth smeltery is built right over a coal mine, the company having acquired a large acreage comprising the Pittsburgh seam, which is here 5 ft. in thickness, together with other workable seams, making a total thickness of 10 ft. of coal, which are opened by a shaft only 90 ft. deep. The company is developing its coal mine upon modern lines, and contemplates the marketing of its lump coal and the use of the slack for its own smelting purposes. The latter will be delivered from the mine directly into the bunkers of the smeltery.

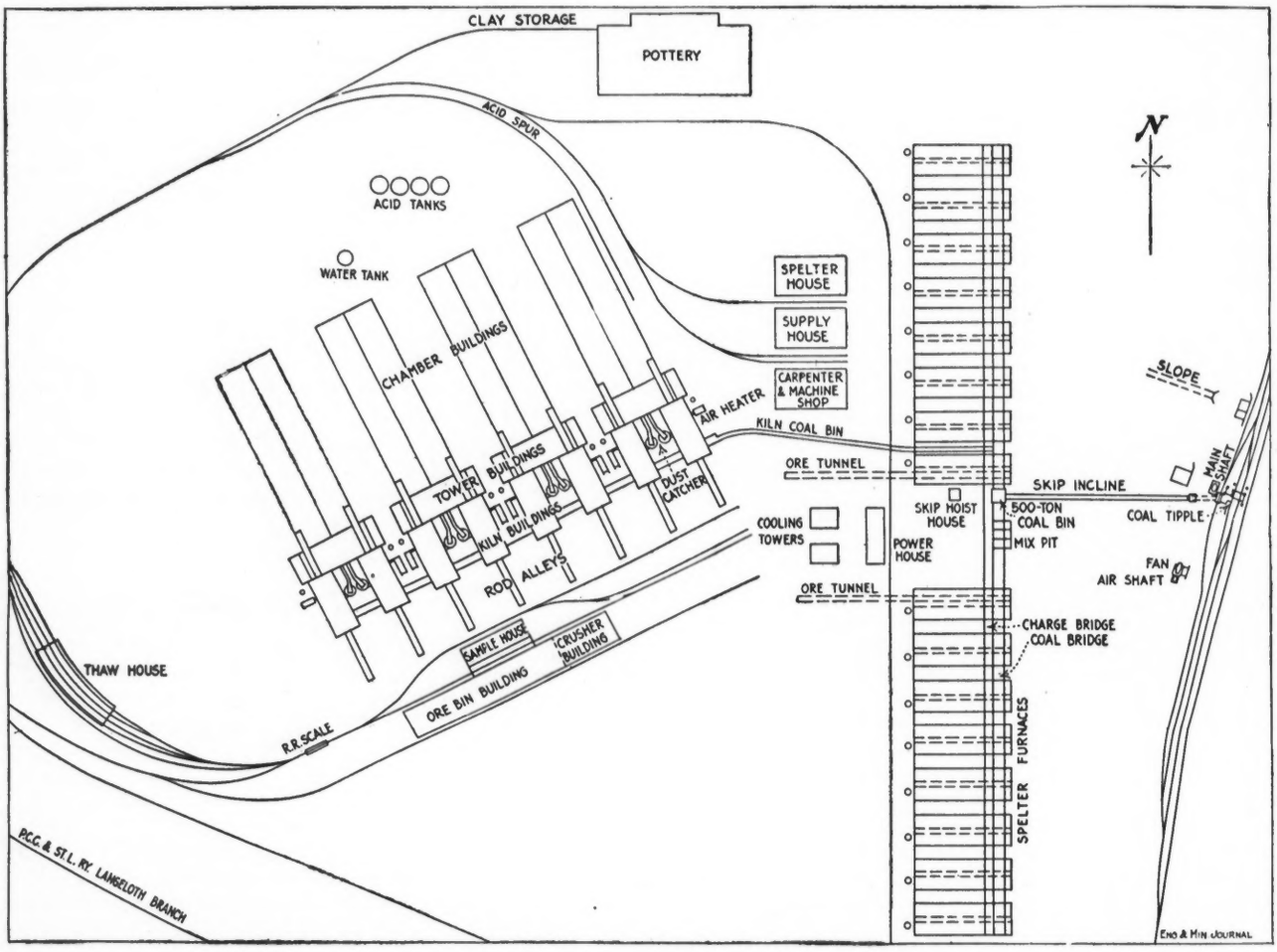
The situation chosen for the smelting plant is unique, being on the top of a hill, from which the ground slopes away in most directions. The topography is uneven, and a good deal of excavation and concrete work had to be done. The disposition of the several departments has been made upon a broad scale; therefore it is unlikely that a cramped condition will develop through any future growth of the plant that can be imagined.

The General Plan

From the metallurgical standpoint, Langeloth is a magnified and modernized La Salle, the roasting, mixing, and distillation departments following closely the Hegeler

designs, but with improvements in details. The plant at present under construction comprises two roasting furnaces and four distillation furnaces, but the layout calls for four times the present number of each. At the time of my visit (Oct. 10) one roasting furnace, together with the connecting sulphuric-acid department, was in operation. The pottery was completed and the manufacture of retorts had just been begun. The distillation furnaces were well advanced, one of them indeed being so far along that it could be put in operation on short notice if desired.

The arrangements for receiving, storing and handling the ore supplies are decidedly better than are to be found in most zinc smelteries. The ore is unloaded from the railway cars into deep bins of reinforced concrete, these bins being built on a side hill, which permits a great depth to be obtained. The row of bins is spanned by a traveling crane, and the distribution of the ore in the bins and the reclamation from them are done by means of a grab bucket. This crane and bucket takes the ore to the crushing and sampling mill, which is of large and thoroughly modern construction. This mill is designed for the handling of both lump ore and fine ore. The ore is dumped upon a very capacious grizzly, the coarse passing to a jaw crusher, and the fine to rolls. For the drying of the ore before screening, there is a Ruggles-Coles cylindrical drier, the gases from which pass through a sheet-steel dust-collecting chamber before being discharged through the chimney. The mill is provided with modern methods for sampling.



General Plan of Works

The Roasting Furnaces

The roasting department comprises two Hegeler muffle roasting furnaces of the standard design. Each furnace is double, seven hearths high, the individual hearths being 6 ft. 1 in. by 80 ft. Consequently the furnace has a hearth area of 6813 sq.ft. Only the lower three hearths are muffled. These furnaces are of extraordinarily massive construction. The interior arches, which are built with a considerable spring, are laid with tongued-and-grooved brick. Above each row of skewbacks is laid a line of heavy projecting brick, which carries the weight of the rabble and keeps it entirely off the hearth. The hearth paving is, of course, free to rise or fall with the arches.

The rake rods are jointed in sections, permitting easy replacement of any part. They are pulled and shoved by connection with an endless chain, following the fashion originally introduced at Peru, Ill. The time of raking each hearth is registered automatically in the office, enabling the roasting operation to be supervised at headquarters.

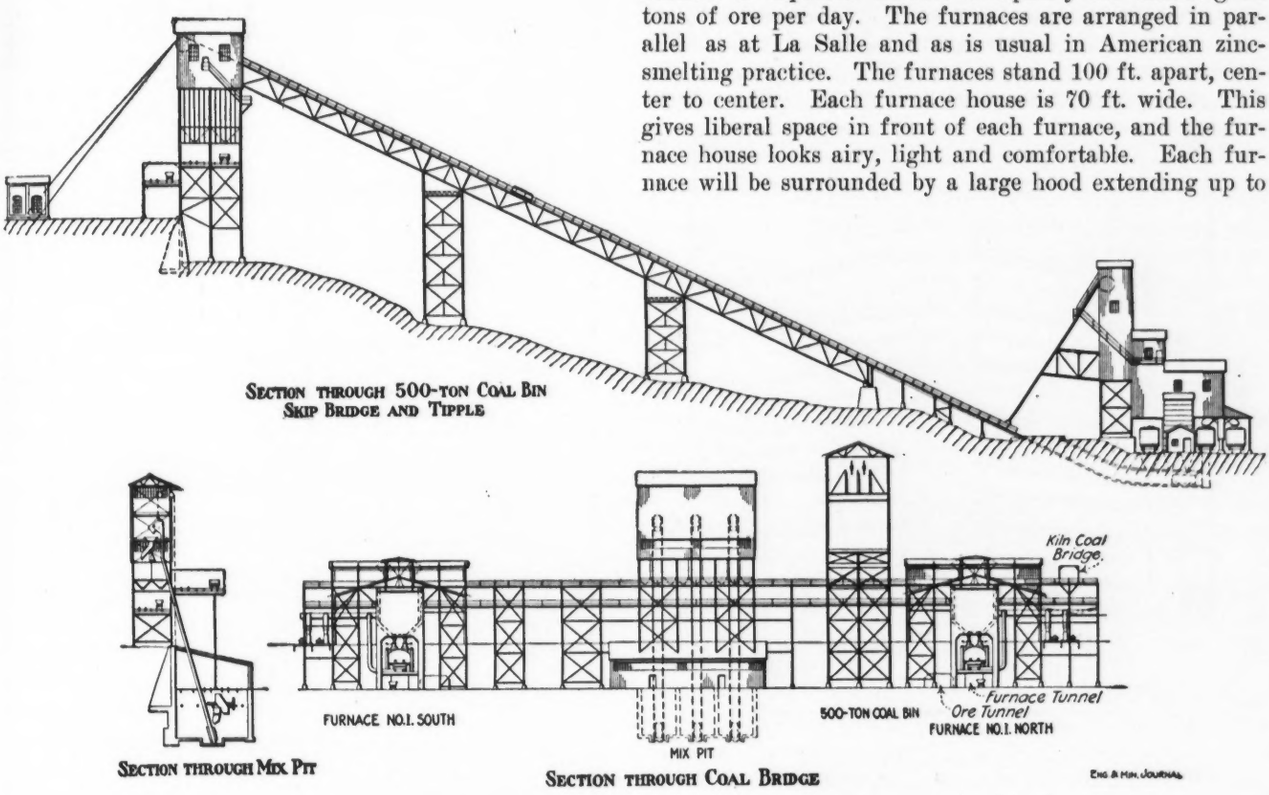
Each furnace has a gas producer, 9x15 ft. The boshes of this producer are water-cooled. The gas from these producers burns in the flues under the fifth, sixth and

seventh hearths, the secondary air being introduced through ports in the sidewalls of the furnace. From the combustion flues the gases pass through a U-pipe stove and thence to the chimney. Their temperature upon leaving the furnace is 800° C.; upon arriving at the chimney, 200° C. The air required for the combustion of the ore passes first through the U-pipe stove, wherein it is heated to 400° C.; thence it passes through flues under the sixth and seventh hearths, alternating with the combustion flues, wherein it is heated to 700° C.; thence it passes through flues and ports in the middle wall of the furnace into the muffles. The air supply is forced into the furnace by means of a Sirocco fan. The preheating of the air and the construction of the furnace generally give very good results in the matter of fuel economy.

54-in. fans, made of hard lead (90% lead and 10% antimony), motor driven. The above mentioned towers and chamber space are for one roaster only; therefore, each roaster has one Glover tower, three Gay-Lussac towers and 10 chambers with 360,000 cu.ft. of chamber space. The acid is elevated to the tops of the towers by means of cast-iron acid eggs; each egg holds seven tons of acid. The dust chambers are set directly over the tunnel which runs underneath the roasting furnace, and are hoppered to one point so that they are very easily cleaned.

The Distillation Furnaces

The distillation furnaces now under construction at Langeloth are four in number. They are Hegeler furnaces, each comprising 864 retorts, six rows high. The retorts are cylindrical, 8 in. in diameter inside. Each furnace is expected to have a capacity for smelting 20 tons of ore per day. The furnaces are arranged in parallel as at La Salle and as is usual in American zinc-smelting practice. The furnaces stand 100 ft. apart, center to center. Each furnace house is 70 ft. wide. This gives liberal space in front of each furnace, and the furnace house looks airy, light and comfortable. Each furnace will be surrounded by a large hood extending up to



Profile and Section of Coal Bridge

The furnace roasts about 55 tons of ore per day, or about 16 lb. per square foot of hearth area, using about seven tons of coal, or about 13%. The roast gas contains about 4.5% SO_2 by volume and reaches the Glover towers with a temperature of 380° C.

Sulphuric-Acid Department

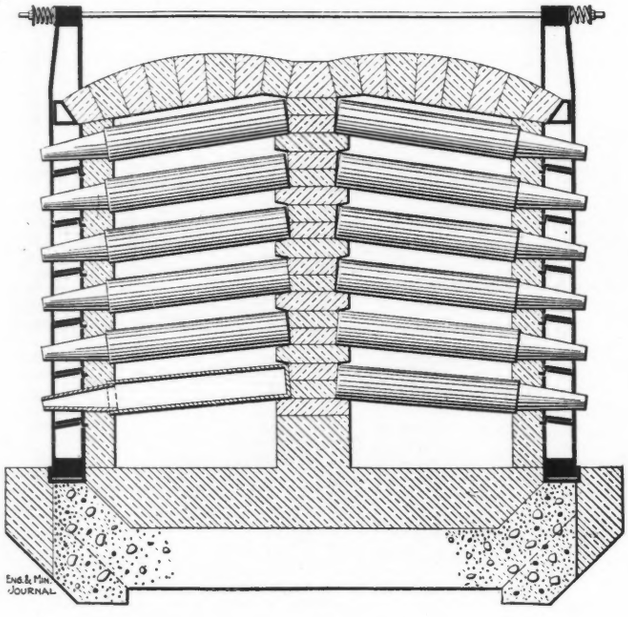
The gases leaving the roasting furnace pass through a centrifugal dust catcher, which is 30 ft. in height and 26 ft. in diameter inside. From here the gases pass to the Glover tower, which is 14x14 ft. in section and 40 ft. in height. The gases leaving the Glover tower pass through 10 lead chambers, which have a total capacity of 360,000 cu.ft. Then, from the chambers the gases go through three Gay-Lussac towers, 14x14x40 ft. All the towers are filled with special brick. The gases are forced through the acid chambers and towers by means of two

the monitor on the roof, as at La Salle. The spaces 30 ft. wide between the respective furnace houses are roofed in.

Each furnace is fired with gas from a Hegeler producer 9½x22 ft. At the gas-inlet end, the middle wall stops short of the end wall and is reduced to a thin edge, the purpose being to divide the gas between the two combustion chambers. At the chimney end there is a wall of checker-work, just in front of the main end wall of the furnace, by the closing of the openings of which the current of the combustion gases may be controlled to some extent. From the furnace the combustion gases pass through a Rust boiler (vertical tubes) of 525 hp., and from the boiler they pass to a brick chimney 125 ft. high, 6 ft. in diameter (inside) at the top. Standing by each chimney and connected therewith is a down-draft kiln for annealing retorts. Each boiler is provided with a fire-

box for the direct combustion of coal, enabling use to be made of the boiler when the distillation furnace is cold, for repairs or otherwise.

The air for the combustion of the gas in these furnaces is delivered by a No. 6 Sirocco fan (one for each furnace), which has capacity of delivering 27,000 cu.ft. of air against 5 in. of water. The air main extends longitudinally over the furnace in the middle, branches conducting air to the front of the furnace, where it is blown in through ports in the wide front pillars between every section of 24 retorts. A new feature of this furnace is the flat roof-arch laid at a slope corresponding with the slope of the retorts. Inasmuch as such an arch will not give upon expansion, but will transmit a full thrust to the skewbacks, the upper ends of the buckstaves are connected with the tie-rods through springs, so as to allow for expansion in the usual manner of many metallurgical furnaces of similar construction. The buckstaves are of cast iron. Their footings have a ball-and-socket joint, permitting movement in any direction. In the construction of the front wall, pillars stand on pillars. Every



Transverse Section of Distillation Furnace

other pillar has a piece of heavy steel wire baked in it. The ends of this wire are bent around the flanges of the buckstave, holding the pillar to the buckstave.

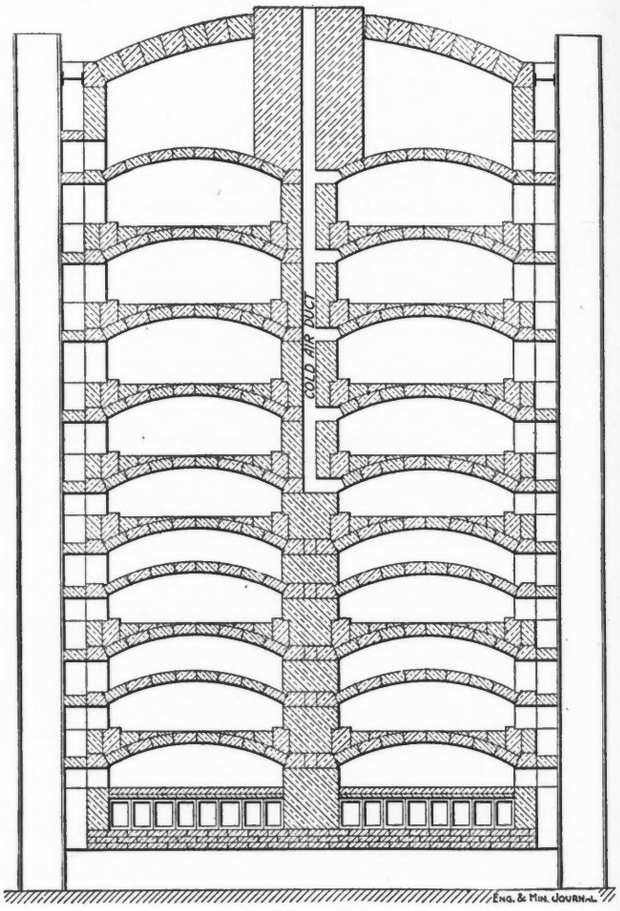
The ash pockets in front of the furnace are unusually commodious. It is contemplated that they will not be completely emptied at any one time, but that enough residuum will be left in them to prevent any updraft in front of the furnace. In the floor of the furnace house are several chutes for the immediate disposition of broken retorts. The tunnel beneath the furnace is large.

Power Plant and Pottery

The power plant of the works is of 2000-kw. capacity, developed by turbine-generator sets, the steam coming from the waste-heat boilers of the distillation furnaces. Both alternating and direct current are available. The production of power will be greater than required by the works itself, and it is contemplated that a considerable surplus will be sold to a local street-railway line.

The pottery is an unusually spacious building. In the manufacture of the retorts, chamotte from Cresson, Penn., and plastic clay from St. Louis, Mo., are used in the proportion of about half and half. The clay is crushed in edge-runner mills of ordinary construction. The clay is pugged in a Wettengel pug mill, and the retorts are molded by a Wettengel hydraulic press. The condensers are made by the well known Garrison machine. The drying rooms are heated by steam pipes beneath the grated floors upon which the retorts stand, the moist air passing away through galvanized-iron ducts.

In this brief sketch of an interesting plant, I have scarcely touched upon the character of the construction, which in the main is brick and reinforced concrete, nor upon the system of handling material through the works.



Transverse Section of Roasting Furnace

Speaking generally, there is large storage capacity between the several departments; therefore, it is hard to imagine how an interruption of work in any one would interfere with the operation of the other departments. The mouth of the coal mine, which supplies the fuel, is at the foot of the hill on which the works is erected, the coal being sent up over a long, inclined trestle, the top of which is at such height that delivery may be conveniently made to any department of the works. The car running up this trestle delivers into a 500-ton bin. In starting up this system, one man, a green hand, raised coal at the rate of 150 tons per hour.

In the layout of the works there has been no servile adherence to the theory that the material ought to pass from one department to another by gravity, disregard-

ing the fact that the elevation of material to a moderate height costs but a trifle per ton. An attempt to conform to the conditions of gravity often results in a cramped condition of the works. At Langeloth the several departments have been laid out with broad spacing, and where it has been necessary to elevate material, the problem has been approached boldly, levels being created where they were desired. Thus the ore is brought to the roasting furnaces through a tunnel beneath them, and is elevated to the top of the furnaces by means of a large substantial belt elevator for each furnace. The belt elevator delivers to a drag conveyor which carries the ore to the feed hole in the top of the furnace, the ore experiencing its final drying during this movement.

Not far from the works the company is building a model town for the housing of its employees. The late Jacob Langeloth was greatly interested in this town and remembered it substantially in his will. It is expected that this town will embody all the best ideas for promoting the comfort and welfare of the working men, and being situated in a pleasant farming country, there are unusual opportunities. A description of this must be deferred, however.

Limestone Production and Its Uses

By Edwin C. Eckel*

Limestone is one of the most important raw materials among the mineral products available for modern industry. This would be more readily understood if the total limestone output of the United States, including all the stone used for various purposes, were to be reported as a unit. In the past this has not been done, owing to the inconvenience of the computations necessary; and to the fact that in some cases only approximate results can be secured. But in the course of revising a volume on cementing materials, it has seemed desirable to attempt to place the matter on a reasonably clear footing, and the following results are thus made available.

In the official statistical volume of the U. S. Geological Survey, a portion of the total limestone output is reported under the head of "stone," and of this portion part is given in long tons, part in short tons, and part merely by value. Another portion of the total is, of course, represented by the figures given in another chapter under the head of "lime," where the lime produced is reported in short tons. A third portion of the limestone output is implied, though not stated, by the figures given in still another section under the head of "portland cement," for both portland and natural cements use limestone as a raw material. Other smaller portions of the total appear as raw materials or adulterants in other industries.

It is, of course, possible to make quite close approximations to the quantity of limestone represented by the actual output of lime, portland cement and natural cement. It is further possible to make approximations, though necessarily somewhat less accurate, as to the tonnage of stone represented by the values given for the building stone output. The last step, the conversion of these figures into the same unit, is merely a matter of arithmetic.

The official statistics relative to the stone industry during 1913 have appeared on the day that this is written, and have been recalculated and added to figures already prepared for the 1912 output of various types of limestone. In the table following, therefore, we are prepared to furnish data on the total quantity of limestone quarried in the United States during the two years 1912 and 1913, and on the subdivision of this total output according to its main types of utilization. It is the first time that estimates of this character have been presented; and, of course, they are merely approximate. But they are close approximations, and most of us would prefer a prompt diagnosis to a precise post-mortem.

TOTAL LIMESTONE OUTPUT AND USES, 1912-1913; SHORT TONS.

Utilization	Short Tons 1912	Short Tons 1913
Crushed stone for road metal, ballast, concrete	33,122,642	35,169,528
Blast-furnace flux	22,613,420	25,335,476
Raw material for portland cement	18,500,000	20,720,000
Burned into lime directly	6,300,000	6,435,000
Rough and dressed building and paving stone	3,700,000	3,300,000
Sold crude, mostly burned into lime by buyer	2,000,000	2,000,000
Raw material for natural cement	150,000	135,000
Total limestone output, short tons	86,386,062	93,085,004

The preceding table enables us, for the first time, to form some definite idea of the relative importance of the different utilizations of limestone in the United States during recent years. So far as can be determined, only about 4% of the total output of limestone and marble is used as building stone, decorative stone, curbing and flagging, etc. Adding to this the crushed stone used for road metal, railway ballast and concrete aggregate, we see that all of the physical utilizations of limestone, taken together, absorb about two-fifths of the total output. The remaining three-fifths goes into uses in which the chemical properties of limestone are the important factors.

As to these chemical utilizations of limestones, we can see that about one-quarter of all the limestone quarried is used as blast-furnace flux and that about one-fifth of the total is used as raw material in the manufacture of portland cement. Almost exactly one-tenth of the total is burned into lime and used in that form for one purpose or another.

The statistics which are available do not enable us to go back very far in the past history of the limestone industries, for it is not until recently that even fairly accurate estimates as to some lines of utilization are obtainable. But it seems clear that for at least a decade past there has been a progressive increase in the relative importance of the chemical uses of limestone, as compared with the purely physical utilizations. If it were not for the growth of the crushed-stone industry, the disproportion between the two main classes of use would have been still more striking, for, so far as we can learn there has been little proportionate increase in the structural uses of limestone for many years.

Precipitation of Alumina in Presence of Fluorides

In presence of fluorides, alumina is not completely precipitated by ammonia, according to H. Cavaignac, in *Comptes rendus.* Thus, from a solution of ammonium-aluminum fluoride, ammonia precipitates only 84 to 98.6% of the alumina at the ordinary temperature and less than half that at 100° C. In addition the precipitate is contaminated with entrained fluorides.

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Men and Machinery of the Comstock--The Combination Shaft

By G. W. Dickie

SYNOPSIS—Some of the problems involved in making piping as well as pumping machinery for pressures running up to 2150 lb. were especially interesting before the days of steel castings. Large air chambers were required and special pumps were designed for giving the necessary supply of air to them. The "burial" of a $46,000 two-stage air compressor, which antedated all others by 15 years, was ordered by Mr. Fair. The first Pullman car. The building, testing and starting of the hydraulic plant for three great shafts.

Time was an important element in our contract with the Chollar, Norcross and Savage mines, so we did not lose any in starting. There was nothing new or novel to the engine part, except size, and details for parts of it were in the shop within a week after signing the contract. It is unfortunate that all the plans for this work, including a complete set of drawings and photographs that I had collected, were destroyed in the great fire of 1906, as some illustrations for this article would have added much to its interest. I will, however, give as clear an account of this work as I can, and of what we had to go through and how we finally succeeded.

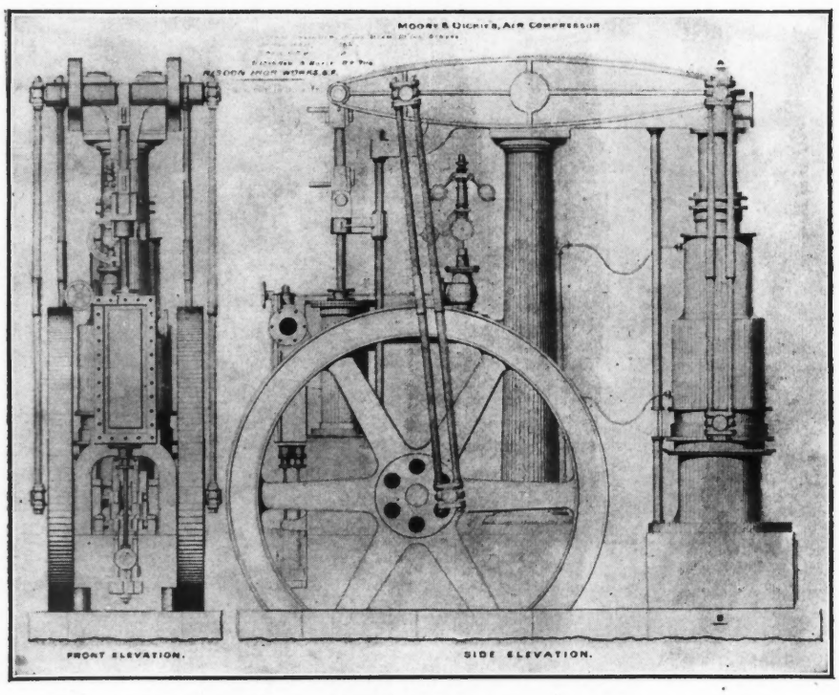


Fig. 1. Dickie's Compound Air Compressor

I was 32 years of age when this work began, and a year later, when all was operating as specified, my hair was as gray as it is today.

There were no steel castings made then and no solid-drawn steel tubing; we had to build this great work with the materials available, which were iron castings and forgings. The pig iron we had was of good quality; it did not pay to ship any but the very best iron to San Francisco, for at that time the freight from the East or Great Britain by sailing ship was $12 per ton. Such being the quality of the iron, we could depend on 18,000 lb. tensile strength for the castings, and I decided on 3000 lb. per sectional inch as the working load on all cast-iron work, with such reinforcing as special shapes required. Thus for the air pressure accumulator, the inside diameter of which was 30 in. and working pressure 1000 lb. per sq.in., the thickness both of walls and of the flanges was 5 in.; the flange belts were 1½ in. diameter, 5 in. pitch; the faces of the flanges rabbeted into each other inside the bolt lines; the joints were copper gaskets. This type of joint was used throughout all the hydraulic work.

A Power Pipe Pressure of 2150 Pounds

The power pipe that stood vertical in the shaft was 10 in. diameter, and 1000 lb. pressure at the top and 2150 lb. at the bottom, being 1⅝ in. thick at the top and 3½ in. thick at the bottom. The 12-in. return pipe, with no pressure at the top and 1150 lb. pressure at the bottom, had a thickness of ⅝ in. at the top and 2⅜ in. at the bottom. All bends and elbows with a radius less than five times the diameter of the pipe were thickened correspondingly on the inside of the curve. We annealed all pipe castings in the hydraulic system. To provide against shock at the ends of the stroke and to absorb it, we had three air chambers at the back end of the pump station at the 2400-ft. level, one for each of the pumps. On the descending column we fitted recording pressure gages at each 100 ft. to determine if there should be water rams at any point. These enabled us to ascertain the cause of two breaks that occurred in the pipes, one at the 1800-ft. level and the other at the 1200-ft. level.

The charging of the air chambers and the great air-loaded accumulator at the surface involved the necessity of designing a special air compressor, and as the pressure at the pumping station was 2150 lb. per sq.in., we had to devise something that would deliver air at 160 times the atmosphere, at Virginia City. I had been working on a type of air compressor that would compress in two stages with a compound engine, and determined to make a smaller model of this compressor to be used for the hydraulic-pump system. I fortunately have a lithograph, Fig. 1, of a larger one made at this time, which I will use to illustrate what I made to charge the air chambers. This was made many years before compressing in two stages came into general use.

In the small one, made for the Chollar, Norcross and Savage shaft, the steam cylinder was 8 in. diameter with

a stroke of 24 in.; the rams, which were stationary, the cylinders sliding over them, 7 in. diameter for the lower and 2 in. for the upper one. On the up-stroke the air was taken through the valve in the head of the lower fixed ram; on the down-stroke this air was compressed through a valve into the upper part of the cylinder. It was then at nine atmospheres. On the next up-stroke this air was compressed until the valve in the lower end of the upper ram opened, which it did at 2150 lb. pressure and at about 2 in. from the end of the stroke, and delivery was made into the receiver. This small compressor gave excellent results with little trouble; it was run about two hours each day to supply all the air required.

The Crown Point Compressor

We built at this time a large compressor, of which the above was the model, and I think it would enliven the narrative to tell here the story of the Crown Point compressor. The Crown Point mine had been long under the control of the Bank of California crowd. It needed a new and large compressor, and I urged its management to order one of my new compound type, which it did. It was to have two beams—a double arrangement, as shown in Fig. 1. The high-pressure steam cylinders were to be 18 in. and the low 36 in., with a stroke of 42 in. The air rams were to be two lower rams 26 in. diameter and two upper rams 14 in. diameter, with a capacity of 2000 cu.ft. of free air per min., compressed to 80 lb. per sq.in. pressure. The flywheels were arranged as shown in Fig. 1.

We completed this compressor in four months and had it set up and tested in the shop, a fine foundation having been built for it at the Crown Point mine. Just about the time that we were ready to take it down for shipment the Bonanza crowd got control of the Crown Point mine. Mr. Taylor, president of the Risdon Iron Works, came to the office one morning in great trouble and called me into a private room to inform me that the enemy were in control at Crown Point and it was all up about the compressor.

"Now," said he, "you seem to be on better terms with Mr. Fair than any of us, and I want you to go up to his office and see what you can do about it." So to Mr. Fair's office I went with great trepidation, for he might be in a bad humor, in which case I had little chance of accomplishing anything. I found him in his office evidently elated over the Crown Point business. When I entered he said heartily, "Be seated, Mr. Dickie; now what can I do for you, my son?"

"Mr. Fair," I said, "I have come up to see you about the new compressor for Crown Point. It is all ready and has been tested in the shop, and I thought you might like to come down and see it run before we ship it."

"But," he replied, "I do not want that compressor."

That remark made me feel rather down-hearted, so I ventured cautiously to extol the virtues of my compressor, and said, "Mr. Fair, why don't you want that compressor; it will be more economical than any compressor now on the Comstock by at least 30 per cent."

Then he let me in on some of the economics of mine control by replying, "Now, my son, you've got it. We have got control of that mine, so that if we can't get metal out of her we can put wood into her; we are selling Crown Point 80 cords of wood per day and an economical compressor will cut down our sales."

"Mr. Fair," I said, "the foundations are all complete and the holding-down bolts in place, ready to receive the compressor, and you cannot afford to leave it incomplete, so you had better let me ship it, especially as a great many mining men are anxious to see how it will turn out."

"Now, my son," he said, "you had better not say anything more about it; we are not going to take that compressor." "Then," said I, "what are you going to do about our contract?" "Oh, you have a contract have you? Robert, where is that contract with the Risdon for a compressor? Ah, my son, here it is, $46,000. It seems to be all right. Robert, make out a check to the Risdon Iron Works for $46,000 on Crown Point account."

Burying a New Idea

"That's all right," I said, "but what are we to do with your compressor?" "How big is this thing, my son?" I told him about 20 ft. long, 17 ft. high and 8 ft. wide. "Well, my son, it's pretty big—too big to bury it standing up, as you get into water pretty quick down at your place, but dig a nice hole and lay it on its flat. You can go down 9 ft., and cover it up carefully; no headstone, I want your compressor to have a nameless grave and we'll say no more about it."

So ended the chance for a real two-stage compressor, and it was 15 years before anyone else built a compound compressor. Passing some time ago the site of the old Risdon Iron Works, I came across one or two parts of the old Crown Point compressor; probably no one but myself could identify them. In those days we had some rather strange experiences in our endeavors to advance science and engineering.

Reverting to the matter in hand—the great hydraulic pumping plant for the Chollar, Norcross and Savage Combination shaft—good progress was made with the work. Within one month from signing the contract, details of all the principal parts were in the shop and the engine cylinders were in the foundry. Foundation plans had also been made and sent to Mr. Requa at Virginia City, where work was begun on them. The estimated weight of this plant was 1175 tons, but it finally ran a little over 1200 tons. A special testing outfit was made so as to have the testing done thoroughly and without loss of time. In order to insure ourselves against the danger of porous castings, all parts that were to be under the high pressures were carefully cleaned and pickled to remove all scale, then filled with liquid resin, and placed in an oven, 400 deg. F., where twice the working pressure was applied to the resin. After this they were subjected to an hydrostatic test of two and one-half times the working pressure. In no case was there any sign of the water finding its way into any porous parts in the metal.

A modification was made in the first plan for the hydraulic pumps, whereby the operating valves were worked by rams outside the valve box. The valves were operated by a floating lever in such a way that when one valve was seated it became the fulcrum for the lever lifting the other. By this means there was no danger of one valve leaving its seat before the other was seated. The small valves, which got the name at the mines of the "piano" valves, were worked by cams on an oscillating shaft actuated by adjustable tappets on the pump rams. These worked perfectly from the start.

Erecting the Great Pumping Plant

In about six months' time the great bulk of the work had been delivered at the mines and erection began. The best men we had were employed in this work. Andrew Moore, son of Joseph Moore, of the Risdon Iron Works, had charge of the erection of the engine. Charley Matheson, the underground foreman at the shaft, was in charge of the work in the shaft, the pumps at the 2400-ft. station, and of all handling of heavy parts, whether in the shaft, underground or at the surface. In due course I was notified that a start would be made on a certain day, and that I had better come up, and as I wanted to go carefully over the whole work before a start was made, I at once left for Virginia City.

At that time we left San Francisco on the five o'clock boat for South Vallejo, 28 miles up the Bay, and thence went by train via the Central Pacific to Virginia City, arriving there at nine o'clock the following morning. The first Pullman car was built for this service. Mr. Pullman was a close friend of Mr. Requa; they had mined together as young men. I met the Pullmans several times at the Requa home, in Virginia City.

This special Pullman reserved for passengers to Virginia City was named "The Silver Palace," from the fact that the columns from the ends of the seats to the roof and the curtain rods extending between them were all silver plated, and we all thought it the finest thing possible on wheels. There was one stateroom in this car, and as my time was needed at the works as well as at the mines (for I remembered Sir William Armstrong's advice about a wet nurse), I thought it best to secure the stateroom for a month. During the next three months I slept 88 nights in that stateroom—a pretty good record. Arriving at Virginia City at nine o'clock in the morning, I would be at the mine till four o'clock in the afternoon, then rest up and go to dinner, leaving in the Silver Palace at six in the evening for San Francisco, arriving there at nine the following morning. I would be at the works all day, leave on the boat at five, have dinner on the way to Vallejo, get to the mine next morning, and so on day after day for three long months.

Pumping 2000 Gallons a Minute

We made a good start about eleven o'clock. The great engine made a fine appearance, making about four strokes per minute. As soon as the stroke was properly adjusted, the pumps below were started and in less than an hour water was being delivered at the Sutro Tunnel at the rate of 2000 gal. per min. We were just beginning to have a safe feeling about everything when a Y-piece, where the discharges from the four pumps came together into one pipe leading to the air accumulator outside, burst, and the upper half of it, weighing about 1000 lb., went whizzing past my head and through the roof of the engine house. The roar of the air from the accumulator was fearful.

The engine behaved just as I figured it would. It kept moving just as it had been doing, the differential gear keeping the lead and admitting just steam enough to turn the engine over. Upon examination of the broken Y-piece, I saw at once where the mistake had been made. The large area where the two pipes joined had not been properly reinforced. I telegraphed immediately for another Y-piece and gave instructions how to make it. Next day at San Francisco I found the new piece ready to be cast, and in the evening it was finished and tested and ready to go up on the boat I went with. The new piece was at the Combination shaft by half past ten o'clock, nearly as soon as I got there myself. The engine was started and pumping by half past two o'clock.

As everything seemed to be going all right, I went back that night. No telegram was received all day, I slept very well on the train all night, found things working well in the morning, and no one had any suspicion that there was any trouble ahead. That day I examined the pipe lines in the shaft and found a heavy fluctuation in the pressure in the pressure pipe at the 1600-ft. level. Returning to the surface, I said to Mr. Requa that there was great danger at that point and suggested that we slow down to 1000 gal. per min., and I would order an air chamber fitted at that point. The engine was slowed to 2½ strokes per min., and I went back that night scheming all night as to how to arrange the air chamber.

When I got to the works I had it all worked out in my mind and had decided to fit an air chamber at the 2000-ft. level, as well as the 1600. In 10 days we had this work all ready, during which time I was at the mines and works on alternate days. Many a day I sat in the station at the 2400-ft. level and wondered what would happen if anything burst in there, with half a mile of vertical pipe above it, the contents of which, if let loose, would work havoc all around. But nothing happened and we took courage.

Troubles from Foundations

When the air chambers had been fitted and charged, we set the engine speed for 2000 gal. per min. But our troubles had not yet ended, for after everything had run well for two weeks, the foundation under the vertical pipes at the 2400-ft. level suddenly crushed, due to some movement in the rock. The lower section of the pressure pipe broke, causing a general destruction of the other pipes in the shaft. Fortunately the pumps were uninjured, but we were much disheartened, though thankful that no one was hurt. Charley Matheson was in the pump station at the time of the accident and managed after the first shock to get to the valve on the bulkhead at the Savage drift and shut off the water. By that time the Savage mine had been almost cleared of water. When all this occurred, I was taking my bath, getting ready to return to San Francisco. This bath was not only a great pleasure but an absolute necessity. It was followed by at least 15 minutes' rubbing with alcohol in order to get my skin to fit.

The sinking pump of the beam engine was not injured and in half an hour this engine was taking care of the water in the shaft. Mr. Requa was much disheartened and I was trying to encourage him, though not feeling very strong myself. We went to his home to talk it over and I decided to stay with him that night. While we were in the living room waiting for dinner, Mr. Requa lifted a book from the table. It proved to be a handsome copy of the New Testament. Handing it to me he said, "See if you can find any comfort in that. Read the first verse you see." I opened it casually and read the first verse on the right-hand page. "Let us not be weary in well doing for in due time we shall reap if we faint not." "Now," said Mr. Requa, "let us see. I believe that 'well doing' covers all attempts to drain the Comstock and

we had better not get weary just yet. We will cut off telephone connections and go to dinner."

Next morning we got out a plan for a better foundation for the water column in the shaft; we also put in supports every 400 ft. in the shaft, which clamps below the pipe flanges with the supporting bolts set up on spiral springs, so as to reduce the load on the foundations below. New pieces were made for those broken and in two weeks the pumps were again in operation. And although there were some other minor troubles that developed and had to be fixed, the pumping plant did not stop again for more than an hour or two at any time, until finally the Virginia and Gold Hill water-works supplied water at a less cost than the wood fuel and the engine was shut down, a 10-in. pipe from the water-works attached to the accumulator taking its place. This was the final act in the efforts to drain the Comstock and it set, at 3000 ft., the limit of depth that could be reached by any plant the mines could afford.

The Loyalty of the Men

The men of the Comstock were not easily discouraged and they did wonderful things. Not only were the men at the head directing these things men of brains and character, but those who carried out their plans in the steam and heat a half mile underground were also men of strong natures and unyielding courage—men of a make and kind of stuff that one could not get to serve him today. I have been in a pump station many a time with only a pair of drawers, socks and miners' boots on, with nothing to do but think when a drop of water from the roof would raise a blister. I found it very severe and I wondered at the grit of the men working under such conditions and giving the best they could give to the work, the success of which they all had at heart. I sometimes meet Charley Matheson and notice that when we talk about the big hydraulic pump his eyes sparkle and his muscles get tense and he says: "It was a great work, Mr. Dickie, and I would like to do it again."

The Savage, and with it the Chollar and Norcross, being flooded, the companies concerned had to face either abandonment or the construction of a pumping plant of more power than any hitherto erected on the Comstock. The general pumping scheme that I had been advocating was impossible because the Bonanza Mines had little water to contend with and controlled all the sources of wood supply from which all the other mines got their fuel. A plan I proposed to use the power in all the surplus water of the Virginia and Gold Hill water-works by using it to operate hydraulic pumps on the lower levels discharging through the Sutro Tunnel also failed of support for the reason that the same people owned the water-works and they preferred to sell wood rather than water. For another mine, I had proposed a hydraulic pumping plant of 700 gal. per min. capacity and that plan was used by me to illustrate my proposition. I am able to present this scheme, see Fig. 2, which has already been fully described in this article.

The proposition of the Chollar, Norcross and Savage was that I should design for them a hydraulic pumping plant that would enable them to pump, if necessary, from the 3200-ft. level 2500 gal. per min., discharging the water pumped at the Sutro Tunnel level and returning the power water to the surface to be used over again. Here was a proposition big enough to satisfy the ambition of any young engineer. I undertook to have the plans ready in one month.

Plans for a Hydraulic Pumping Plant

Owing to the necessity of keeping the opposition off the scent, I had our chief draftsman, Mr. Sherholtz, come to my home and stay there till the plans were ready for presentation. Mr. Sherholtz was the best man I ever knew for getting an idea pictured visibly on paper. He did not fail me that time.

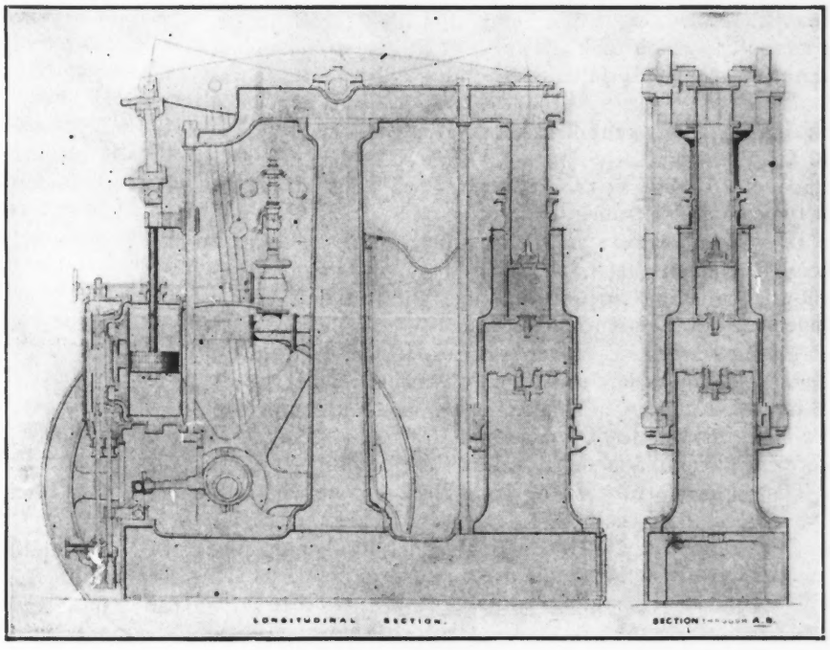


Fig. 2. Longitudinal and Cross-Sections of Pumping Plant

I decided to depart radically from the plan I had first presented as a type and determined that the surface engine should be a direct-acting, compound, condensing, Davey differential engine having a 45-in. high-pressure cylinder, an 88-in. low-pressure cylinder and a stroke of 14 ft.; the plunger pumps were to be eight in number, four being on each side of the crosshead; the pump rams were 7½ in. diameter; four were on the suction stroke while four were on the discharge stroke. At full power the engine was to make 10 double strokes per minute or a mean piston speed of 280 ft. per min. The discharge pressure was to be 1000 lb. per sq.in. The air pump was set vertical and operated from a tail rod and bell crank; the diameter of this pump was 36 in. and the stroke 42 in. The discharge from the air pump was into a cooling pond, about three acres in extent and arranged with dividing dikes so that the water circulated around for nearly a mile before it came

back to the injection pipe. The steam valves were of the double-beat type, and to have perfect control, the subsidiary and pause cylinders of the differential gear had a stroke of 20 in. The whole was mounted on a massive base plate, 10 ft. wide, 68 ft. long, and 5 ft. high, which was cast in three sections and weighed complete 112,000 lb. The arrangement of the cylinders was the same as described in a previous article, the high-pressure cylinder being nearest the crosshead and the low-pressure piston having two piston rods which worked in tubes cast on the side of the high-pressure cylinder. All the piston rods were 8 in. diameter. The low-pressure piston had a door through the center large enough to pass the high-pressure piston through, so that that piston could be removed without disturbing anything else. The crosshead worked in slides on the upper part of the bedplate; the pump rams, four on each side, two facing each way, were outside the guides; the width over the pump bodies was 12 ft.

To eliminate as far as possible any shock, I decided to do without a weighted accumulator and substitute an air cushion, which took the form of a huge air chamber. This was erected outside the pump house and was mounted on a large bedplate 12 ft. square, supported on a great block of solid masonry. The chamber itself was 30 in. diameter inside with walls 5 in. thick and was made in 10 sections, each 8 ft. long, so that the height of the complete chamber, or tower, was 80 ft.

In working, the water in this tower was normally at a height of about 10 ft. above the base, its height being known by having three ½-in. pipes run from it to the gage board in the pump house, where there were test cocks on the pipes. The pipes were set at 9, 10 and 11 ft. above the base of the tower; thus there was usually 70 ft. of air in the tower. A special small air compressor was provided for charging this tower, and some 10 other air chambers were installed in the shaft and at the pumping stations.

The power pipe extending from the great air chamber down the shaft to the 2400-ft. station was 10 in. diameter and the return pipe 12 in. diameter; the two pump discharges were each 12 in. diameter and terminated at the Sutro tunnel. The pump station at the 2400-ft. level was 23 ft. wide and 98 ft. long with two lines of pillars, making three compartments each 7 ft. wide. In each of these compartments I installed a hydraulic pump of the Davey type with some modifications necessary on account of the high pressure under which we had to work, which, at the 2400-ft. level, was slightly over 2000 lb. per sq.in. I adopted the Davey type of hydraulic pump because it had been well tried and proved to be an excellent arrangement for underground work. Fig. 3 is an elevation and plan of this hydraulic pump. The novel point in the design was the method of applying the force of the water power directly on, or rather within, the pump plunger through a fixed hollow ram; this enabled all the packing to be done by outside stuffing-boxes, which was an important point, especially in pumping dirty or gritty water, such as is always the case in quartz mining. The valves were all operated directly by the water pressure and gave a clear straight opening for the water. Fig. 3 is from a lithograph I made of the pump and shows it as submitted; in making the final details some changes were made in the method of working the valves.

Before the above plans were quite ready, some information as to what I was doing got to the outside and methods were used to prevent the adoption of the hydraulic scheme. One day a note was sent me requesting me to call at a certain office in San Francisco where I would find something that would be of interest to me. I went and found an empty office with an envelope having my name upon it. Inside was an unsigned check for $75,000 and an intimation that if I would promise to go to Europe for three years and enjoy myself, a good name would go on the check. That was in a way quite a temptation, but it was also a compliment to my ability and an incentive to my determination to see the hydraulic scheme through. I went on with my work, my plans were adopted, and the big pumping plant ordered. This work, of course, went to the Risdon Iron Works.

Colorado Fuel & Iron Co.

This company owns extensive iron ore and coal properties in Colorado, New Mexico and Utah, and blast furnaces, steel works and rolling mills in Colorado. The report is for the year ended June 30, 1914.

The capital liabilities include $34,235,500 common stock; $2,000,000 preferred stock; $45,158,000 bonds. Stocks were unchanged during the year; the funded debt was diminished by $108,000 bonds retired or exchanged.

The president's report is entirely devoted to a history of the coal-miners' strike, and a consideration of the causes leading up to it. It is a careful and well considered statement of the company's side of the case. So much has been written about the strike that is not necessary to repeat this statement here.

The production statement for two years past is as follows, in short tons:

	1912–13	1913–14
Iron ore mined	853,878	614,039
Limestone mined	485,756	376,226
Coal mined	4,091,667	2,428,992
Coke made	784,627	535,274
Pig iron made	416,467	268,883
Finished iron and steel	458,521	352,929

Of the total coal mined in 1913-14, commercial sales absorbed 877,761 tons; 588,883 tons were used at the company's plants; 962,348 tons were used in making coke. The average consumption of coal to one ton of coke was 1.798 tons; or, stated conversely, one ton of coal produced 0.556 ton of coke. The large decrease in production resulted from disturbed industrial conditions, and is, of course, shown in the earnings, as given below.

The income statement for the year is as follows:

	Earnings	Expenses	Net or Deficit
Iron Department	$12,085,037	$10,515,749	Net $1,569,288
Fuel Department	5,717,988	6,213,506	Def. 495,518
Total	$17,803,025	$16,729,255	Net $1,073,770
Add outside income, interest, etc.			577,477
Total income			$1,651,247
Bond interest			$2,021,103
Taxes			293,580
Sinking funds and miscellaneous			242,533
Total charges			$2,557.216
Deficit for the year			$905,969

Miscellaneous charges include $18,168 for prospecting, $43,016 for equipment renewal and $55,128 for insurance, personal injury and sociological purposes. The gross earnings for the year show a decrease of $6,512,863, as compared with 1912-13; the expenses a decrease of $3,966,366; and the net earnings a loss of $2,546,497. Those losses were due almost entirely to the coal miners' strike.

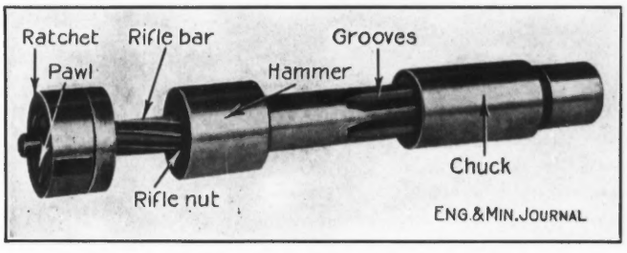
Modern American Rock Drills--VII

By L. O. Kellogg

SYNOPSIS—Pluggers are now largely of the automatically rotating type. The Jackhamer is the best known of the class. A new machine brought out by the Sullivan company uses water for cleaning the hole bottom and may be used with some new types of mountings. The Chicago pneumatic nonrotating plugger does not differ in the drilling end from the ball-valve stoper of that company. The McKiernan-Terry rotator also is not essentially different from the rotating stoper. The Cleveland "Mucker" has a small, separate transverse engine to effect the rotation.

The automatically rotating plugger machine is rapidly displacing the older types in all fields to which the plugger is applicable. For that reason, no attempt will be made here to describe the nonrotating pluggers, except in one instance where a machine has been lately developed.

A plugger is not essentially different from a stoper. In many designs, one machine can be transformed into the other by merely changing over its telescope feed for the handle, or *vice versa*. In general, however, the plugger uses hollow steel, into which either exhaust air, live air or water is thrown for clearing the bottom of the hole. It is more common to use steel with a lug or collar on it, or else steel with a cone-ended shank, than to use an anvil block. In the rotating models, frequently some device is applied to the front head, which grips the steel and permits its being churned up and down in the hole. The cylinder and front and back heads of the plugger are substantially the same as in the stoper. But in the case of the rotating machines, the front head becomes more elaborate, as it is required to house part or all of the rotating mechanism.



The Jackhamer Hammer and Rotation

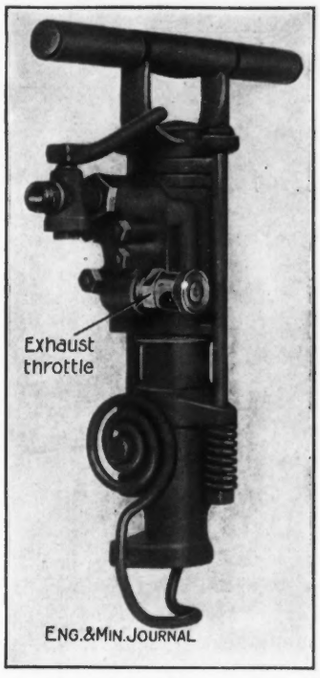
Rotation in general, so far as the machines have appeared on the market, may be said to be effected in two ways. Either part of the reciprocating energy of the hammer may be translated into rotary motion and communicated to the drill steel, or else a separate small engine may be used for the purpose. In the former case, a ratchet and rifle bar are employed as in a piston machine. The rotating mechanism will be described more in detail in the several machines. The valve actions on the plugger machines correspond to those on the stoper, save that the valveless plugger is usually a small nonrotating drill. The handle of the plugger may be a single central grip or it may be extended to the side so as to give a grip for each hand.

Another feature of difference between plugger machines and stopers should be noted—it lies in the control valve. Since air is not required for a telescope feed in the plugger machine, it is not necessary that the valve be so designed and the arrangement of air passages be such that the telescope feed can be actuated without allowing the drill to reciprocate. For this reason, a simple throttle valve is all that a plugger machine usually needs.

The Ingersoll-Rand Jackhamer

The Jackhamer has come to be regarded as the type of self-rotating plugger drill in this country, inasmuch as it was the first machine to attain any considerable commercial success, although not, strictly speaking, the first on the market.

The Jackhamer is actuated by a butterfly valve, and the control and distribution of the live air and exhaust are effected just about as they are in the butterfly-valve piston-machine previously described. Air is admitted through a simple throttle-valve set between the air hose and the valve chest, and not constituting an integral part of the machine. The valve chest is bolted to the cylinder. The air passages, which are contained in the cylinder shell, are not shown in the drawing. The hammer or piston in general resembles the hammer of the Leyner machine, having a large-diameter portion and a smaller projecting portion. The large portion is hollow and carries a rifle nut, which engages with a rifle bar in the rotation at the top or back of the machine. The forward end of the small portion is grooved, and the grooves are engaged by projections from a sleeve or chuck in the front head. The steel is held in the other end of this chuck, and the rotating motion of the hammer is thus communicated to both chuck and steel. Between the cylinder shell and the front head is a collar bearing for the ungrooved portion of the hammer projection. Front head, piston bearing, cylinder and back head are all held together by two through-bolts furnished with helical springs on the front-head end.

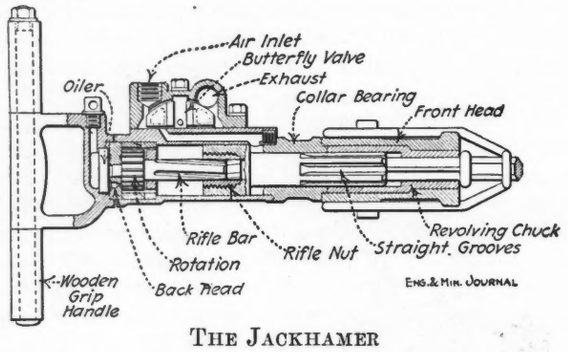


The Jackhamer

The steel used is commonly hexagonal in section and is hollow. The shank end is collared, and no anvil block is used; the hammer strikes directly on the shank of the steel. The exhaust of the machine to the valve chest is supplied with a special throttle valve, shown in the photograph of the exterior of the drill. By throttling the exhaust, live air is allowed to blow through the machine and down the drill steel, so as to clean the hole of cuttings with more force than when the exhaust air only is used.

The operator, by occasional intermittent throttling, thus can keep his hole entirely clear. The rotation mechanism, set next to the back head, is of the same type as that used on the Leyner machine.

In the back head is the lubricating device. It consists of a hollow disk, in which a porous filling material can be placed, the end being closed with a perforated brass plate. This lies between the oil chamber and the rotating mechanism, and operates automatically to filter the oil from the chamber and give it up to the cylinder under the variation of pressure in the back of the cylinder. The chamber itself is filled through an oil hole stopped with a screw plug.



THE JACKHAMER

The usual type of handle is that shown, provided with wooden grips; while rotation is automatic, the handle is required to lift the machine and steel from the hole. The spring device in the front or lower end is intended to grip the steel below the collar and permit of its being moved up and down with the machine. It can be swung up and out of the way when not in use. It is of service for churning the steel in the hole to prevent sticking.

The length of the machine is 18 in., the cylinder diameter is 2¼ in., the stroke is 2 in. and the weight is 40 lb.

THE SULLIVAN ROTATOR

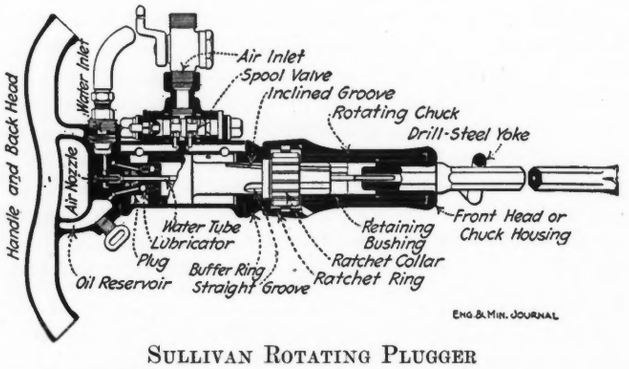
The Sullivan automatically rotating plugger machine, recently offered to the public, is based on a model that appeared some eight years ago, but that was laid aside in favor of the then more popular nonrotating types. The present model embodies some novel features, not the least interesting of which are certain mountings which assist the machine to drill horizontal or approximately horizontal holes.

The machine resembles the McKiernan-Terry and the Jackhamer in obtaining rotation for the drill steel by reciprocation of the piston. It differs, however, in obtaining its rotation directly from the piston itself instead of from an independent rifle bar. The result is a compact and simple rotating plugger. The longitudinal section shows the machine equipped with a water attachment. It is also furnished without the water attachment. The valve action, rotation, steel holder, shell and front head being practically the same, no further description of this non-water-using model is required here.

The Sullivan rotating plugger uses the Sullivan three-spool valve with enlarged central spool, as described for the Liteweight piston machine. The valve chest is of the side-rod pattern, with slotted bushings. The valve action is substantially the same as in the piston model. The drawing shows the main supply and exhaust ports. Certain crossports which control the valve are not illustrated. Further description is unnecessary.

As stated, the rotating mechanism is all contained in the front head. In the small forward-projecting portion of the hammer are milled two straight grooves and two helical or inclined grooves. Projections in the ratchet collar engage the inclined grooves. On the working stroke of the hammer, the ratchet collar slips on the pawls in the surrounding ratchet ring and is allowed to rotate; the piston is not rotated. On the back stroke, the pawls of the ratchet ring catch the ratchet teeth and prevent the ratchet from rotating; the inclined grooves on the piston are forced to follow the projections on the collar, and the piston is rotated a certain amount. The ratchet ring contains roller pawls held in by flat leaf springs, as in the standard Sullivan type of rotation.

The straight grooves on the piston engage projections on the inside of what is called a retaining bushing, which is screwed into the chuck itself. This communicates the rotation of the piston to the chuck. In the forward end of the chuck is inserted a bushing to receive the drill-steel shank. This bushing is a ground press fit, and revolves



SULLIVAN ROTATING PLUGGER

with the chuck, at the same time forcing the steel to rotate. The shank is usually hexagonal, with the chuck bushing made to correspond. The chuck itself revolves inside a housing which is brought back over the front of the machine so as to protect the contained moving parts to the fullest extent against entering dirt.

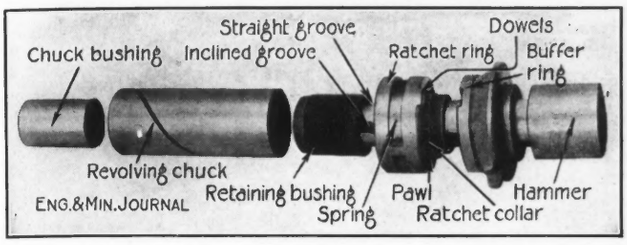
Between the housing and the cylinder is inserted a buffer ring. The ratchet ring is held against turning by heavy dowels fitting recesses in this buffer ring.

The rotation housing and the back head have side lugs. Side rods through these lugs hold together the housing, buffer ring, cylinder and back head. The rods work against helical springs applied against the housing lugs.

The back head and handle are drop-forged in one piece. The handle is extended into two horn-shaped side grips. The forward portion of the back head contains a lubricating chamber. The automatic lubricating device is contained in a plug screwed into the back head. This plug also carries part of the water attachment. The lubricator is in principle like that described for the Liteweight piston drill. Two spring-controlled ball valves, working in opposite directions, subject the lubricating chamber to variations of air pressure, so that oil is fed slowly to the cylinder and through the exhaust ports reaches the valve, while the drill is running. The plug projects an inch and a half into the back of the cylinder, but the back of the piston is hollow, so that it slips over the plug without contact. The clearance of these parts is such that the whole back of the piston is subjected to the full air pressure at the beginning of the stroke.

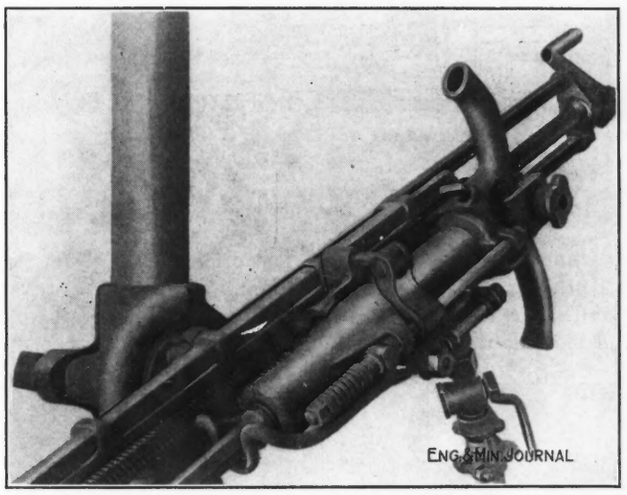
The air ports of the cylinder are so placed that there is always a slight cushioning on the return stroke, due to entrapped air, and a corresponding cushioning on the down stroke if the steel is not in the chuck.

One of the most interesting features of the drill is the water-and-air feed. This is arranged about as it is in the Liteweight and Hy-speed water-feed models of piston machines. The water is conducted in through a hose with a cup-shaped strainer at the end of the connection,



ROTATING AND STRIKING PARTS OF SULLIVAN ROTATOR DISASSEMBLED

which filters the water without restricting the port area. It is drawn into the water tube by entrainment with live air through the small nozzle which is shown pointing



SULLIVAN ROTATOR IN ITS CRADLE MOUNTING

toward the entrance to the water tube. The water tube itself runs through the piston and into the shank of the steel in the usual manner.

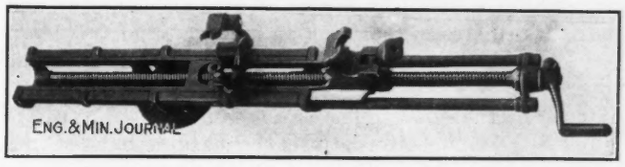
Whether the water model be used or not, hollow steel is commonly employed, and in such case the air for cleaning the bottom of the hole is that which leaks past the rotation mechanism and thus enters the steel. It should also be noted that in both models, the exhaust air from the front of the cylinder passes into the steel around the water tube.

A device is provided for holding the drill steel in the chuck when it is desired to pull it from the hole or churn it up and down. This is a yoke which ends in trunnions mounted in sockets above the side-rod springs in such manner that the device is kept in operation by the normal compression of the springs.

The machine weighs 38 lb., has a 2¼ cylinder and about a 2½-in. stroke.

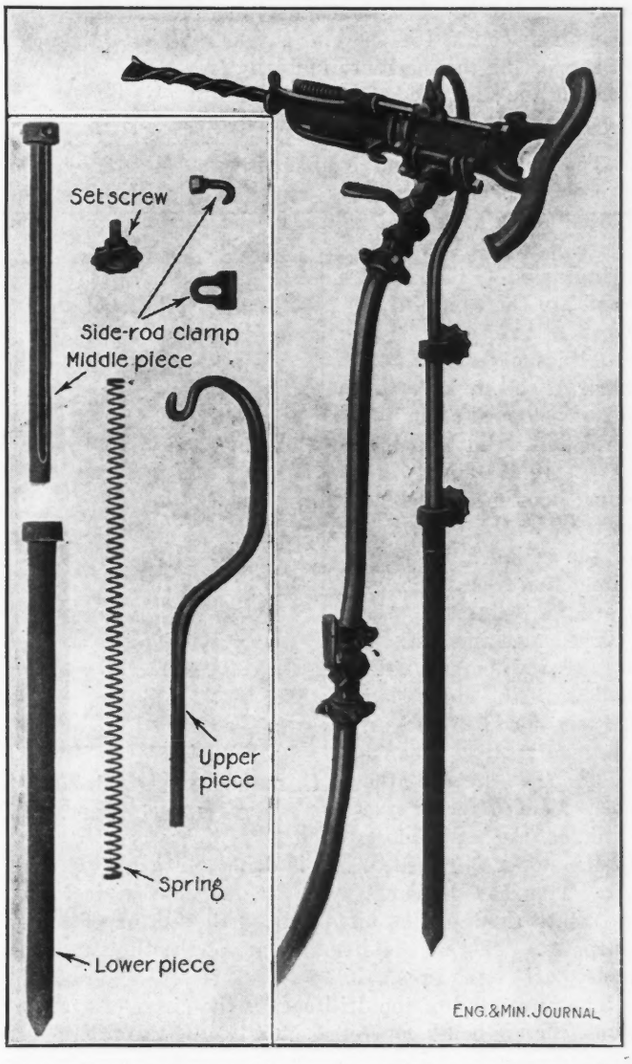
MOUNTINGS FOR SULLIVAN ROTATOR

The machine is designed to be used not only as a plugger or sinker, but also as an all-round drilling tool. To this end two mountings are furnished. One of these is a cradle, running in a shell equipped with a feed screw, by means of which the machine is manipulated exactly as is a piston machine or a Leyner. The cradle or sliding



SHELL AND CRADLE FOR SULLIVAN ROTATOR

part of the mounting consists of two hinged clamps, the feed nut being attached to the back clamp. One of the clamps swings from the side over the cylinder of the machine; the other swings forward and grips the handle. Both are readily tightened by hand setscrews so as to hold the drill firmly in position. This mounting, drill and cradle weigh together about 90 lb.



THE "FISHPOLE" OR "SHEPHERD'S CROOK" MOUNTING FOR THE SULLIVAN ROTATOR

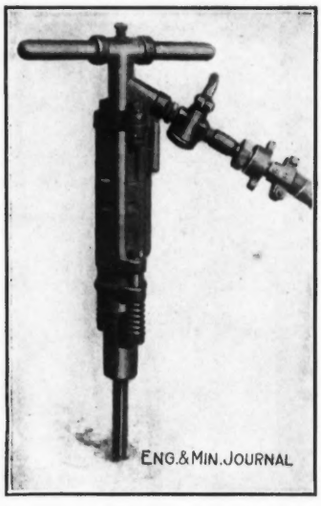
An entirely novel mounting is the "fishpole" or "shepherd's crook." The rotating plugger with twisted steel has proved an excellent machine for drilling horizontal holes in soft formations, such as the softer iron ores. It

is for facilitating work like this or for boring any short horizontal holes that the "fishpole" mounting is designed.

It consists of a double-telescopic column of small section and light weight. The upper section makes a bow and ends in a hook; by means of a small clamp around one of its side rods, the machine is hung from this hook. The lower portion of the column contains a spring. This upper section is free to slide in the middle section, unless clamped by the screw. The device is designed to operate as follows: The operator adjusts the machine to its proper height by means of the upper screw and telescopic adjustment. Then with both screws clamped he collars the hole. Then he releases the lower screw, and by a slight depression of the machine against the pressure of the spring in the lower section, keeps the steel always in line with the hole axis. The spring is just a little stronger than is necessary to support the weight of the machine and column above it. The operator is thus relieved of the duty of supporting the machine, and can devote his strength to keeping the steel pressed against the ground.

Chicago Pneumatic Sinker

The Chicago Pneumatic sinker is in general merely the Chicago Pneumatic stoper, with the telescope feed removed and a back head with a rotating handle put in its place. The ball valve, the cylinder and the front head are the same in almost all respects. The longitudinal exhaust ports of the stoper cylinder are stopped off by the solid back head bolted to the cylinder, and inclined ports are drilled to these at the lower end of the cylinder, so as to direct the exhaust downward.



Chicago Pneumatic Non-rotating Sinker

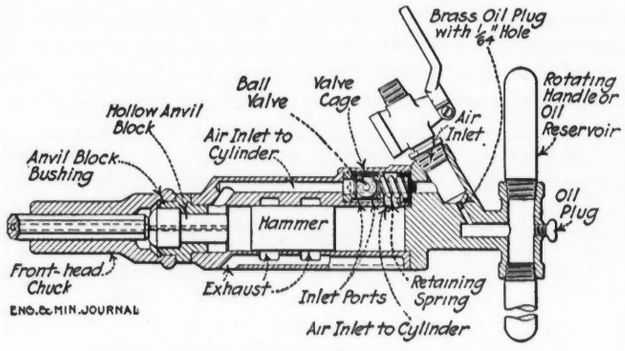
The machine is designed to operate with hollow drill steel, but this is made collarless, commonly called "shankless." To prevent the steel from entering the cylinder, the anvil block of the stoper is retained, but is drilled through the center. This hole registers with the hole in the steel and furnishes a supply of air to the drill bit for cleaning purposes. This will be live air part of the time and exhaust part of the time.

The back head of the drill carries the air inlet connections, the air being controlled by a simple throttle. The rotating handle, which consists of two portions screwed into the head, is hollow and acts as a chamber for lubricant. This is conveyed to the drill through a $^1/_{64}$-in. hole in a brass plug, as in the other ball-valve machines of this company.

This plugger weighs 43 lb., has a 2⅛-in. cylinder and a 4-in. stroke.

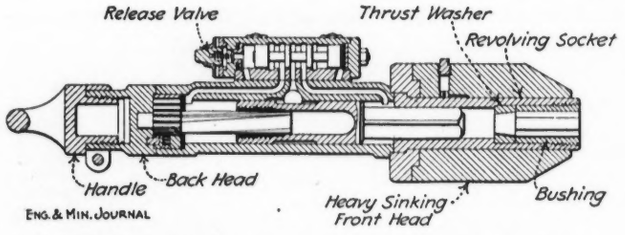
McKiernan-Terry Rotating Plugger

The McKiernan-Terry rotating plugger was the first machine of the kind sold in this country. The McKiernan-Terry Co. was thus a pioneer in introducing both rotating pluggers and rotating stopers. The description of the McKiernan-Terry rotating stoper applies almost intact to the rotating plugger, with the exception that the telescope feed is replaced with a handle. In fact, the



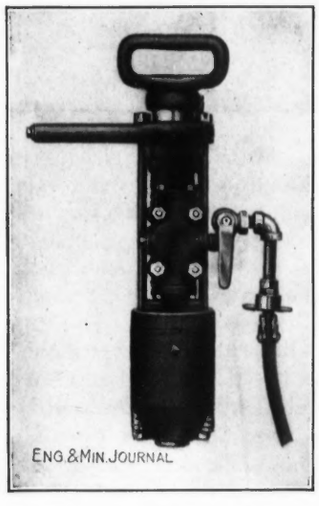
Chicago Pneumatic Tool Co. Sinker

telescope feed and the handle are interchangeable, and any one cylinder can be used for either a plugger or a stoper. The handle is screwed on and clamped just as is



McKiernan-Terry Rotator with Sinking Head

the inner tube of the stoper. The plugger may differ in two other points, however. For the upper end of the valve chest, a release valve is often applied, by pressing which, the motion of the valve and of the hammer is stopped, and the full pressure of live air directed through the drill steel into the hole for cleaning. Another difference is in the use of an extra-heavy front head to give weight for sinking.



McKiernan-Terry Rotating Plugger with Heavy Sinking Head

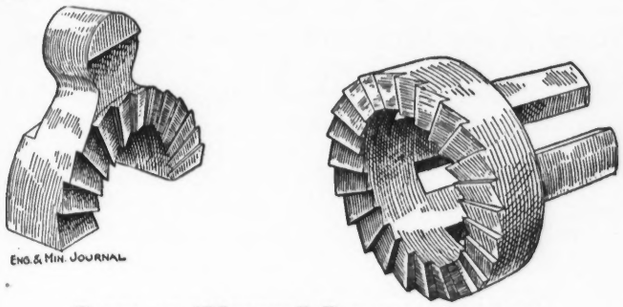
There is, of course, no necessity in the plugger for the valve arrangement by which the pressure in the feed cylinder can be varied. In view of the great similarity between these two machines, no further description seems necessary.

The weight of this plugger is 92 lb. Its stroke and cylinder diameter correspond to those of the stoper.

Cleveland "Mucker" Rotating Plugger

The "Mucker" drill, made by the Cleveland Rock Drill Co., and only recently put upon the market, is in some respects the most interesting machine of the automatic-

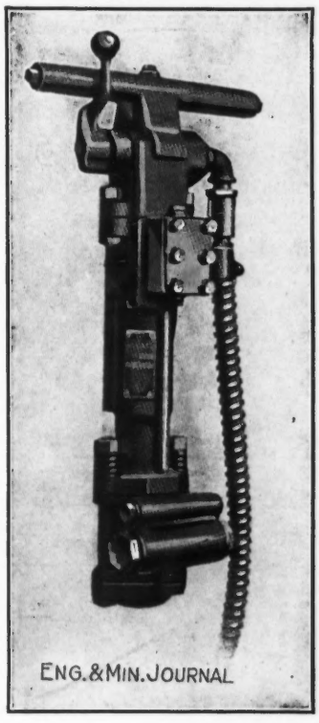
ally rotating plugger class. Instead of the rotation of the steel being affected by the reciprocating piston or hammer, a small but complete engine is mounted on the bottom of the machine and is capable of control separate from the hammer.



PARTS OF "MUCKER" ROTATION RATCHET

The hammer valve is of the three-spool pattern, set in a valve chest on one side of the cylinder, the chest having a bolted cover. The hammer itself is not symmetrical, but has a forward-projecting portion with a diameter to correspond to the small inner end of the anvil block, as has been usual in Cleveland machines.

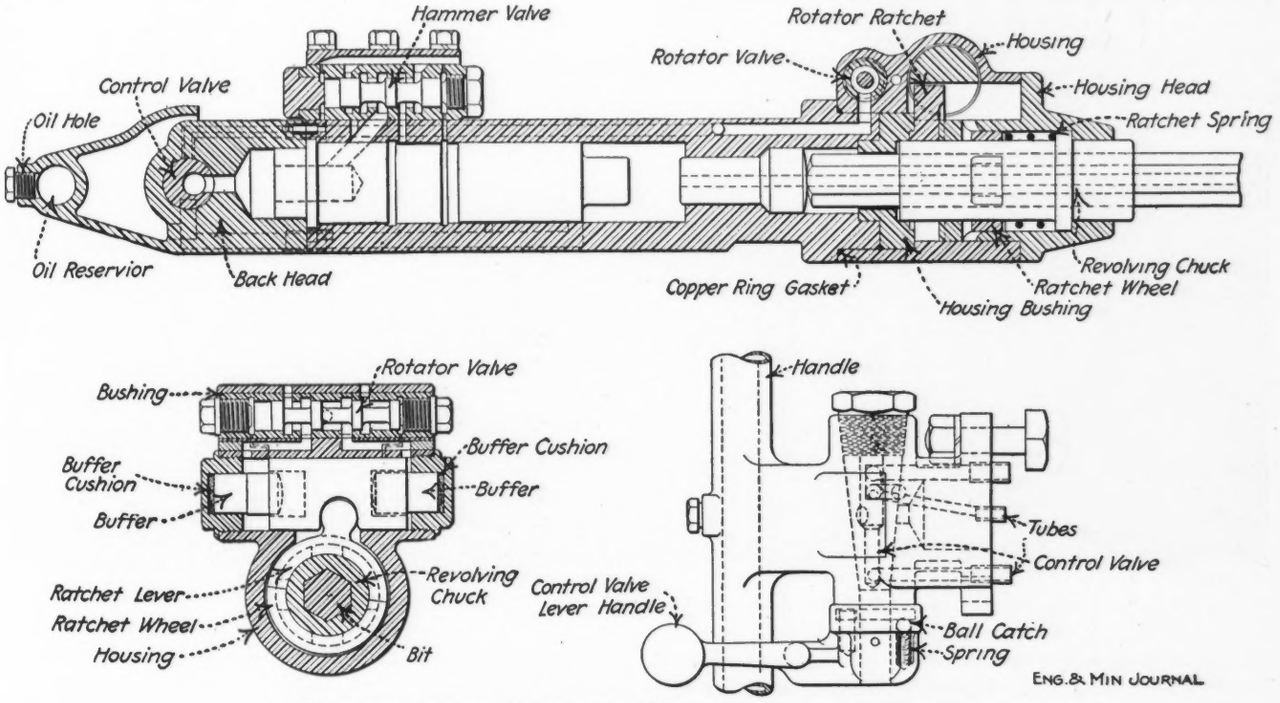
The anvil block lies in the cylinder itself. The lower end of the cylinder is closed by the rotator housing and its bushing, and the end of the housing again is closed by the housing head. These parts are held together by short through-bolts with helical springs on their upper ends. The back head and handle are of one piece, bolted to the upper end of the cylinder. This back head contains the control valve or throttle and the necessary accompanying ports.



CLEVELAND "MUCKER"

still runs at full speed, available for cleaning the hole. In the third position, both hammer and rotator are running at full speed, the ordinary drilling position.

The air supplied for the rotator does not pass through the hammer valve or the cylinder, but is conveyed through a separate passage in an enlargement of the cylinder wall. The rotator consists of a four-spool valve and a small piston working transversely on the machine. The lower part of this piston contains a recess which engages an upward-projecting tooth of the rotator ratchet. This is a segmental face ratchet covering about 180° of arc; the unsymmetrical radial teeth engage similar teeth on the full-circle ratchet wheel. This ratchet wheel has four forward-projecting lugs which engage the rotating chuck itself. The general shape of the segmental ratchet and the ratchet wheel is illustrated by sketches, which, however, are not exact-



SECTIONS OF THE CLEVELAND "MUCKER" ROTATING PLUGGER

This control valve is a tapered plug with such an arrangement of ports as to give three drilling positions. In the first position, the hammer hits lightly and the rotator runs at half speed; this is desirable when starting a hole. In the second, the hammer is stopped while the rotator

ly correct and are not to scale. These parts are kept in engagement by a helical spring surrounding the chuck and bearing against the lugs of the ratchet wheel on one end and against the collar of the chuck on the other. The rotating chuck has a hexagonal

section inside to receive hexagonal steel. This steel and the anvil block are hollow, and because of the anvil block, no collar is necessary on the steel.

The rotator piston works against buffers and buffer cushions at both ends of its cylinder. The ends of the rotator cylinder and the ends of the rotator-valve chest, as well as the ends of the hammer-valve chest, are closed with screw plugs. The chuck revolves in the housing head and the housing bushing as bearings. The joint between the rotator housing and the cylinder is packed with a copper ring gasket.

The control valve in the back head has a lever handle ending in a ball, and is held in its various positions by a small spring-actuated ball. The several air passages are fitted with tubes between the back head and the cylinder walls in order to prevent leakage. The handle of the machine is an oil reservoir with the oil plug in the center.

The machine weighs 85½ lb. and has a cylinder diameter of 2 in.

A Wooden Suspension Bridge

A suspension footbridge 273 ft. long was recently built across the Gila River, near Kelvin, Ariz., by the Kelvin Sultana Copper Co. to connect its mine and power plant and to accommodate miners living in Kelvin, according to *Engineering News,* Sept. 24, 1914. Although designed only for pedestrians, single pieces of machinery weighing 1800 lb. have been taken across it. The maximum load placed upon it to date was 3000 lb. The bridge carries a 4-in. pipe line which conveys boiler water from the mine to the power plant.

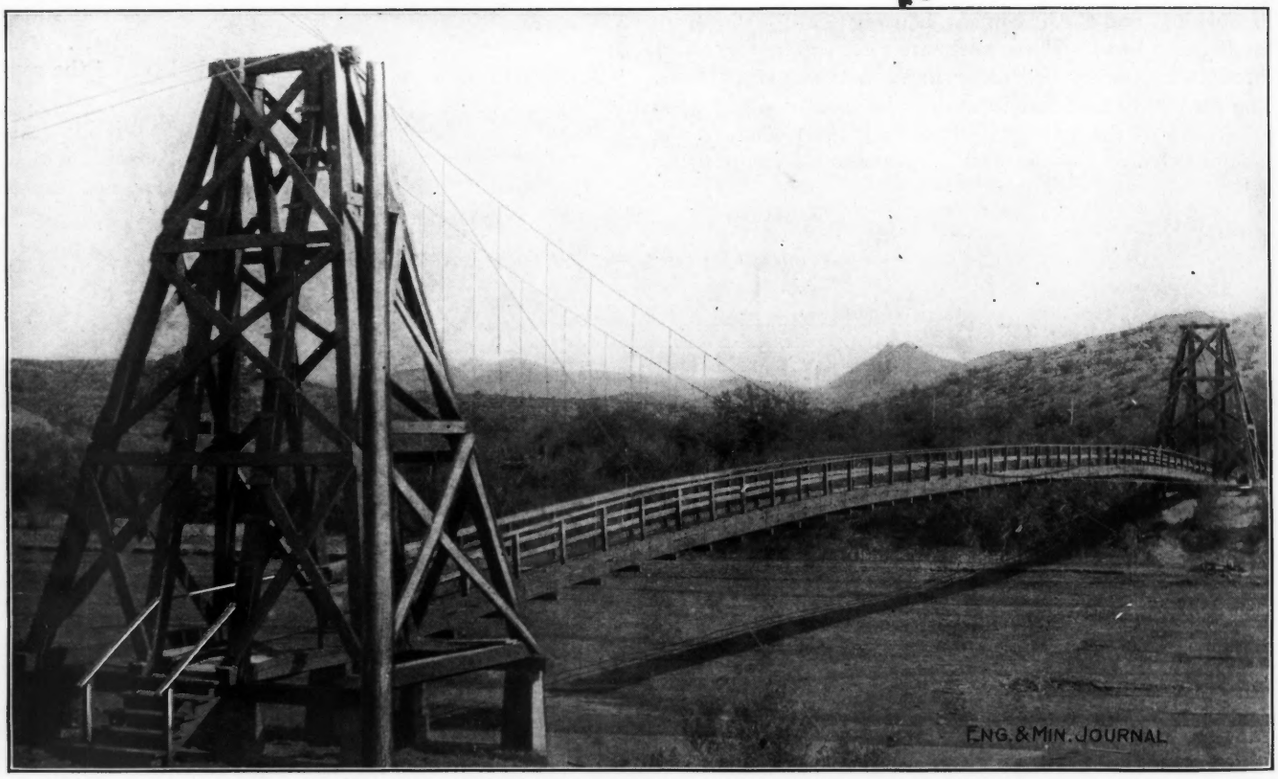
The general design is shown in the accompanying view. At the center the roadway is 15 ft. above mean high water. The wooden towers are carried on concrete foundations. On the west side of the river (the far side in the view) the former river bottom, now about 8 ft. above mean high water, forms a flat several hundred feet wide which affords poor bearing. The concrete foundations on this side are 14 ft. deep and 6 ft. wide at the base. On the opposite side, the piers are about 3 ft. high. The towers, constructed of 10x10-in. Oregon pine posts with 3x8-in. bracing, are 21 ft. square at the base and 31 ft. 5 in. high.

The two cables are made each of two ¾-in. plow-steel ropes which had seen about six months' service in hoisting. The floor, 4 ft. wide in the clear, is attached by ⅝-in. Ernst patent hangers passing through 4x6-in. cross-bars, on which rest two 4x8-in. and one 3x8-in. stringer. The floor, of 2x12-in. lumber, is nailed directly to the stringers. Directly over each side stringer is a 4x6-in. guard timber bolted through plank and stringer to the cross-bars.

Anchorages are concrete blocks. The cable ends are passed around several 16-ft. lengths of 90-lb. rail embedded in the concrete. On the power-plant side turnbuckles are provided.

From the center of the bridge there are four guys to the bank, making an angle of 30° with the center line of the bridge. There is little sway to the bridge under ordinary loads.

In building the bridge, as soon as the towers were completed the cables were hung and roughly adjusted to nearly the proper deflection. The hangers were then put on, beginning with the longest and working from both ends toward the center simultaneously. When the hangers were all placed, the deflection was adjusted (27.2 ft.), the floor laid and the handrail put on.



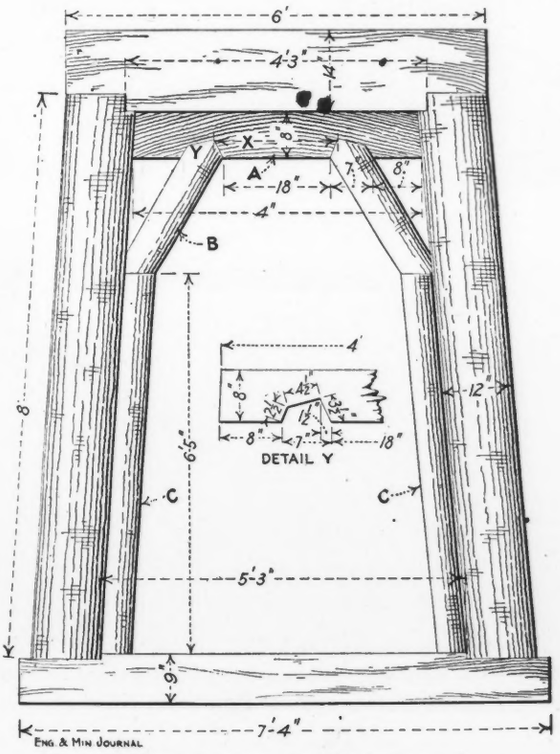
General View of 273-Ft. Suspension Bridge

Details of Practical Mining

A Method of Reinforcing Set Timbers

By H. H. Hodgkinson*

The following method of bracing set timbers has proved successful and economical. It not only permits the use of much smaller timbers, but gives the additional advantage of making it possible to use the set timbers and braces several times. The most striking feature of the method is the absence of spikes. Only two 6-in. spikes are used, as will be seen from the accompanying sketch. These two timbers *CC* remain fastened to the posts when the set timbers are torn apart. This absence of spikes



Reinforcing Set Timbers

not only saves considerable time in tearing the set timbers and braces apart, but avoids damaging the timbers themselves. If set timbers are to be removed and used again, only a few spikes should be used in framing and bracing the sets. Six- or 8-in. spikes are hard things to remove from oak timbers, and, in the process of removing them, the joggles are almost sure to be damaged and the timbers split, rendering them unfit for further use.

Referring again to the sketch, the timber *A* is hewed off on the top so as to conform to the bottom of the cap and permit a good bearing. It is beveled at each end to fit the posts and is held in place temporarily by means of a small wedge driven in between it and the posts while the two braces *B* are being driven in. The braces *B* are cut and beveled so that when driven into place they fit exactly and make tight joints. The timber *A* not only acts as a distance piece, but prevents the braces *B* from forcing themselves up into the cap and splitting it. Besides, this permits the use of much smaller joggles on the cap and posts, as will be seen, since they are only 1½ in. The pieces *CC* are fastened to the posts with 6-in. spikes to keep them in place, while they rest directly upon the sill.

The pieces *B* are rounded instead of coming to a sharp point at *X*, to prevent splitting the piece *A*. The pieces *CC* are 6-in. diameter round oak lagging; *B* and *A* are 8-in. round oak lagging.

*Mining engineer, Franklin Furnace, N. J.

Balancing Dummy in Inclined Shaft

By L. Hall Goodwin*

In the inclined shafts of the Lake Superior district it is the custom to hoist in balance; the practice, however, is different from that used generally throughout the West in that the drums are not designed to clutch in and out of balance but both ropes are wound on the same drum so that the position of one skip in the shaft relative to the other is always fixed. Mines in the development stage usually sink and timber the two-hoisting-compartment shaft in final form, except that rail stringers are put in one road only and hoisting is carried on unbalanced until the shaft has attained a considerable production, when rails are put in the other road and the second skip put in service. At the Houghton Copper mine, a small development property on the Superior lode just north of the Superior mine, a novel method of securing balanced hoisting from the start was employed. Work is now confined to the 625-ft. level, and hoisting is done electrically.

Track stringers were laid in the south road only, but in the north road rails of usual weight were laid on the 12x12-in. sleepers to carry a dummy. These rails were laid in the center of the roadway with a 2-ft. gage, so that when permanent stringers are put in they will be laid outside of the present rails, and the latter will be simply transferred to them as the work progresses. The dummy was made of riveted sheet iron and filled with iron scrap; it is 2x2 ft. in section and 6 ft. long. A point in its construction worthy of attention is a pivoted rear axle, which swings freely on a pinion projecting from the lower end of the dummy. This allows the four wheels to accommodate themselves to irregularities in the narrow track, which in this improvised arrangement are probably pronounced, and minimizes the possibility of the dummy's jumping the rails.

The main reason for the adoption of this device was the need of cutting down the heavy power demand when starting an unbalanced skip. The contract with the power

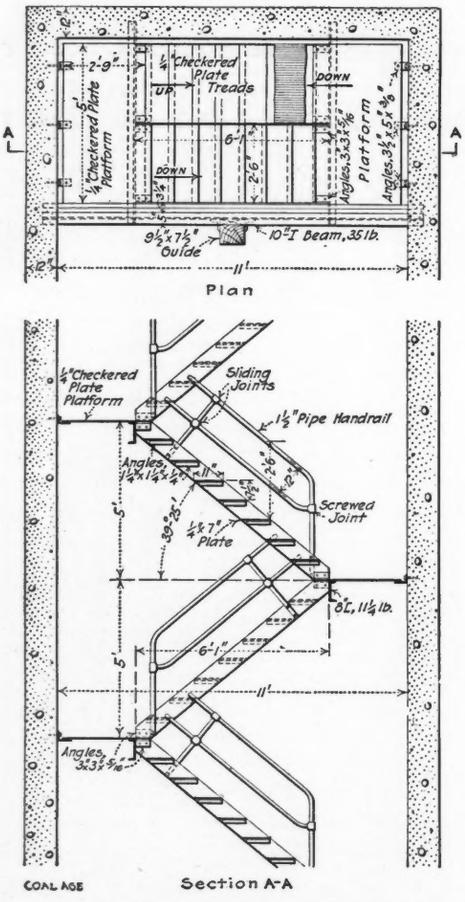
*Mining engineer, 3 Barstow St., Allston Station, Boston, Mass.

company imposes a penalty for peak load at all times and an additional penalty for load on the company's lighting peak. The penalty would be nearly four times as great with an unbalanced skip as it is with the present arrangement, and a larger hoist motor would also be required.

Vertical-Shaft Steel Stairway

The air shaft or auxiliary shaft of the Bunsen Coal Co., Danville, Ill., is divided into three compartments and lined with concrete. One of the compartments, about 5x11 ft., is reserved for a manway and fitted with a steel stairway. The shaft is vertical, rectangular, 11x25 ft. inside lining and about 210 ft. deep (*Coal Age,* Nov. 2, 1914).

The stairways are of zigzag pattern, and, together with the landings, occupy a space longitudinally in the shaft for a width of 5 ft. 6½ in. Each flight rises on a



PLAN AND SECTION OF STAIRWAY

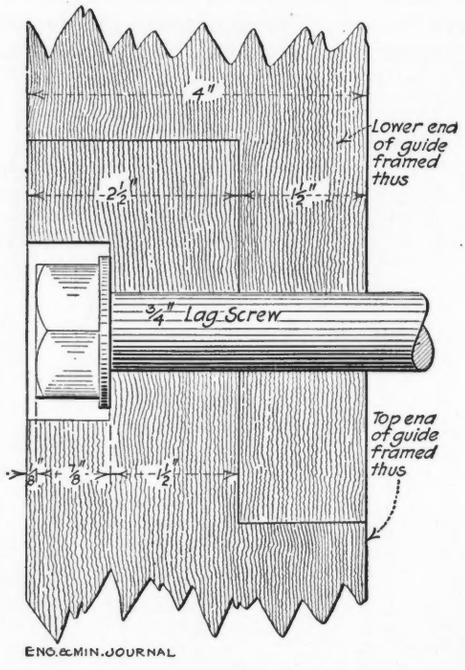
39° 25′ angle from the horizontal, and is 8 ft. long. The separate flights, including the landings, are supported on 8-in. channels weighing 11¼ lb. per foot, placed crosswise in the shaft, which in turn are supported at one end on the 10-in. I-beam dividers, while the other end is secured in the concrete end-wall and has a bearing of 6 in. The channels are placed 2 ft. 5½ in. from the side walls, and are spaced vertically 5 ft. apart center to center, alternating for each flight.

The stair stringers are ¼ in. thick by 7 in. deep. The treads are ¼x11 in. by 2 ft. 6 in., with checkered surfaces, and are supported on 1½x1½x¼-in. angles, riveted to the stringers. The rise between treads is 7½ in. The landing plates are ¼ in. by 2 ft. 9 in. by 5 ft., and are also checkered on the surface. Three lugs of 3½x5x⅜-in. angle iron are riveted to the landing plate and fastened to the concrete wall by means of ⅝x5-in. expansion bolts well drawn up. The hand railings are made up of two lines of 1½-in. pipe; the uprights are bolted to the stair stringers and connected to each line of railing. The total weight per vertical foot of stairway and landings, not including the channel supports, is 100 lb. The stairway is easy for the men to walk on and is of economical design.

Framing Shaft Guides

BY PERCY E. BARBOUR*

The cut shows a method of framing and securing guides in the shaft of the Montgomery mine at Candor, N. C.



FRAMING FOR SHAFT GUIDES

The shaft sets were placed 6 ft. 6 in. centers and the guides were fastened to each set by lagscrews as shown. The guides were of oak dressed on three sides.

Belt-Maintenance Reduction

At a certain Western manufacturing plant until a few years ago it was customary, as in many plants, for each operator to care for the belting at his machine (*Eng. News,* Nov. 12, 1914). No records were kept, but at the end of each year the books indicated that a large part of the expense was for the renewal of leather belts. Improvements were undertaken. One of the first was the installation of a belt-tension machine, all belts being stretched in accordance with belting slide-rules. Errors, such as the use of too light or too heavy belts, were corrected; all pulleys were properly aligned, and the shifting fingers were adjusted to give plenty of clearance.

A man was appointed whose duty it was to record all data pertaining to the belts, such as the date of installa-

*Mining engineer, 887 Middle St., Bath, Maine.

tion, the maker's name, the length and tension, the condition of the belt and the amount of time spent on repairs. All this information proved of valuable assistance in purchasing new belts and in obtaining a knowledge of the cost of belt maintenance. All belts were inspected regularly, and often a slight repair saved not only the stoppage of machinery but also the cost of a new belt.

It was found that to keep the leather soft and pliable it must receive an occasional treatment of neatsfoot oil and beef tallow, mixed in the proportion of 5 gal. of oil to 1 lb. of tallow. This application combined with the proper tension gave the belts a firm hold on the pulleys and produced good results.

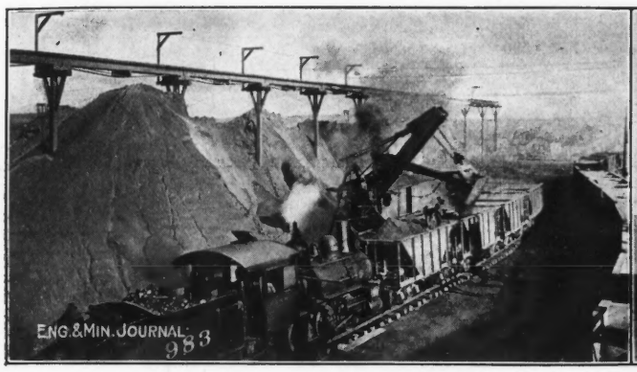
Experience at this plant has proved that, with proper care and treatment, the life of a belt may be prolonged and the stoppage of machinery from belt breakage materially reduced. Thousands of dollars have been saved in this plant each year by this method of caring for belts.

Permanent Stockpile Trestle of Wood

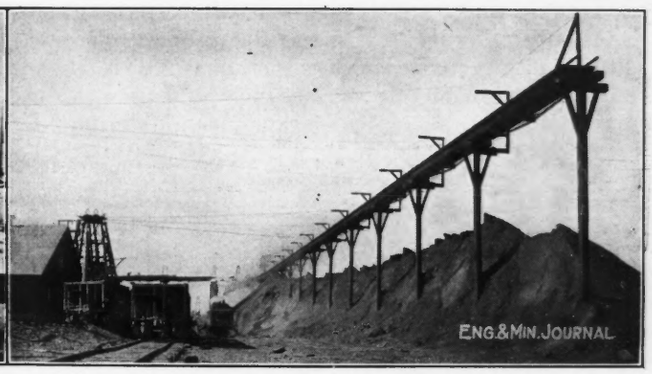
By Oscar Gustafson*

The several methods of stockpiling ore on the Michigan and Minnesota iron ranges were outlined in the Journal of May 23 and 30, 1914. The article describes the meth-

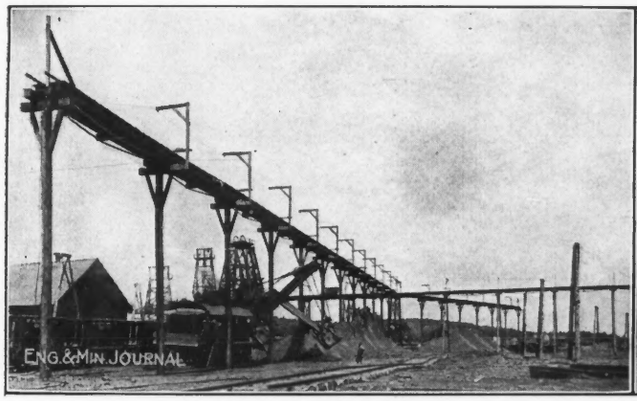
*Surface foreman, Colby Iron Mining Co., Bessemer, Mich.



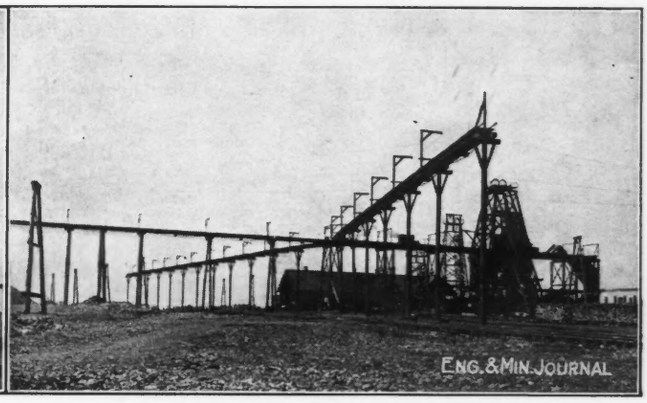
Shovel at Work on First Cut



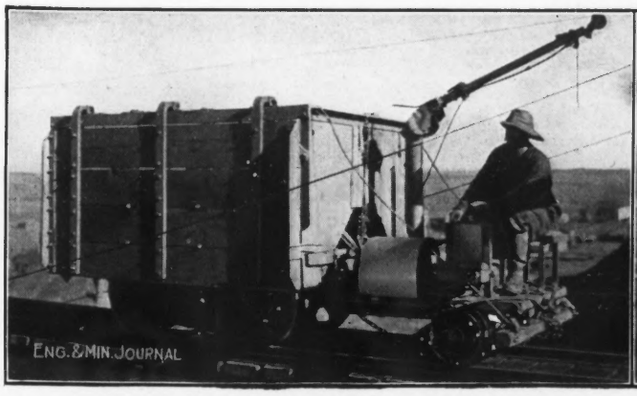
Shovel Finishing First Cut



Shovel on Third or Clean-Up Cut
Note boom and dipper working between the legs.



Stockpile Cleaned Up
Trestle leading to left is of old two-leg type.



Motor-Driven Stockpile Car
Endless-rope or electric-locomotive haulage is more common in stockpiling. There are a few Michigan mines where this self-propelled type of car is used.

Top of Trestle
First cut on one side almost finished. Trestle slightly displaced by unequal removal of ore. Displacement can be corrected by adjusting guy wires. Note the four side bents.

ods in general use. A special method used on the Mesabi was described by Clarence M. Haight, in the JOURNAL of Jan. 31, 1914. At the 1914 meeting of the Lake Superior Institute, Lucien Eaton described in great detail the various methods followed on the Marquette range and S. R. Elliott described the Negaunee trestle of steel and concrete. This last mentioned trestle is commonly spoken of as the only permanent installation in use. However, the Colby Iron Mining Co., operating the Colby and Ironton mines on the Gogebic range, has in use a wooden stockpile trestle, which is designed to be permanent and is giving great satisfaction. Besides not having to be taken down each year, it differs from the trestle in common use chiefly in that the bents have but one leg instead of two.

Loading tracks are laid on each side of the stockpile, and the one line of legs spaced 32 ft. apart offers but little difficulty to steam-shovel loading. It is an advantage to both the railroad and mine to have a loading track on each side of the stockpile, for after finishing the first cut the end of the loading track is thrown over and the shovel runs back on this track and starts a cut on the other side of the pile without waiting for the first track to be placed again and connected. This saves considerable time to the shovel and crew. While the shovel is working on the second cut, the railroad section crew has plenty of time to place the first track and is not compelled to call in an extra gang.

After designing this trestle, I had an experimental piece built at the Colby mine in the fall of 1912. This proved so satisfactory that 632 ft. was built in 1913 and 1500 ft. in 1914. It is found to be cheaper than the old trestle, remains in alignment better while loading is going on, and is more sightly.

The design follows broadly that of the Negaunee trestle. Each bent is a single leg of 12x12-in. fir, 38 ft. long, on which a 12x12-in. fir cap, 7 ft. long, is mounted and braced by two 6x8-in. by 6-ft. fir braces, mortised and bolted to both leg and cap. To each cap are bolted two 12x12-in. by 4-ft. fir corbels or bolsters, to which again are bolted the 8x16-in. by 32-ft. fir stringers, as shown in the illustrations.

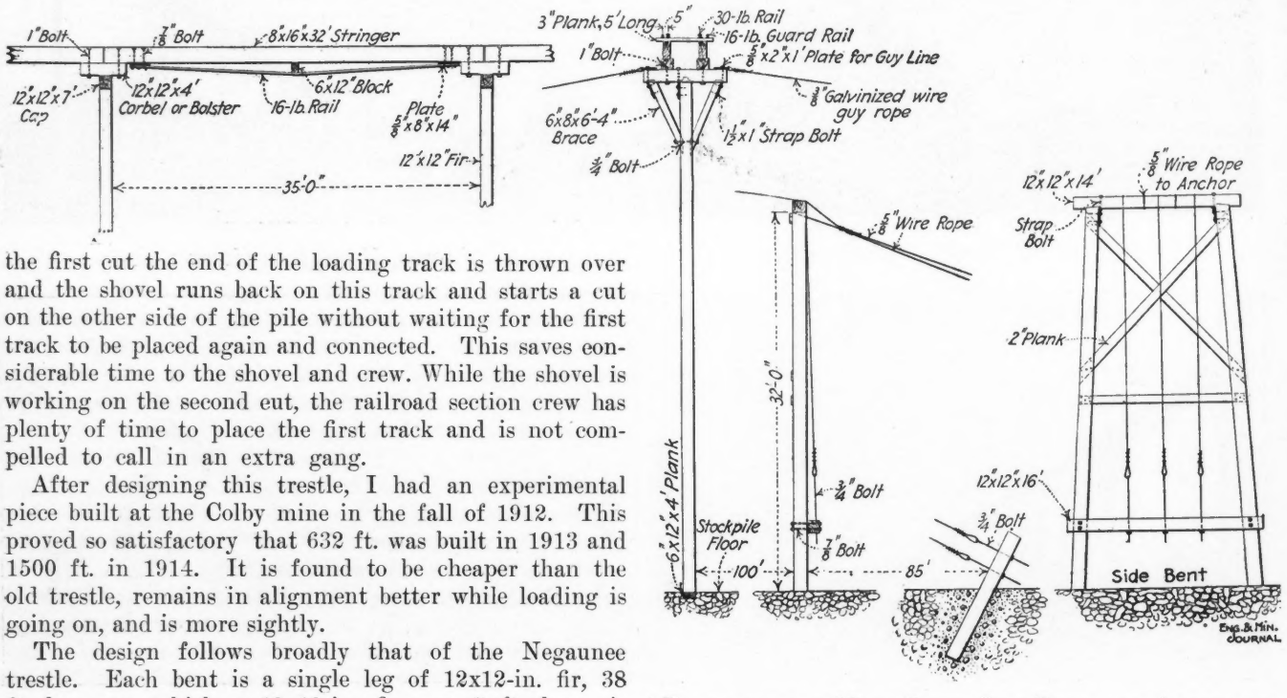
The stringers are trussed with 16-lb. rails; to each end of these a 5/8-in. plate is riveted and then bolted to the stringer. The truss rods are blocked in the center with a 6x12-in. wood piece. To the stringers are spiked 3-in. planks 5 ft. long, and the 30-lb. rails are laid on the planks at 30-in. gage. Outside of the 30-lb. rail, a 16-lb. guard rail is spiked. To each end of the cap is bolted a plate with an eye in the end, for attaching the guys. These guys are 3/8-in. galvanized-wire strands; they extend out to side bents erected at 100 ft. from the trestle, the guys from three center bents being attached to each side bent.

The guys pass over the cap and down to eye-bolts, passing through a 12x12-in. by 16-ft. timber near the ground. The side bents are 32 ft. high, built of round timber and well braced. They are themselves guyed by two 5/8-in. wire-rope guys to a "dead man," concreted in the ground.

Following is a comparison, Table I, of the cost of the old-type two-leg trestle and this one-leg design, and in Table II is shown the estimated yearly saving of the new type over the old.

TABLE I—COMPARATIVE COST PER LINEAR FOOT OF TWO- AND ONE-LEG TRESTLES

	Two Legs	One Leg
Fir timber at $40 per M.	$1.160	$1.660
Hemlock planking and bracing at $20 per M.	.190	.220
Round timber	1.130	.120
Iron at 3c. per lb.	.080	.080
Cut and cast washers	.003	.006
Spikes and nails	.024	.026
Track rails, 30-lb.	.290	.290
Guard rails, 16-lb.	.160	.160
Trolley wire	.081	.081
Labor, carpenters	.720	.752
Labor, blacksmiths	.114	.132
Labor, electrician	.035	.035
Galvanized rope and clamps	...	.112
Truss rails, 16-lb.	...	.101
Cement	...	.020
Total	$3.987	$3.795



ELEVATIONS OF MAIN BENT, SIDE BENT AND ANCHORAGE

TABLE II—ESTIMATE OF SAVING PER FOOT OF NEW TRESTLE OVER OLD

Taking down old trestle	$0.150
Labor of erecting	.720
Timber destroyed	.850
Bracing plank	.095
Top plank	.032
Iron	.019
Washers	.005
Spikes and nails	.006
Fish-plate bolts	.003
Labor, blacksmith	.059
Labor, electrician	.035
Use of rope and blocks	.019
Total	$1.993

The photographs show various stages in the process of loading from around one of the new trestles and also the self-propelled dump car used for tramming on the trestle from the shaft to the stockpile.

Tar Painting of Concrete—B. N. Abbott says ("Eng. Record") that asphaltum will not firmly adhere to concrete, but if the concrete surface be first painted with coal tar, the asphaltum will adhere so firmly that it cannot be broken away without bringing pieces of concrete with it. The coal tar should be heated in small quantities, just to the boiling-point, and then applied immediately.

Details of Milling and Smelting

Sampling Lead Bullion

The sampling of lead bullion at the International Lead Refining Co.'s plant at East Chicago, Ind., is described[1] by G. P. Hulst. The lead bullion comes into the plant on a high line in carload lots of 30 to 40 tons; it is taken from the car, weighed over scales and thrown into sampling kettles of 45 tons capacity. These are fired with coal and heated until no frozen bullion remains in the bottom or adheres to the sides of the kettle. The kettle is scraped clean on the sides and bottom, and the wet dross is skimmed off clean into molds. The kettle is thoroughly stirred while 24 to 30 samples of approximately ½ assay ton are taken. These are taken in a long-handled iron mold providing for taking six to eight "gum drops." The mold is inserted and heated to the same temperature as the molten metal and the gum drops are dipped out and cooled in the mold by dipping the bottom of the mold into water. The samples should be free from fins.

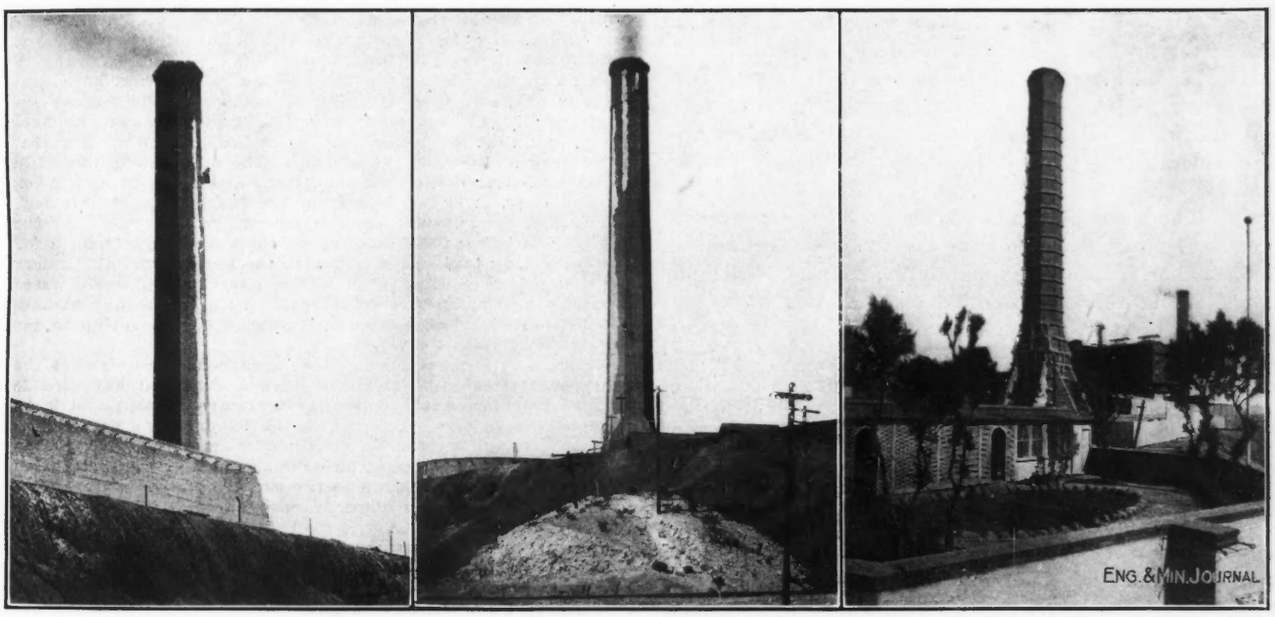
In assaying, the gum drops should not be clipped but weighed up and the results computed. The dross bars are weighed and sawed according to old hammer-and-punch sample template. The sawdust represents a sample of the dross. In the case of high gold in the bullion, there is a slight correction in the assay. This method of sampling, Mr. Hulst states, was developed in 1903 or 1904 at the Omaha plant of the American Smelting & Refining Company.

[1]Bulletin of A. I. M. E., November, 1914.

Smelter Stacks and Lightning

The value of lightning rods seems to be differently appraised by the operators and builders of metallurgical works. As a whole, the vogue of the lightning rod has declined, due, perhaps, to over-assiduousness on the part of agents. Nevertheless, the protection of tall smeltery stacks by lightning rods is considered essential by certain operators. A trip through the smelting districts, however, will show that opinion on this point is divided. Some operators feel that a platinum-tipped rod will attract lightning, but the ground connection usually provided is not sufficiently large to carry away the current. Also that after a period of years with no inspection, a lightning rod is likely to be a source of danger by reason of bad connections or corroded rods. On the other hand, the advocates of lightning rods contend that even though the latter may not have a ground connection sufficient to carry the largest bolt of lightning, they serve to conduct the electric charges away before the potential becomes high.

Many works have no lightning protection for their stacks, but it is noteworthy that one of the newest plants constructed in the Southwest, namely, that of the Arizona Copper Co., has been provided with lightning rods. On the other hand, it may be well to recall that one of the Illinois smelting works found on inspection that the ground connection of its lightning rod was completely severed by corrosion a short distance below the top of the stack. Doubtless many will recall other similar instances of "protection."



TWO STACKS OF THE EL PASO SMELTING WORKS, EL PASO, TEX.

Two views of the main stack which was struck by lightning several years ago; later, on the development of a crack in the brickwork, it was decided to repair the stack. At the left is the reinforced stack now used by the reverberatory and converter departments; the skin friction of the concrete enlacement is estimated to be sufficient to support the entire weight of this stack.

However, the efficiency of lightning rods when maintained in good order is evidenced by one of the most noteworthy structures in the country, namely, the Washington Monument. This monument bears the scar of an electric discharge which struck it during its erection. It has since been protected by four lightning rods, and every amateur photographer in Washington has a photograph of lightning striking the monument, or more properly, these protecting rods, which have carried the current away harmless. During nearly every electric storm in Washington, the lightning discharges through these rods several times. The efficiency of the lightning rod, as installed, is generally conceded, but its efficiency at the end of five or six years without inspection is another question. When were your lightning rods last inspected?

The new stack at the Garfield Smelting Works, at Garfield, Utah, was struck by lightning on Oct. 6, 1914. Pieces of brick were torn out in spots over a considerable part of the height, but so far as can be seen from the ground, no serious injury was done to the stack. The breakage was apparently shallow, not continuing through the walls at any point. The stack was completed last summer and is 350 ft. high and has a diameter of 22 ft. inside at the top; no lightning rods were provided.

At the El Paso Smelting Works, at El Paso, Tex., the main stack was struck by lightning a number of years ago, and while the damage was not deep, it extended over a considerable portion of the stack. No repair was attempted at the time, but several years later a crack developed. The accompanying engravings show the stack in process of repair and also after the repair was completed, the new mortar indicating plainly the course of the lightning. About this time another stack at this works was discovered to be in a precarious position, though not due to lightning. The stack was one of the oldest at the works and when the new management found out the condition of the stack, it was decided to repair it. On investigation it was discovered that there was almost no foundation under the stack, only such as might be placed under a building wall or column; as the stack had developed a slight crack and showed a tendency to get further out of plumb, it was decided to reinforce the stack with the buttresses and the concrete enlacement, shown in the engraving at the right. An interesting fact in connection with this repair is that it was estimated that the skin friction of the concrete reinforcement is sufficient to support the entire weight of the stack, which has continued to serve its purpose for 10 or more years, without any evidence of further deterioration. From an artistic point of view, the repair was also an amelioration. The attractive photograph was taken by the *padre* from the garden of the adjacent St. Joseph Church, which ministers to the religious needs of the Mexican settlement just outside the north gate of the smelting works. The stack was originally the outlet for the copper blast-furnace gases, but since 1911 it has been used by the reverberatory and converter departments; the gases from the old copper blast furnaces now pass out of the main stack with the lead-furnace gases.

Smelting Titaniferous Ores

According to O. Simmersbach (*Stahl und Eisen,* 1914, p. 672), in smelting titaniferous iron ores the aim should be to obtain all the titanium in the slag, as it does not improve the quality of pig iron. Ores mixed so that the slag does not contain more than 2% Ti, can be smelted in the same way as titanium-free ores; and provided that the slag contains under 6% MgO, its melting point will not be inconveniently high.

Notes on Leaching Experiments at Douglas, Ariz.

In discussing the various papers on the leaching of copper ores presented at the last meeting of the American Institute of Mining Engineers, Lawrence Addicks contributes the following remarks in the November *Bulletin* on electrolytic deposition of copper from the solutions:

I have been particularly interested in this subject the last three months in doing some work for Phelps, Dodge & Co., and I have been astonished to find under what adverse conditions it was possible to get good deposits. A coherent deposit premises a sufficient number of copper ions in contact with the cathodes to satisfy the current. This can be obtained by having the solution heavy in copper, or a solution considerably lighter in copper but with rapid circulation. The ordinary electrolytic refiner has a handicap which is entirely absent in leaching liquor, namely, the presence of gold and silver slimes at the anode which cannot be disturbed by any violent circulation, or there will be prohibitive silver and gold losses in the cathode. I also think that it is wrong to look at this problem as a cyclical one rather than as a continuous one, and that it would be better to consider the use of liquor high in copper, say 3%, take it down to 2 or 2½%, run that back into the tanks, make up the ½% that is missing and return the liquor to the electrolytic tank. In this way better depositing conditions are obtained and, when studied over, it is not bad from the leaching point of view. Of course, that means counter-current washing of the ore in order to bring the liquor up to the necessary strength for the depositing tanks, and indicates the use of Dorr thickeners or something of that kind. The question of wash water bringing up the bulk is easily dealt with in the dry climate of the West by using a cooling tower and evaporation to get reduction of bulk.

Now as to a depolarizer; using a carbon anode, iron is the real depolarizer in most cases, even though sulphur dioxide may be introduced. Iron is almost always present and is an efficient depolarizer. I found in the experiments at Douglas that it was quite possible to consider working voltages as low as 0.6 and 0.7 volts. The depolarizer requires circulation in order to bring fresh iron to the surface of the anode. With such voltages I aim to obtain a recovery of 3 lb. every kilowatt-hour.

There are two questions I want to ask. One is regarding the apparently remarkable wood in the West, which seems to withstand the acid liquors. I am used in all my experiences in electrolytic work in the East to see wood, after an exposure to sulphuric acid, reduced to a soft charcoal through which you can poke your finger. If redwood will withstand acid to the extent which my brief observation indicates, I do not see that there is any problem entailing the use of asphalt mixtures and other protective coatings for this work.

The other question I want to put is whether anyone has had experience in the restraining of the solution of impurities by having the leaching liquor high in those impurities. The real problem in Arizona is one of alumina and what to do with it after it gets into the solution. My idea was to use a solution so high in alumina that the additional amount dissolved from the ore would be small. I might also say that I have worked with solutions and electrolytes as high as 7% alumina, and use regularly liquor containing 3% Al_2O_3 and 3% Fe, without any trouble with the deposit.

The First Large Rectangular Copper-Smelting Furnace in North America was built about 1880 at Capelton, Que., according to Alfred W. G. Wilson, of the Mines Branch, Canada Department of Mines. This furnace was approximately 10 ft. in length and 4 ft. in width at the tuyeres. W. E. C. Eustis, in a personal letter to Mr. Wilson, states that "the furnace was built in about two weeks as an experiment. It was provided with two tap holes, and I believe was operated with two No. 9 Sturtevant fans or their equivalent. I remember distinctly that John L. Thompson, who was in charge of operations, ran down to the office and told me that the double elephant was in operation and to come up quick and see it. To my astonishment I found on arriving two streams of slag and metal rolling from this furnace, each of which looked as big as my leg. It was a most surprising sight at that time"

Combined Cyanide and Other Processes--I*

By Herbert A. Megraw

SYNOPSIS—The cyanide process is seldom used alone, in spite of its applicability to many different kinds of ore. Concentration is the most usually employed auxiliary. It removes base metals, allowing them to be saved separately, and averting excessive cyanide consumption. Comparison of a concentrating and nonconcentrating mill is given.

Notwithstanding the wide popularity of the cyanide process in the treatment of ores containing gold and silver, it is seldom indeed that it is used alone. Almost invariably other aids to the highest economical extraction are employed, and it is by no means rare that two or even more other processes are used in conjunction with it. Some of the systems used as aids to cyanidation are actual extraction processes, while others are preparatory processes, designed to put the material in the best possible condition for action of the cyanide.

Process Depends upon the Nature of the Ore

The processes used as assistants depend, of course, altogether upon the nature of the ore to be treated. Simple ores require simple processes, while complex ores may require a combination of processes. For example, a clean siliceous gold ore, in which the gold is finely divided, will require only the cyanide process to extract the economical maximum. If the gold occurs partly fine and partly in a comparatively coarse state, it is probable that amalgamation would be required to recover the coarse gold. If the gold is contained in complex sulphides, and only partly free, concentration may be required as one of the assistant processes. The same is true with silver ores, except that native silver is rarer and not usually considered amenable to cyanide treatment, although in some cases it has been made so, as will be mentioned later. Gold or silver ores, or both, containing small amounts of copper may require an entirely different treatment, which may possibly include ammonia dissolution of the copper. And so it may be seen that with various ore compositions various processes may be required to satisfactorily extract the maximum possible value from the ore.

Possibly the simplest combination of processes is that of removing the pyrite from gold ores by concentration, and cyaniding the tailings. This is a system which is employed in a large number of cases, although in many of the California mills amalgamation is added to the combination of systems, and the cyanide omitted. Confining ourselves, however, to concentration and cyanidation, it may be readily seen that this procedure is applicable to those gold ores which contain an appreciable part of the gold combined with the pyrite. The free gold which does exist in the ores may be either coarse or fine. In the first case it will be removed with the pyrite on the concentrators, and in the second it will proceed to the cyanide plant, where there will be no difficulty in dissolving it in a reasonable time.

Concentration is one of the most inexpensive of metallurgical processes, and there is usually no hesitancy in using it in combination with cyanide or other processes whenever it is considered that any benefit may be obtained. The power cost is low, and the maintenance and supervision required are small. The greatest item of cost, and one that must be examined carefully wherever the process is considered, is the marketing of the concentrates after they are made.

Concentrates Not a Final Product

Concentration produces a material which does not command a stable market, such as bullion does, but is subject to treatment charges which vary according to its analysis. Transportation charges on concentrates are higher than those charged against bullion, and they must usually be shipped in a moist state, so that freight has to be paid also on a certain percentage of moisture. Besides, the exact value of concentrates is difficult to arrive at because of the necessity of sampling and assaying by both the buyer and seller, the buyer usually taking good care that there is a safe margin in his favor. Thus, it is rare indeed that the producers of concentrates are enabled to secure the exact value of the precious-metal content of their product. All these considerations must be given due weight in the selection of a combination of processes, since they all have a direct influence upon the ultimate economy. In some cases, which are increasing in number at the present time, the concentrates are treated by a separate process at the mills where they are made. Their higher precious-metal content will justify a much greater per-ton expense on the small quantity produced than would be allowable if the concentrates were treated in the mill run of ore, so that a small concentrates-treatment plant is often justifiable. The cost of marketing concentrates is usually so great that home treatment can be performed in an entirely satisfactory manner at a saving of expense, including as cost the value of the metal left after that special treatment.

Preliminary concentration of silver ores, to remove the pyrite, is largely practiced and is more generally required even than with gold ores. This is because silver seldom occurs native, but is almost always in combination of some kind. The most usual silver mineral is the sulphide, argentite, which is found either partly or wholly in almost all silver ores. There are, of course, a number of other sulphide combinations, some of which are easily treated by cyanide, and others of which are not. Where the latter occur the necessity for concentration is apparent.

Treatment of Mexican Silver Ores

In many silver ores the concentrates are shipped to smelters, who recover the silver by fire methods, but in a number of other cases they are treated on the ground with a high-grade cyanide solution, being reground to extreme fineness before treatment. Since Mexican silver

*This is the seventeenth 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, Sept. 12, Oct. 17 and Oct. 31, 1914. The next article will deal with "Combined Cyanide and Other Processes—II," and will appear in the issue of Dec. 26, 1914.

ores are probably of greater interest in general than those of any other single district, consideration of the plans of working there will be considered. In view of the fact that the greatest silver-producing district in the United States, Tonopah, is in many ways similar to the larger Mexican districts, a discussion of this subject from the Mexican standpoint will be of wide interest and may be said to be of almost general application.

Generalization can only be permitted in cases where the conditions are alike, but this is so rare that each particular instance needs special study. In considering the question academically, however, we may begin by assuming an ore containing silver sulphides, but which contains no base metals or minerals of a kind detrimental to cyanidation, and one from which it is not possible to derive such a quantity of base-metal concentrates as to make it profitable to separate these as a special product. Such are the ores of the principal Mexican camps of Pachuca, Guanajuato, largely those of Zacatecas, and many others.

Comparison of Concentrating and Nonconcentrating Systems

In a combination of processes, the ultimate profit is the thing to be looked after, and that process or combination of processes which gives the greatest ultimate profit is the one which will be used. Therefore, in the case of the class of ore mentioned, the object is to determine whether there is a greater profit in the process of concentrating the ore prior to cyanidation and subsequently selling the concentrates to the smelter, or in the process of direct cyanidation of the ore as a whole, after which consideration may be given to the alternative of treating the concentrates in a separate process at the same mill in which they were produced. This will probably offer some economy over shipments of the concentrates to a smelter, particularly where the latter is at a considerable distance from the point of production. An actual comparison of this sort is mentioned by J. B. Empson in a communication to the Mexican Institute of Mining and Metallurgy, Vol. 3, 1912-13. Mr. Empson presents figures and data from the practice of the Cia. Minera "La Blanca y Anexas," given by the superintendent, G. W. Harris.

In this calculation, the metal quotations are, silver at 40 pesos, and gold at 1333.33 pesos per kilo. The object of the calculation was to show what lesser total extraction would have yielded the same money value had the contents of 354 tons of concentrates carrying 5747.6 kilos of silver and 35.446 kilos of gold been produced as bullion. The data taken in the calculation represent the official returns from the sale of concentrates by La Blanca y Anexas, as well as the actual returns on bullion shipped for the half year ended December, 1911. The facts are substantially that 48,252 metric tons were milled during the half year. The average of mill feed was 4.09 grams gold and 774 grams silver per metric ton. The ratio of ore to concentrates was 136:1. The tonnage of concentrates and the contents of gold and silver have already been mentioned. The extraction by concentration was 15.36% of the silver content of the ore and 17.93% of the gold content. The total extraction by concentration and cyanidation was 93.12% of silver and 95.567% of the gold.

In the preparation of figures, all costs are given in Mexican currency and are separated under two heads. Milling costs represent all expense up to the time that the bars are in the express office and concentrates at the railway station. Liquidation costs cover all charges subsequent to those included in milling. The cost of concentration per ton of ore milled is as follows:

COST OF CONCENTRATION

	Centavos
Labor	3.5
Power	2.0
Labor and maintenance	1.4
Sacking, sampling, teaming, etc. (5 pesos per ton of concentrates)	3.7
Total	10.6

In the calculation of the cost of production of bars it is assumed that the treatment cost, including cyanide, lead acetate, etc., would not be increased over that incurred in the ores from which the concentrates have been removed. Precipitation and melting costs, including labor, vary directly with the amount of metal precipitated and melted. Excluding labor, the costs for this period are 55.2 centavos per kilo of fine metal produced (including zinc, coke, crucibles, etc.). Multiplying this amount by the total fine kilos of metal contained in the concentrates, we have 3191.66 pesos. Dividing this by the total number of tons milled gives 6.6 centavos, and subtracting this amount from the above, namely, 10.6 centavos, equals 4 centavos per ton of ore milled, the assumed saving by not concentrating.

Marketing Bars and Concentrates

The accompanying tables show the basis of liquidation of bars and concentrates. It is to be noted that state tax is levied upon gold at 24 pesos per kilo, equivalent to 1.8% on 1333.33 pesos, the value of a kilo of gold. The tax is applied to 80% of the total.

LIQUIDATION BASIS FOR CONCENTRATES AND BARS

Concentrates	Bars
Silver—95% at N. Y. quotation.	Silver—100% at N. Y. quotation.
Gold—approximately 97% at 1.33⅓ pesos per gram.	Gold—100% at 1.33⅓ pesos per gram.
Treatment.....21.00 pesos per ton	Treatment.60 centavos per kilo gross, or 70.6 centavos per kilo fine
Freight..... 5.13 pesos per ton wet or..... 5.70 pesos per ton dry	Assay..... 2.50 pesos per bar
Total.....26.70 per ton dry	Express....78 centavos per 1000 pesos
Federal tax, 2½% of total value.	Federal tax, 2½% of total value.
State tax, 1.8% on 80% of silver and 24 pesos per kilo of gold, on 80% of total.	State tax, 1.8% of silver, and 24 pesos per kilo of gold.
Revenue stamps, after all deductions except state tax, 5 centavos per 10 pesos or fraction.	Revenue stamps, after all deductions but express, 5 centavos per 10 pesos or fraction.
	75% returned by refinery.

The total smelter deduction per ton of ore milled, on the concentrates, amounts to 26.8 centavos. Treatment and freight charges of 26.70 pesos per ton of dry concentrate equals 19.6 centavos per ton of ore milled. The Federal tax, equal to 2½% of the total value, makes a total of 6928.33 pesos, a tax of 14.4 centavos per ton of ore milled. The state tax equals 1.8% of 80% of the total silver, and 80% of the total gold pays 24 pesos per kilo. At this rate, the total is 3990.85 pesos, or 8.3 centavos per ton of ore milled. The revenue stamps amount to less than 0.5%, but in order to cover miscellaneous, stamps, etc., on freight bills, 0.5% is allowed, making a total of 1385.67 pesos, or 2.9 centavos per ton of ore milled. Thus, the total cost in connection with liquidation of concentrates amounts to 72 centavos per ton of ore milled.

In bars the total content of gold and silver is paid for by the refinery. The cost per kilo of fine metal is: Treatment, 70.6 centavos; assaying, 8.9 centavos; and express on a bar of 1300 pesos, 3.6 centavos, a total of 83.1 centavos per kilo. This amount multiplied by the number

of kilos in the concentrates, as formerly given, equals 4804.84 pesos, or 10 centavos per ton of ore milled. The federal tax is 14.4 centavos per ton of ore milled, and the state tax in this case, 10.3 centavos per ton of ore milled. The cost of revenue stamps per ton of ore milled is 0.7 centavo; the total liquidation cost in connection with production of bars per ton of ore milled, 35.4 centavos.

The total liquidation cost then, in the case of concentrate, is 72 centavos, and in the case of bars, 35.4 centavos. The difference in favor of bars is then 36.6 centavos, while under the head of milling, the difference is 4 centavos per ton of ore milled, making a total in both liquidation and milling, of 40.6 centavos per ton of ore milled. The difference in favor of bars has now to be calculated in terms of percentage of the original ore value.

The original ore contained 774 grams of silver, valued at 30.96 pesos, and 4.09 grams of gold, valued at 5.35 pesos, a total of 36.41 pesos. Of this total it would appear from the foregoing calculations that 40.6 centavos could have been saved if concentration had been used, and as 40.6 centavos is 1.12% of 36.41 pesos, it follows that 1.12% of the recovered value could have been sacrificed and still leave the result of nonconcentration equal to that obtained by concentration, as far as profit is concerned.

In this calculation, however, it has been considered that all the gold and silver contained in concentrates would have been obtained in the form of bars by straight cyaniding, but inasmuch as it is impossible to obtain 100% from this material in the ordinary way, it is necessary to apply the percentage recovery obtained in cyaniding the general pulp to the sulphides of the concentrates. This result is shown in the accompanying table.

LOSS IN CYANIDING WITHOUT CONCENTRATION

	Grams Silver	Grams Gold	
Average value of heads to batteries	774	4.09	
Average value of heads less concentrates	655	3.36	
Average value of tailing	53.25	0.196	
Actual extraction on cyanide heads	91.87%	94.17+	
This percentage applied to battery heads		33.57	pesos
Actual extraction recovered in 6 months by concentration and cyaniding		34.04	pesos
Total extraction recovered during 6 months in percentage		93.5%	
Loss in extraction by not concentrating per ton of ore milled		47 centavos	

Thus we see that the loss in extraction by omitting concentration would amount to 4.7 centavos per ton, and this is equal to 1.29% of loss per ton. Comparing then the 1.12% estimated profit by bars over concentrates with the 1.29% estimated loss by not concentrating, there is a difference of 0.17% in favor of concentrating previous to cyaniding. This difference seems to be too small under ordinary circumstances to justify plant changes, or even to guarantee that there would be any material difference between the two methods. Certainly, on any ordinary plant, it would not be sufficient to justify the additional installation expense required by the concentration.

There is, however, another alternative which has not been considered by Mr. Empson in this article, and that is the possibility of treating the concentrates by themselves in a separate concentrates-treatment plant, and extracting very nearly 100% of the precious-metal content at a cost considerably lower than that of shipping to the smelter. Certainly there is a great difference between the cost of shipping concentrates, and the probable cost of treating them on the spot, so that there is a fair possibility, at least, that advantage might be gained by having recourse to that system. It is by no means impossible to handle concentrates successfully in this way, and often only an improvised installation is required. I know of one small plant which produced about 300 lb. of concentrates per day, which successfully treated the material, extracting about 99% of the gold and silver contained, by grinding concentrates and cyanide solution in an improvised tube mill made out of an oil drum. Eventually, four of these were installed, lined with silex brick, and kept operating on concentrates exclusively. The consumption of cyanide, while high, was not more than might have been expected on that class of material, and the total cost of recovery did not approach the cost when the concentrates were shipped to the smelter. An added advantage was that the metals in the concentrates were recovered much sooner than would have been the case had they been shipped, since the amounts produced day by day would have had to be stored until sufficient for economical shipment had accumulated. With the present advantageous methods of treating rebellious ores, such as desulphurization and the other processes which have lately come to light, cyaniding the concentrates ought to be a much easier and cheaper process and should give high-percentage extractions.

(To be continued)

Mining Dividends for November

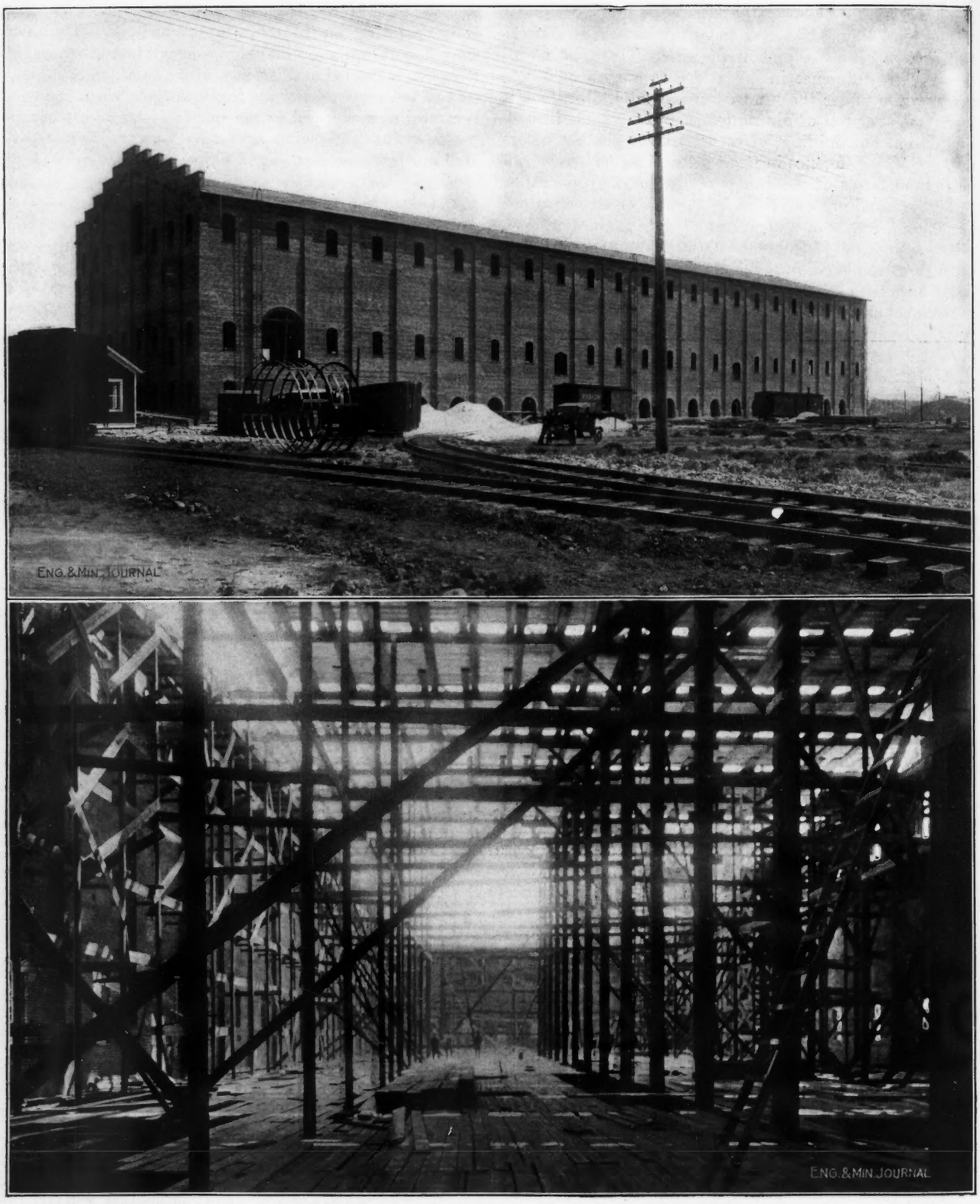
Nineteen United States mining companies reported dividends aggregating $1,473,123 for November, 1914, as against $2,343,646 paid by 31 companies in 1913. American metallurgical and holding companies paid dividends of $8,692,022, as against $9,977,955 last year, and Canadian and Mexican companies paid $634,894, as against $1,879,896 in 1913.

United States Mining Companies	Situation	Per Share	Total
Alaska Mexican, g.	Alas.	$0.20	$36,000
Alaska Treadwell, g.	Alas.	1.00	200,000
Alaska United, g.	Alas.	0.20	36,040
Bunker Hill Con, g.	Calif.	0.02½	5,000
Bunker Hill & Sullivan, l.s.	Ida.	0.25	81,750
Arizona, c. pfd. B.	Ariz.	.....	53,842
Caledonia, l.s.	Ida.	0.01	26,050
Elkton, g.	Colo.	0.02	50,000
Federal Min. & Sm., pfd.	Ida.	1.00	119,861
Fremont, g.	Calif.	0.02	4,000
Golden Cycle, g.	Colo.	0.20	300,000
Homestake, g.	S. D.	0.65	163,254
Hecla, l.s.	Ida.	0.01	10,000
Jerry Johnson, g.	Colo.	0.00½	12,500
Nevada Wonder, g.s.	Nev.	0.05	70,350
Parrot, c.	Mont.	0.15	34,477
South Eureka, g.	Calif.	0.07	20,999
United Verde, c.	Ariz.	0.75	225,000
Yosemite, g.	Calif.	0.10	24,000
Iron, Industrial and Holding Companies	**Situation**	**Per Share**	**Total**
Amalgamated, c.	U. S.	0.50	1,538,879
Cambria Steel	Penn.	0.62½	*562,500
International Nickel, pfd.	N. J., Can.	1.50	133,689
U. S. Steel, pfd.	U. S.	1.75	6,304,919
Warwick, I. & S.	U. S.	0.35	52,035
White Knob Copper & Dev.	Calif.	0.25	100,000
Canadian, Mexican and Central American Companies	**Situation**	**Per Share**	**Total**
Amparo, g.s.	Mex.	0.03	60,000
Coniagas, s.	Ont.	0.30	240,000
Crown Reserve, s.	Ont.	0.02	35,376
Dominion Steel, pfd.	Can.	1.50	105,000
Hollinger, g.	Ont.	0.15	90,000
Lucky Tiger, g.s.	Mex.	0.09	64,380
Right of Way, s.	Ont.	0.01	16,855
Temis. & Hud. Bay, s.	Ont.	3.00	23,283

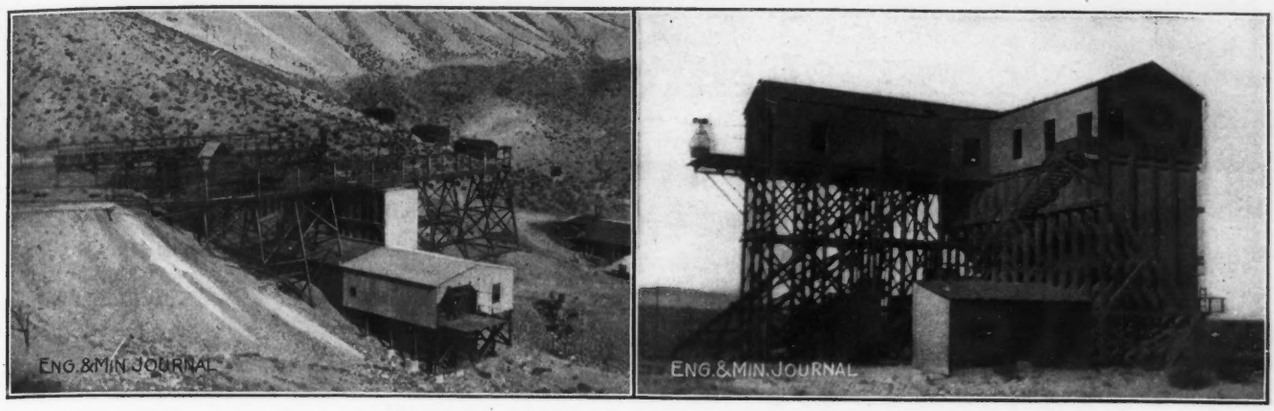
*Paid in scrip.

Totals for the first eleven months of the year are: United States mining companies, $50,715,223 in 1914 against $64,519,256 in 1913; smelting and holding companies, $78,819,124 in 1914 against $81,974,586 in 1913; and Canadian, Mexican and Central American mining companies, $14,315,259 in 1914 as against $20,697,712 last year.

Photographs from the Field



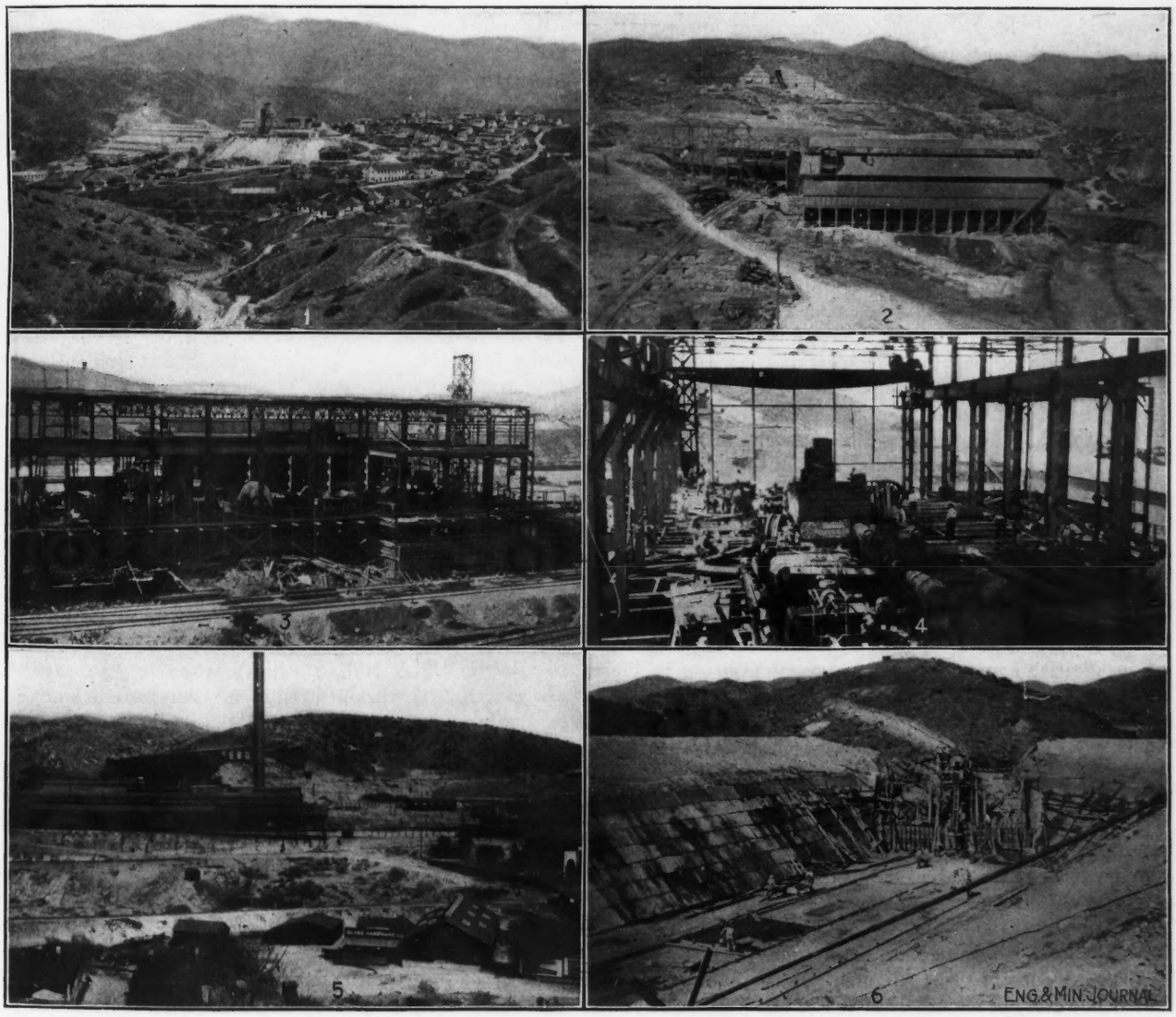
EXTERIOR AND INTERIOR VIEWS, DURING CONSTRUCTION PERIOD, OF THE 100-TON ACID PLANT OF THE ANACONDA COPPER MINING CO., ANACONDA, MONT.



THE MASON VALLEY MINES CO., MASON, NEVADA

The Mine Ore Bins and Upper Tram Terminal — The Lower Tram Terminal and Loading Bins

Tramway is 6250 ft. long, with a drop of 600 ft. It has a capacity of 100 tons hourly. It connects the mine with the Copper Belt Ry., which delivers to the company's smeltery, 16 miles distant.



IN THE MIAMI COPPER DISTRICT, ARIZONA

1. The Miami Concentrator and Settlement. 2. International Smeltery and Inspiration Mill. 3. Blowing Engines and Turbines of the International Smeltery. 4. Power Plant of the Inspiration Co. 5. The Old Dominion Smeltery, at Globe. 6. The 5,000,000-gal. Reservoir of the Inspiration Co.

Editorials

The Recovery in Copper

The sharp rise in the price for copper in November was based chiefly upon improved demand for domestic consumption, the large sales for the month having been more for domestic delivery than for foreign. During the three months of gloom—August, September and October—manufacturers lived largely on their old contracts for supplies, and placed new orders only for their immediate requirements. The normal business in contracts for delivery during the two or three ensuing months practically ceased to exist. Gradually, however, the orders received by the manufacturers, reflecting ultimate consumption, began to increase, first in the brass business, then in the sheet business, and last of all in the rod and wire business, and along with the clearing up of uncertainties in several directions, and the general increase in optimism, the manufacturers of copper saw that the ground had become safe for the resumption of business with the copper producers in the old way.

Some very substantial buying began in the latter part of October, when already it looked as if daylight were ahead. The interruption to the export business, which happened suddenly at the beginning of November, cast a new shadow over the field, but as things turned out, this proved to be simply an excellent test of the soundness of things. Copper was in fact in the position that producers would rather keep the metal than sacrifice it. When manufacturers became convinced that the producers meant what they said and that there were not going to be any "bargain counters," they began to buy in earnest and congratulated themselves that they were getting copper at less than 12c., which was quite bargain enough. With these circumstances the price for copper rose rapidly, so much so that it was laid to "speculators" by some skeptics who must always have a manipulative reason for everything. In fact, there is never any considerable speculation in the domestic copper business. The producers sell in the main to the manufacturers who are going to use the copper and are quite averse to selling it in any other way. Certain of our British contemporaries are more amusing in their suspicion that the American producers have raised the price for copper in order to make the British government pay more for the copper it has been seizing!

At the end of November, we find the copper market at about the same level where it stood at the end of July, when war was expected, although there were still faint hopes that it might be averted. Even before the war cloud gathered in July, everybody was gloomy because copper was selling down toward 13c. Everybody is now happy because it is around 12½c. We surely do not want anybody to be anything but happy, and we hope that a further advance in price will increase the happiness. We must, however, point out that the present situation does not offer any basis for excessive enthusiasm. The copper producers are much better off than two months ago they had any reason to hope. The price having gone to 11c., has recovered to 12½c., instead of sinking to 10c., which many feared would happen. Furthermore, the porphyry producers have exhibited their ability to operate their mines on half scale without increasing their cost of production per pound of copper. Thus there is in prospect a resumption of dividends, if not at the old full rate, at least at a partial rate.

It must be remembered, however, that the improvement in copper, satisfactory as it has been, reflects the conditions in the industry upon the basis of a 50% curtailment of production. It would be fatal to the welfare of everybody if any important producer should become minded to do anything other than to remain curtailed. The essential thing in the copper business, just now, is to preserve the *status quo*.

The Copper-Export Controversy

The controversy over the exportation of copper from the United States to other neutral countries has had a curious dénouement, if dénouement it be. For our own part, we are inclined to think the affair is as good as ended, although some agitation will doubtless be continued.

In the present phase of the matter, Great Britain apparently does not deny the right of the United States to sell copper to Italy (or Sweden), but insists upon being assured that the copper is destined for use there. This, in itself, may be high-handed, but evidently the Italian government agrees to the principle and itself has formulated measures to insure it.

Let it be noted that Italy had previously declared an embargo on copper exports. Manifestly Italy herself is not now minded to let any copper come within her borders that might be surreptitiously forwarded to Germany.

The system of regulating the business that has been put in effect is substantially as follows: An Italian consumer wants to buy copper and inquires about its purchase in New York. New York says it will sell him the copper if he can satisfy his government that he is going to use it. The Italian consumer having so satisfied his government, the latter informs the Italian Embassy in Washington, the Embassy then certifies the shipper's papers and the shipment may be made. Mere affidavits by the shippers of copper are not valid in the eyes of the foreign governments, which say, in effect, that they do not take anybody's word. Nor are consular certifications of any good.

This procedure puts serious obstacles in the way of direct business between New York and Italy. In quoting prices the shipper needs to know when and how he is going to ship. He cannot figure on his insurance and some other things until he can give the name of the ship, the underwriters requiring that; but with the formalities that must now be executed, the contemplating shipper is quite in the air. Furthermore, no shipping agent will agree to carry any copper unless all the papers are in the highest form of regularity. No ship owner can afford

to risk days or weeks of demurrage on account of seizure for the sake of the freight on a few hundred tons of copper. In fact, the shipping men have been so thoroughly scared that some of them are looking upon the carrying of any metal as a thing to be avoided, whether it be contraband or not.

What, then, is the industrial effect of this, letting it be taken for granted that all ideas about getting copper into Germany have been dismissed; that that no longer is a possibility?

Some expert authorities say that the difficulty of doing business directly with New York will result in its being done primarily with London. They argue that such a capture of trade is just what England wants to accomplish, i.e., that she intends to command the whole Continental market.

It is well known among the copper producers that when England seized the copper at Rotterdam, which she was reputed to have paid for generously, she did in fact obtain a lot of very cheap copper, which may have been resold advantageously, it is hinted. Anyway, the producers here did not appreciate England's "generosity" in this matter.

But supposing that Italy is going to buy her copper through London, instead of directly from New York, she is going to use just as much in one case as in the other, and the producer here is not affected. What really affects him is his inability to sell copper to Germany, but it is Italy that prevents him from doing that; and if to make surer her embargo, Italy interposes difficulties in the way of copper transactions between herself and the United States, that is her own affair. Furthermore, if London scalps a profit on copper transactions done for Italy, it seems to us that it will be the Italian who will pay.

However, we can hardly believe that England is contemplating doing the copper business for the whole of Europe, so long as the center of the refining industry is New York. Certainly she has not undertaken to supervise the transactions of either France or Russia.

The long and short of the copper-export controversy is that England is not now interposing objections to the transaction of business between one neutral country and another, but claims the right to assure herself as to the innocence of the parties doing the business. It is the European neutral countries which are interposing the real difficulty. They say that copper may not be shipped to them on order, and that every transaction in which their citizens participate must be supervised by their authorities. In bringing this about, British diplomacy appears to have outgeneraled everything else. The original American contention against Great Britain was sound in the eyes of eminent international lawyers, but what can America do if Italy does not want to take copper from her except in a certain way?

"Skilled Miners Familiar with the Mines Around"

It is unfortunate, but true, that many plain mining men cherish hostile feelings toward mining engineers; sometimes in general and often in particular. In the latter cases the psychological attitude may be entirely justified by the circumstances. And, too often perhaps, the attitude may be reciprocated. But it is certainly unjust for either class to generalize when indulging in condemnation. In the hope that publication will contribute in some degree toward harmony, we take the liberty of quoting from the files of a private correspondence between a consulting engineer (*sic*) and one of his mine-owner clients. This engineer wrote:

> Your letter of Sept. 20 received, and I note that you have expended $15,000 on this property without satisfactory results. The data furnished by Mr. B. is very incomplete, and my opinion is that you will find it difficult to raise additional capital in the way you suggest, one of the chief obstacles being the lack of maps and other records of work done in the past. But, as I explained to you some time ago, this lack can be remedied to a certain extent by expending a moderate sum for surveys, sampling and assays.
>
> With all respect for the personal convictions of Mr. B., I beg to dispute the point that "a skilled miner familiar with the mines around has more show than a mining engineer." Perhaps he bases his opinion upon his experience with some who call themselves mining engineers, but are rank imitations. I have recently received a so called report from one who is perhaps a home-made, self-titled mining engineer. In the course of his report he pretends to quote from a U. S. Geological Survey bulletin. A comparison with the original text shows that dates have been altered and whole sentences omitted, for obvious reasons.
>
> I recount this merely to emphasize the importance of knowing whether one is considering a "real" mining engineer in comparison with the experienced miner. The latter's experience is often limited to one or two mines of a single district, whereas the mining engineer brings to a property a breadth of experience covering many considerations not dreamed of by the average miner. The miner has concentrated his attention almost entirely on the breaking and removing of rock, an essential part of mining, but the successful management of a mining property embraces many other considerations.

A mining engineer worthy of the name always relies to a large degree upon the "skilled miner familiar with the mines around." He would be a fool not to rely on several miners. But his training as an engineer permits him to form his conclusions by studying all material available. This includes not merely what the experienced miner has observed, but a personal study of the ore deposit itself and a study of what the government geologists and other mining engineers have concluded concerning the mines of the district. The mere miner, no matter how expert he may be in his own particular line of coöperating with the engineer who directs, is seldom able to assume in turn all the various functions of a mining engineer with any great degree of success. For when he reaches that point, he *is* a mining engineer himself and is qualified for membership in the professional societies and is accepted in full fellowship, lack of college diploma being no bar whatever. The college diploma merely indicates that a man has been examined and has qualified in the studies and a recent graduate may or may not be as good as the practical skilled miner. Sometimes he is a skilled miner before he goes to college and sometimes he takes up pick-and-shovel and hammer-and-drill work immediately after graduation.

Deposits differing widely in character occur in the same district. A San Juan miner, skilled in working at the American Nettie mine, where the ore lies almost horizontally between sandstone and shale, may not be competent to take charge of the "Salamander." A miner who has worked in the "Republican" or the "Moonshine" would probably be a good foreman for the "Salamander," but could he sample the ore, assay it, survey the workings, keep books, make contracts, etc.? Again, perhaps the man from the American Nettie would discover ore which had been totally overlooked by every miner who had ever been in the "Salamander."

There are instances of this sort that are not hypothetical. Many will recall the story of the Camp Bird mine.

Among other work a 40-ft. drift had been extended eastward in the Gertrude claim without finding ore; to qualify for patent, another 10 ft. was subsequently driven. The Allied Mines Co. relinquished its control of the property because its "skilled miners" did not recognize as ore what had not been previously so regarded. Twenty years later Thomas F. Walsh, who had been mining in other districts of Colorado, was interested in what he saw on the Gertrude dump; he had the east drift sampled and found that rich ore had been left in the breast. He secured the adjoining property and ultimately a magnificent reward for not being bound to the traditions of a single camp. The miners who drove the last 10 ft. of that drift were probably "skilled miners familiar with the mines around," and their familiarity with the first 40 ft. of the drift may have been such as to breed contempt for the last 10 ft. Walsh was a mining engineer without knowing it. His experience in other mining districts made him inquisitive; he added good judgment and executive ability to this inquisitiveness, and got results. These are the broad qualifications toward which the training of the mining engineer is directed. The mining of lower-grade deposits has gradually increased the complexity of the operation and has contributed toward the disappearance of the "skilled miner" from the management, valuable as he may be in the actual mining of the ore.

BY THE WAY

Diamonds exposed to the action of radium become highly radio-active, said Sir William Crookes, in the course of an address before the Royal Society, according to the *Engineer*. This acquired radio-activity continued for years with apparently undiminished force. Sir William produced a diamond which had been exposed to radium for some months about 12 years ago. After the exposure it was found to be highly radio-active, and affected a photographic plate. Though it had never been near radium since, it was now practically as active as ever, in spite of the fact that it had been carried about in his pocket and subjected to the drastic treatment of being boiled in strong acids.

⁂

It seems a far cry from the foot-and-mouth disease to metallurgy, but the following circular from Edward Hill's Sons & Co., of New York, indicates a connection:

The U. S. Department of Agriculture has made a ruling as follows:

Imported packages of merchandise and goods packed in hay and straw may be shipped out of this state intact as received from foreign countries, provided you furnish this office with your written guarantee to secure affidavits from each of your consignees that such packing is promptly burned as the goods are unpacked at destination.

For any antimony, therefore, shipped to you, we will have to have your guarantee, sworn to before a notary, to comply with the regulation. This is something over which we have no control, and we cannot help doing it, as it is a regulation that is made on account of the foot-and-mouth disease among the cattle. We do not think it will last long. When we are shipping you antimony, we will inclose one of these affidavits and will be obliged if you will comply with the ruling. We have given guarantee that you will.

⁂

A cablegram from Melbourne advises that the Australian military authorities have raided the offices of the Broken Hill Proprietary, Mount Lyell, Mount Morgan, North Brokenhill, and South Brokenhill mining companies, and also the offices of the Australian Metal Co., says *Iron & Coal Trades Review,* Nov. 13, 1914. Books and other documents have been seized, it being understood that the authorities are desirous of obtaining information concerning the disposal of metals, and also information regarding contracts entered into since the outbreak of war. Mr. Hughes, the attorney-general, announces that the raids were made by his authority under the Trading with the Enemy Act, and that circumstances required this unusual action.

⁂

In the growth of population-centers it is not unusual to hear of what was once a homestead or farm being divided into city lots. The opportunity, however, of homesteading city or town lots does not often present itself. Such an occurrence has just been brought to light in the old mining camp of Springdale, near Pioneer, Nye County, Nevada. Years ago a townsite was established and named Springdale. It flourished, and one Albert Lidwell, it is stated, sold many town lots. Springdale, like all other mining camps, died in the course of time. Recently, numerous complaints have been filed, stating that Lidwell has made a homestead and desert entry on the same ground he once sold as town lots. The United States General Land Office has taken a hand in the matter and a hearing was given all opposing interests at Rhyolite, Nov. 20.

⁂

The revival of the kelp industry in consequence of the war should bring advantage to the peasantry on the West Coast from Donegal to Kerry and Cork. The Germans, owing to their great potash mines at Stassfurt, had a practical monopoly of the supply of potash to all countries, the only attempt to compete with them being made by the United States, which, however, was only able to engage in that enterprise on a small scale. The only source for the supply of potash to the British Isles, in addition to the imports of niter from India, is the potash made from Irish and Scottish kelp. The Irish kelp-burning industry, says the *Freeman's Journal,* has almost disappeared in recent years, owing to other sources being tapped for the supply of iodine. The failure of the potash supply should give it fresh stimulus.

⁂

The potash situation in the United States has entered into an interesting stage by reason of a circular letter which has been issued to American manufacturers by the New York agent of the German Potash Syndicate, says the *Chemical Trade Journal.* United States consumers were advised that the Syndicate had on hand a limited supply of potash salts, which, pending the cancellation of contracts with American buyers, it would be pleased to forward to such neutral shipping ports as are available for transshipment. The Syndicate would ship as much as possible of concentrated salts—chiefly muriate of potash—and only fill up shipments with crude salts whenever this was necessary. The philanthropic scheme would, in all probability, have touched the hearts of American buyers had not the announcement been made that all grades were to be advanced $4 per ton, cash to be paid before delivery, and delivery to be accepted of any grade of material that the Syndicate felt inclined to ship.

PERSONALS

F. W. Bradley, of San Francisco, Calif., is visiting in New York.

C. A. Burdick has gone to Michigan on a business trip of a few weeks.

J. H. Curle has joined the Sportsmen's battalion of the Royal Fusiliers in the British army.

Kirby Thomas has been making examinations of iron properties in the Chattanooga district of Tennessee.

Dr. F. S. Pearson, of London, was in Ottawa on Nov. 20 and had an interview with Premier Borden, of Canada.

F. L. Hall, representing an English manufacturing company, is in Canada to arrange for a supply of raw asbestos.

Arthur Feust does not purpose to return to Nicaragua, as it was previously reported in the "Journal" he intended doing.

P. K. Lucke, general superintendent of Cia. Minera de Peñoles, Mapimi, Mexico, is now resident at the Limes, East Molesey, England.

A. J. Loomis, for several years manager of Whiteside mine of Shenango Furnace Co., at Buhl, Minn., has resigned, to take up his residence in California.

James MacNaughton, general manager of the Calumet & Hecla mines and subsidiaries, has returned from a two weeks' business visit to the Eastern offices.

Frank S. Hartman, for 15 years past in charge of the office of the Thomas Iron Co., at Hokendauqua, Penn., recently completed his 50th year of continuous service with the company.

W. Y. Williams, of Spokane, Wash., formerly connected with the Granby company, is now largely interested in the Swede group at Bear Creek, in the Similkameen district of British Columbia.

Charles Enzian, of the Bureau of Mines, with headquarters at Wilkes-Barre, Penn., has left Santa Rita, N. M., where he has been observing the operations of the Chino Copper Co., and has gone to California.

N. Truschkoff, recently at the Eiderlinsk mines in the department of Orenburg, is now manager of the Ekibastous mines and smelting plant of the Khirgis Mining Co., Ltd., in the Semipalatinsk district, Siberia.

D. C. Jackling, managing director of the Chino Copper Co., was in Santa Rita and Hurley, N. M., the middle week of November. He incidentally made a brief hunting trip in the upper Gila country with Chino officials.

H. Sin Hio, an engineer in the employ of the Japanese Government, is making an inspection of the iron-mining operations on the Mesabi range, Minnesota, having special interest in the washing and drying appliances in use.

J. P. Hutchins is now in Petrograd. He expects soon to go to Southern Russia to examine a coal mine, after which he plans to return to London via the Mediterranean, if war conditions permit. He hopes to be in London by Jan. 1.

Z. T. K. Woo, T. C. Hsu, Z. U. Kwank, of Nanyang, China; M. Oshima and T. Fujita, of Tokyo, Japan, all connected with the Hanyeh Ping Iron & Coal Co., a Chinese corporation, have completed a trip of inspection of the Minnesota iron ranges as the guests of the Oliver Iron Mining Co. The purpose of their trip is to secure information relative to pit mining and the operations of the ore-carrying railroads, and iron and steel manufacturing methods in general.

Arthur Crowfoot, who for the past 19 years has been associated with the Boston & Montana reduction department of the Anaconda Copper Mining Co., at Great Falls, Mont., has been appointed concentrator superintendent for the Arizona Copper Co., Ltd., with headquarters at Morenci, Ariz., the appointment to take effect Jan. 1, 1915. Since the closing down of the Great Falls plant, Mr. Crowfoot has been employed at the Washoe reduction works at Anaconda, Mont.

A. G. Andrew, Jr., has taken the position of superintendent of the stamp mill of the Isle Royale Consolidated Copper Co. at Houghton, succeeding James G. Glanville, who was compelled to resign because of continued ill health. Mr. Andrew has been in charge of the Point Mills subsidiary mill of the Calumet & Hecla, where a reputation for efficiency and high recovery of copper made his work conspicuous. Mr. Andrew is a graduate of the Michigan College of Mines. Wallace Hayden, of New York, succeeds him at the Point Mills plant. Mr. Hayden is a Colorado School of Mines graduate.

OBITUARY

Joseph Selden, a director of the Hancock Consolidated Mining Co. and various other properties in Michigan, vice-president and general manager of the First National Bank of Calumet, died suddenly of heart failure at his home, Nov. 21. He was prominent in the industrial and commercial life of the copper district of Michigan, being president of the Copper Country Commercial Club.

Charles Davies, a pioneer mining engineer of New Mexico and Arizona, died in Phœnix, Ariz., Nov. 1, aged 78 years. Mr. Davies was a native of Wales, coming to America at the age of 21 and locating in New Mexico, where he operated mines at Pinos Altos, Georgetown, Mogollon and Silver City in the early '80s. He was for several years superintendent of the Breman mill. In Arizona he was interested in the Octave mine at Congress and had engaged in mining at Globe and Dos Cabezas.

August Christian, chief engineer of the Anaconda Copper Mining Co., died Nov. 19, after an illness of five months, aged 61 years. Mr. Christian was born in Germany, went to Butte in 1891 and had been identified with the Anaconda company for more than 20 years, his valuable services being greatly appreciated. He was a member of the Montana Society of Engineers and of the American Institute of Mining Engineers. He ranked high in his chosen profession, being considered among the best engineers in the state. He is survived by his wife, a daughter and two sons.

SOCIETIES

American Institute of Mining Engineers—The New York Section held a meeting, preceded by a dinner at the Machinery Club, New York, Dec. 2. Following the dinner, at 8 o'clock, Robert Sticht, manager of the Mt. Lyell Mining & Ry. Co. in Tasmania, prophet and oracle of pyrite smelting, talked informally. Disciple David H. Browne acted as toastmaster.

Mining & Metallurgical Society of America—The San Francisco section gave a dinner on Nov. 16, at the Palace Hotel, in honor of the homecoming of F. W. Bradley. Twenty-one guests and members were present.

The New York section held a meeting on Thursday, Nov. 19, at Browne's Chop House, New York, 46 members and guests being present. Prof. J. F. Kemp made an address on "The Newer Theories of Ore Deposition," and Robert Sticht gave a talk on his work in Australia.

Utah Society of Engineers—An address on the "Adjudication of Water Rights" was made before the society by W. D. Beers, state engineer, on the evening of Nov. 20. Mr. Beers called attention to the necessity of taking measures for the settlement of water-right disputes and suggested that a board be formed to study the question of water rights and their adjudication in Utah and other states. He recommended also that the legislature refrain from attempting to solve the problem of water rights by radical legislation, and proposed that the state stream measurement fund be increased from $5000 to $10,000 yearly.

University of Washington—The eighteenth annual short mining session of the College of Mines at Seattle will begin on Jan. 4, 1915, and end April 1. It will give to all mining men and others interested in the work of mining an opportunity to take up in a systematic, well balanced way, work in ore or quartz mining and milling, geology and mineralogy, chemistry, fire assaying, metallurgy, placer mining, mine and claim surveying, coal mining, mining law, and other related subjects. The course is designed to meet the needs of men who wish to learn something about the technical side of prospecting, mining, testing and assaying of ores, valuation of placer properties, and coal-mining problems. In this work all of the laboratories and apparatus of the various departments of the university are made available to the student. Twelve instructors direct the lecture and laboratory work of the different subjects of the short session. As far as possible individual needs are considered, and the beginner who wishes to learn something of mining, as well as the mine superintendent or college graduate entering the course, will find opportunity to take up the best work suited to his requirements.

Editorial Correspondence

DENVER—Nov. 23

A Gold Brick, believed to be the largest ever derived from placer operations in Summit County, was recently poured by the Tonopah Placers Co. It weighed 160 lb. avoirdupois, was worth $37,660, and was recovered by boat No. 2 in 16 days.

A Fire was started at the Arkansas Valley smelting plant in Leadville, during the night of Nov. 17, by a piece of hot ore which fell from a Dwight-Lloyd sinterer upon a patch of oil spilled on the floor. The roaster building was totally destroyed and the two roasting units practically ruined. The destruction was really the result of carelessly casting a bucket of water on the burning oil, thus scattering the flames in all directions. Excellent work by the employees acting as volunteer firemen prevented the spread of fire to adjacent buildings. Manager William B. McDonald states that the damage is being rapidly repaired and he hopes to keep the rest of the plant running uninterruptedly, with a resumption of roasting operations in the course of two or three weeks.

BUTTE—Nov. 26

Muckie McDonald and Joe Bradley, former president and vice-president, respectively, of the Butte Mine Workers' Union, were convicted, Nov. 22, of the charge of kidnapping and deporting three miners and were sentenced by Judge Clark, of Boulder, McDonald to three years and Bradley to five years in the penitentiary. During the trial they attempted to shift the whole blame upon James Chapman, whose whereabouts are unknown. The latter, it will be remembered, was arrested by the military authorities, but was released at the request of his wife and left with her soon afterwards for California. Efforts are being made to arrest him and bring him back to Butte for trial. "Red" Foley, who was tried in Bozeman on the charge of grand larceny for assisting in the dynamiting and looting of the safe of the Butte Miners' Union No. 1 during the rioting of June 13, was convicted Nov. 23 and sentenced to 20 months in the pentitentiary. The whereabouts of his partner in the crime, "Kid" Davis, who is supposed to have got away with $5000 from the safe, are unknown. At a meeting of the union Nov. 23 it was decided to raise a fund of $10,000 to appeal the cases of McDonald, Bradley and Foley and for the defense of the men still in jail awaiting trial on other charges.

SEATTLE—Nov. 25

The Hot Springs district of Alaska, situated on the strip of land between the Yukon and the lower Tanana, has had the best season of its history, with a production of nearly $750,000, a big gain over 1913. Most of the increase resulted from the extensive drilling done by Bock on the deep ground of lower Sullivan Creek during the last two years. After discovering pay, Bock let lays on most of the ground; his profit for the season is placed at $225,000.

JOPLIN—Nov. 24

The Tuberculosis investigation by representatives of the Bureau of Mines and of the U. S. Public Health Service is really an investigation of safety and sanitation in the Joplin mines. The mine operators are taking a far more active interest in the proceedings than had been expected when it was at first undertaken. For two weeks Edwin Higgins, of the Bureau of Mines, and Dr. J. A. Lanza, of the Health Service, have been visiting the mines, taking samples of air and examining the men engaged in the industry now as well as those who have become diseased and are now known to be victims of miners' phthisis. Many of the operators are lending great assistance to the investigators, and the state mine inspection department is actively helping the work. To date approximately 20 mines have been inspected and samples of air taken for analysis. The work will be continued for at least two weeks more.

Doctor Lanza is conducting that part of the work relating to the sanitary conditions of the mines and of the men at work and in their homes. This includes examinations of the changehouses, locally known as "doghouses." Free clinics at the local hospitals are being conducted and the experiences of the district physicians obtained in their treatment of miners afflicted with disease. Into this end of the investigation the visiting nurses under the employ of the Antituberculosis Society have been able to go a good ways, because of the previous surveys undertaken to ascertain the extent of tuberculosis and to help the victims. These nurses now have charge of 150 such patients scattered over the district living under all sorts of conditions, and are for that reason especially able to assist the government health officer. The lack of knowledge on the part of the miners of the simple facts of personal hygiene is appalling.

A Meeting of Operators with the government investigators and the state mine inspectors was held Nov. 21. The investigators discussed some of their findings and asked the operators to give them all the assistance they could in the way of counsel from their experience. It was determined to organize the mine operators into a committee of safety and sanitation. A committee will be elected to undertake this organization and the formulation of rules which may be introduced over the entire field, looking to the reduction of rock dust in the mines, the amelioration of conditions now pronouncedly unsanitary, and other rules for the better safeguarding against ordinary accidents. This committee was to report Nov. 25, and a meeting of all operators was called for Nov. 28 to complete the organization and start active work.

The Results of the work now being done by Mr. Higgins and by Doctor Lanza will be published, along with their recommendations, in a future bulletin of the Bureau of Mines. Their work will include investigations in the southeast Missouri mines and in the mines of southwest Missouri, southeast Kansas and northeast Oklahoma.

DULUTH—Nov. 28

Assessments for 1914 on iron-ore tonnages and mineral lands in the Minnesota iron-producing districts, as finally decided upon by the state tax commission, have been made public. Dr. Rukard Hurd, secretary to the commission, and an authority on the matter of mineral taxation, has issued a statement on behalf of the commission. As regards the Cuyuna range, that portion of the statement relating to the manganiferous deposits is of much interest, since the commission, it is understood, has gone to considerable lengths to ascertain the metallurgical value of this material. An abstract of his report follows:

For the Mesabi and Vermilion ranges, the customary annual adjustments were made, including deductions for shipments and stockpiles (the latter taxed as personalty), additions of newly developed tonnages and revision of previous estimates as now verified, measured and calculated by the Minnesota School of Mines. Upon conclusion of the work of adjustment, a general raise of 5% was ordered upon all mined and unmined iron ore and upon unplatted mineral land in St. Louis County, and of 10% upon all unplatted lands in Itasca County.

The total tonnage of merchantable ore on the Mesabi and Vermilion amounts to 1,407,218,914 tons, which includes 9,308,432 tons in stockpile May 1, 1914. The total assessed valuation of the total tonnage and the mineral lands is $270,603,874. The commission is of the opinion that the iron ores of the Mesabi and Vermilion are now upon a basis of 50% of true and full value, in strict compliance with Minnesota laws.

The iron-ore tonnages of the Cuyuna range having been during the year measured and calculated by the mining engineer of the tax commission, and their grade and class determined, the commission made for the first time an ad valorem assessment thereon of 50% of present indicated full value. The assessment is placed upon 13 active mines, or those about to become mines, containing 30,356,975 tons; on 19 properties of reserve ore of the first class, containing 27,066,558 tons; on 15 properties of reserve ore of the second class (lower grade), containing 13,434,382 tons; on 35 properties, containing 13,907,949 tons of low-grade, nonmerchantable or nonmineable ore; and also on manganiferous "ore material" arbitrary values are placed amounting to a total of $65,250; these values are considered to be upon mineral lands. The total assessed valuation on the total merchantable iron ore of 71,085,440 tons, including 227,575 tons in stockpile, and on mineral lands of the Cuyuna range, amounts to $6,033,085. Long exhaustion periods are taken to discount

the future value of reserve ore. No commercial manganese ore has been developed on the Cuyuna range. There is a considerable quantity of manganese, but so mixed with iron formation as to make it a manganiferous iron "ore material" of no present metallurgical value.

The following figures are published by the commission:

MESABI AND VERMILION RANGES, IN ST. LOUIS, ITASCA AND LAKE COUNTIES

	Total Value of Tonnage and Mineral Lands	Shipments Tons
1906	$64,486,409	25,611,384
1907	191,706,682	29,180,975
1908	180,210,693	18,098,894
1909	204,526,526	29,284,495
1910	224,669,845	30,413,963
1911	235,771,506	23,368,719
1912	259,418,277	33,892,390
1913	260,622,823	35,605,243
1914	270,603,874	24,000,000
		249,456,064

CUYUNA RANGE, CROW WING COUNTY

1914	$6,005,776	1,000,000
Prior	.....	1,186,401
Total		252,642,465

STOCKPILES, MAY 1, 1914

County	Tons	Summary and Total of Assessed Value
St. Louis	8,698,233	
Itasca	518,657	
Lake	71,541	
Crow Wing	227,575	
Total stockpile and value....	9,516,007	*$2,379,000

TONNAGES AND VALUES AT PRESENT

	Tons	Value
Mesabi and Vermilion range ores.	1,397,910,482	$264,553,874
Mesabi mineral lands	.....	*6,050,000
Cuyuna mineral lands	.....	65,250
Cuyuna range ores	70,857,865	5,940,426
Total	1,478,284,354	$278,988,650
Total full value on 50% basis		$557,977,300

*Estimated.

The full value shown above is more than 60% of the entire taxable value of the State of Minnesota in 1906, before the creation, in 1907, of the tax commission; it is of far greater value than all of the real and personal property in Minnesota of all the railroads operating therein, which pay a tax of 5% on gross earnings in lieu of all other taxes on real and personal property used for railroad purposes.

The State of Minnesota, for state purposes alone, and exclusive of county and local taxes, has received in taxes from the iron ore and mineral lands above noted the following sums:

1906	$179,272	1912	$933,193
1907	671,489	1913	1,317,220
1908	604,264	1914	1,325,196
1909	576,174		
1910	609,984	Total	$7,136,435
1911	919,643		

This includes taxes on stockpiles of approximately 5,000,000 tons per annum and assessed at approximately $1,250,000 per annum, 1907-1913 inclusive, and as stated for 1914, with a 4.75 mills state tax for 1914. In addition, from the total shipments, the state has received over $7,500,000 as gross-earnings tax from the ore-carrying railroads.

Since 1907 the tax commission has handled, measured, grouped, classified and assessed over 1,700,000,000 tons of merchantable iron ore. It has the records of many millions of tons of nonmerchantable ore, and the records of hundreds of drill reports showing no ore. No property in the state, except banks subject to frequent examination, with publicity of their financial condition, is under better control and subject to more complete knowledge than the iron ore and lands.

The Chemung Iron Co. is concerned in a deal involving upwards of $18,000,000, recently consummated in Duluth, whereby C. A. Congdon, G. G. Hartley and others, of Duluth, have disposed of their holdings in the Chemung to the Steel Corporation. The Chemung held numerous royalty interests, leases and some fees on the Mesabi range, all of which were under lease to the Corporation. It is stated that the transaction was made on the basis of the present worth of the various interests rated on the tonnage developed, and is in line with the Steel Corporation's policy of purchasing royalty interests outright to avoid the necessity for actual mining on properties whose lease period may be far advanced. Besides the benefits accruing to the purchaser through not having to mine this ore when and as provided in such leases, there is the added benefit to the iron-ore trade of avoiding the possible danger of over-production. Other transfers of a similar character have been carried through by the Corporation in late years, notably those involving the Higgins Estate lands.

HOUGHTON—Nov. 28

A Conviction was obtained at Marquette in the case of John Huhta, who was found guilty of the murder of Thomas Dally and the Jane brothers. He was sentenced to prison for life, and is now serving. The murder of these three Englishmen took place about a year ago during the strike. They were shot in their beds at night. The crime was so shocking that the Citizen's Alliance came into being the next day in a public protest against the Western Federation of Miners. Two months later Huhta, secretary for the Federation organization at South Range, confessed the murder, implicating Nick Verbanac, a prominent Croatian politician and organizer, and two others. The confession later was repudiated, then reaffirmed. Under Michigan laws Huhta had to be tried. A change of venue was asked and the trial was moved to Marquette. It took place before Judge Cooper, from an adjoining district, with a jury influenced by local sentiment. Five high-priced lawyers paid by the American Federation of Labor, including Congressman W. J. McDonald and a lawyer selected and paid by the county of Houghton to defend Huhta, brought into use every possible technicality to keep him out of jail. The jury was out just 38 min. Congressman MacDonald, in his closing plea for the murderer, insisted that a verdict of guilty would mean the condemnation of the whole Western Federation of Miners as murderers. The jury rendered just that verdict. The verdict is furthermore a justification of the work of the Citizen's Alliance and relieves the Waddell corporation of blame; for it was upon the Waddell men that the Federation tried to fix the responsibility.

MARQUETTE—Nov. 28

The Tax Conference announced in the "Journal" of Nov. 28 will be attended by delegates from most of the cities in the iron and copper districts of Michigan. The majority of the delegates will not be representatives of mining companies. Persons in all lines of business in Upper Michigan realize the injustice of the tonnage tax and they are going to be prepared to make a determined stand at Lansing. The bill which has been drawn by attorneys for the State Grange would place a tax of ¼c. per lb. on copper and about 10c. per ton on iron, in addition to all other taxes. The mines of Michigan have a difficult time at present competing with the iron mines of Minnesota and the low-cost copper producers of the West without being burdened with additional expense. It was only a few weeks ago that a Jones & Laughlin representative stated that three Michigan iron mines would be closed down because iron ore could be purchased cheaper in Minnesota than the company could produce it on the old ranges. It is not known how Governor Ferris stands on the tonnage tax as he has never expressed his views on the subject.

TORONTO—Nov. 28

The Standard Stock & Mining Exchange, which, after the outbreak of the war, held only one session daily, resumed double sessions Nov. 16. The minimum price restriction was removed, the only remaining limitation being that all sales must be cash transactions. The abolition of the price restriction had no serious effect on the general market, the most notable result being the drop in Crown Reserve, due to the reduction of the dividend rate.

The Nickel Exportation question continues to be agitated. It is urged that the export of nickel outside the Empire should be prohibited unless the United States will guarantee that it is kept out of Germany and Austria. The agitation is being seriously taken up by many leading newspapers which point out that the recent order-in-council forbidding the export of nickel to European ports entirely, fails to meet the case as regards the shipment of matte from Sudbury for treatment in New Jersey, irrespective of the final disposal of the refined metal. Feeling is intensified by the statemnt, which appears to find general acceptance, that the Krupps are interested in the New Jersey refinery. The question bids fair to become a leading political issue. The government has been investigating the destination of the nickel matte shipped to the International Nickel Co., with a view to preventing exportation of the refined metal to Germany, and is in communication with the British Government on the subject. At the invitation of the International Nickel Co., an expert accountant was sent by the Canadian government to New York, who reported to the British government respecting the safeguards adopted by the company to prevent any of the exported nickel from reaching Germany. It is understood that his report is regarded as satisfactory.

The Mining News

ALABAMA

TENN. COAL & IRON (Ensley)—Work started on plant to manufacture fertilizer out of slag from steel works. Building measures 80x200 ft., and will be completed during early part of 1915.

ALASKA

GOLDEN EAGLE (Port Wells)—Property just opened up and after four days' run plates yielded $6000. If showing continues is intention of owners to add at once another 10 stamps.

BOSTON GROUP (Juneau)—New shaft- and compressor-house being constructed by George Noble company about done. Hoist and compressor installed, will be ready for use in about 10 days. Shaft down 150 ft.

CORDOVA MINING & DEVELOPMENT CO. (Cordova)—Bonds secured on No. 9 and Home Rule claims adjoining Golden Eagle mine in Port Wells district. Contracts let for 200 ft. of tunnel work. Small stamp mill to be installed.

CLARENCE J. BERRY DREDGING CO. (Circle City)—Articles of incorporation filed with Chas. E. Davidson, Secretary of Territory. Capital stock placed at $1,200,000. Company headquarters in San Francisco, owns large acreage in Circle district.

NO. 1 BELOW, FAIRBANKS CREEK (Fairbanks)—Charles Grill manager states that while ground was lower grade this year than last, cost of operating has also been reduced by improved methods. Last year costs ran $1 per ft. in open-cut; this year's are only $0.50. Use of hoists and large scrapers made great difference, allowed stripping, so no longer necessary to put everything through sluice boxes. This winter considerable work will be done in preparation for next summer and some winter dumps will be taken out.

MASCOT ASSOCIATION (Fairbanks)—Recent strike on this property on Kenyon Creek, in Healy River country, of Upper Tanana, made by E. Hammer, owner, turning out better than first reported. Shaft 120 ft. to bedrock, two tunnels 30 ft. each run toward right and left limits, latter showing increased values as tunnel progressed. Gravel now runs $1.25 per sq.ft. That toward right limit pans poorly; decided to concentrate mining on creek on left limit. All ground on creek located and several lays let. Lawrence & Albrecht have large plant on ground for mining on large scale; many smaller outfits already at work. This is first pay struck in this section of country.

KEYES & RETTIG (Fairbanks)—These Chatanika operators made fair profit on ground running only 60c. per sq.ft. During summer also opened large block of ground on No. 7 Below, Cleary Creek, and now have it in shape to start work as soon as water runs next season. New record for district made when Ralph Keyes, son of one of operators, hoisted 551 buckets from depth of 60 ft. in 10 hr.; 60 buckets hoisted in last 30 min. Record remarkable; must consider that bucket, while in shaft, is hoisted with single block, and that, after engaging carrier at shaft collar, it travels up trolley cable 50 ft. or more by straight line before dumping over sluice-boxes. Furthermore, since bucket must engage and leave carrier gently, practically comes to stop at top of shaft both hoisting and lowering. Time also lost handling men and equipment during working hours, so record stands at bucket a minute for day. This record later broken by Charles Watson, another Chatanika operator, credited with 583 buckets in one shift, as reported recently in "Journal."

CALIFORNIA

Amador County

MOUNTAIN KING (Pine Grove)—Sale contemplated. Development progressed to point requiring power hoist, which with other machinery will be installed if sale is made. W. B. Pitts owner.

Butte County

RAMSAY BAR, on Big Nimshaw Creek, near Stirling, operated in early days by hydraulicking and ground-sluicing. Large boulders moved by early miners supposed to cover unworked placers. George L. Febre and others, of Stirling, have installed donkey engine and will clean out tailings in search for placer gold.

INDIAN SPRINGS CHANNEL GOLD CO. (Chico)—Reported property will be reopened and 100-ton mill installed. Mine an old one, former producer, near De Sabla. D. C. & G. C. Kirby, Los Angeles, owners.

SOUTH BANNER (Oroville)—Richard Phillips has reopened mine, is also developing Old Glory mine. Preparations made for extensive work on these and other properties under Table Mountain, but war necessitated confining development to smaller scale than initially contemplated.

Eldorado County

RED WING (Eldorado)—William H. Deaner has recorded location of five acres of ground adjoining mine, to be used as millsite. Mr. Deaner recently took over property on purchase bond, and has started development.

CONFIDENCE (Josephine)—This property in Volcanoville district sold for delinquent taxes to John A. Shields, of Placer County, will be reopened. Formerly equipped with five-stamp mill which was destroyed by fire. Reported to have been producer, though not fully developed.

Inyo County

SANTA ROSA—Reported at Bishop that mine will be reopened and pipe line installed for carrying water for milling.

PITTSBURG-LIBERTY (Masonic)—Reported receiver Sanford has negotiated sale of property for $35,000 and matter has gone to referee in bankruptcy proceeding for confirmation.

WILSHIRE BISHOP CREEK (Bishop)—Building for cyanide plant completed; machinery being installed. New mine hoist ordered in Denver, to be installed immediately. Expected mine will resume by first of 1915. Expected 10-stamp mill will be increased by another five-stamp battery after operation becomes regular.

Kern County

AMALIE DISTRICT excitement has subsided; owners of claims and prospectors now working instead of boosting. No doubt some good ore was found; there is possibility of making a mine or two, but a good deal of talk was newspaper talk. District 15 miles east of Caliente; formation is limestone and schist.

Nevada County

BLACK BEAR (Rough and Ready)—This mine and Forlorn Hope to be reopened. Shaft being unwatered preparatory to extensive development.

BLUE TENT (Nevada City)—Old gravel mine being reopened by D. A. Campbell and others. Tunnel cleaned and drifting in gravel toward pay channel progressing. Mine formerly large producer.

MEADOW LAKE DISTRICT quartz mines near Cisco to be reopened; new claims located. Schist formation, cut by granodiorite and capped by andesite. Ores refractory, and in former working, gold was not saved by crushing and amalgamating. Reported tube mills and cyanide plants will be installed when season opens next spring. George Cooper, of Ophir, Placer County, states all available ground is located. H. J. Gray purchased holdings of Lee Butts, of Penryn.

Sierra County

HYDRAULIC MINING in Slate Creek region to be resumed upon completion of large restraining dam being constructed on creek near American House. Cement for dam construction being hauled from Honcut, on S. P. R.R., in southern part of Butte County, by motor trucks, via Clipper Mills and La Porte. Dam will provide capacity for storing tailing for length of 17 miles and permit resumption of hydraulic mining at La Porte, Howland Flat, Port Wine and St. Louis, which includes one of richest hydraulic regions in northern part of state, one extensively operated in early days.

Siskiyou County

ETNA DISTRICT hydraulic mines rigged up and ready for rains. John Peterson, Woodfried & Barry and Henry Peters, operating in Eddy's Gulch, are prepared for good run should season provide ample water.

SAWYERS BAR DISTRICT hydraulic miners prepared for opening of season, and expect large output of placer gold. Wilke & Matthews have recently purchased large placer holdings on the Salmon and are rigged up ready for rains. Bigelow Bros. have about completed rigging up on high bench claim near Sawyers Bar.

PINERY (Quartz Valley)—Rigging up completed on this hydraulic mine, one of richest in district. Weed & Co. owners.

OOM PAUL (Oro Fino)—Old Johnson mill being fitted up for run of high-grade ore. A. C. Renfrew developing property under purchase bond.

Trinity County

LORENZ HYDRAULIC (Weaverville)—Method of elevatnig gravel with giants proved successful last season and will be operated on large scale as soon as rains insure sufficient water. Six giants used; two for piping in, one for elevating tailing, others for moving gravel forward into position for piping in. Portable flume is used. Lorenz Bros. owners.

UNION HILL HYDRAULIC (Weaverville)—Mine equipment in good shape for long season, provided rains insure sufficient water. Gravel piped in with four giants. Flume 1300 ft. long laid in tunnel through hill to Trinity River. Nearly 1,000,000 cu.yd. of gravel handled last year. Trinity Consolidated Hydraulic Mining Co., owner; D. W. Shanks, manager.

ASBESTOS MINES in northeastern part of county now employing 46 men, including miners and constructors. Reduction mill completed and sawmill cutting lumber for completion of camp buildings. Wagon road to Castella, 20 miles, under construction at estimated cost of $45,000. Extraction of asbestos in progress, but shipments to S. P. R.R. at Castella will not begin until spring, when it is expected to have wagon road completed. H. T. Mecum general manager.

Tuolumne County

PEORIA FLAT (Tuolumne)—Steam shovel digging tailing race. Quenner gravel mill, capacity 1000 tons per day, on ground ready for setting up.

ATLAS (Tuttletown)—Property taken under purchase option by California and Oregon men represented by Edward J. Carter, of Los Angeles, and William W. Elmer, of Portland. Extensive development in progress. Mine recently put in producing class, but not fully developed.

COLORADO

DAMAGES of $24,000 awarded Samuel Watson, of New York in Federal Court in Denver. Watson sued Jacob B. Ross, of Silverton, Colo., charging misrepresentation concerning Esmeralda mining property. Testified he took option in 1909 for purchase price of $100,000, after assurance by defendant that property was worth $250,000. Under subsequent investigation, value dwindled to $50,000; 20,000 tons $23 ore reduced to 4500 tons $19 ore.

Boulder County

BLACK CLOUD (Salina)—Concentrating mill has met with such success that owners, Messrs. Cotton and Seaman, propose erection of similar custom plant at Ward.

Clear Creek County

LINCOLN (Idaho Springs)—Lincoln Gold Mining Co. recently incorported for $20,000, with R. R. Moodie, H. A. Wimbush and H. G. Wimbush as directors. Principal office, Denver; mining operations to be carried on in Clear Creek County. Company will develop and operate Lincoln vein, which lies between Bellman and Dove's Nest properties, to be worked through Big Five tunnel.

Lake County

WARREN F. PAGE, prominent operator in Leadville district, has undertaken new project, viz., driving exploratory and drainage crosscut adit into Canterbury Hill and toward Prospect Mountain. Portal near Great Eastern claim. Three shifts at work and Page has made arrangements to push adit at least 2000 ft.

BIG FOUR (Leadville)—Tramway from shaft to railroad at foot of hill complete. One carload of first-class ore shipped daily. New electric pump installed for sinking, which will now proceed under contract.

DAVIS (Leadville)—New shaft on Fryer Hill going down. Wash found unusually deep but has finally been passed. Sinking will continue into solid formation far enough to permit opening sufficient stoping ground.

San Miguel County

LITTLE DORRIT (Telluride)—Equipment for crosscut tunnel shipped to mine in Bridal Veil Basin and development work will be continued throughout winter.

MOUNTAIN FLOWER (Telluride)—Development work to be carried on during winter in Delta crosscut on Deep Creek. Machine drills installed.

Teller County

NEW MILL for Cripple Creek assured by awarding of contract to Colorado Iron Works by Cripple Creek Cyanide Milling & Mining Co. Will be 150-ton plant on south side of Beacon Hill. Said will cost $70,500 exclusive of grading. Plant to be turned over completed to operating company and run satisfactorily for 30 days. Gold Dollar Consolidated said to have signed contract agreeing to deliver 75 tons of ore daily for 21 years. Similar smaller contracts signed or arranged for.

IDAHO

PULASKI (Hailey)—Mill running smoothly, although requiring still some adjustment. Ore gold-bearing.

MICHIGAN

Copper

OLD COLONY AND MAYFLOWER companies continue exploration with four diamond drills.

SUPERIOR (Houghton)—Just eight days after fire, hoisting was resumed, a record-breaking recovery. Only limited tonnage as yet, since hoisting capacity is limited and compressor in use is only a "dinky." Rebuilding of boiler house and repairing of boilers and compressors will not take longer than month at most; by Jan. 1, at latest, Superior will be furnishing rock at usual rate.

REPUBLIC (Republic)—Cleveland-Cliffs overhauling water-power plant. Guard lock being provided with better device for letting water in and concrete replacing wooden construction wherever possible. Improvements will allow water to get away from turbines faster and will increase efficiency. Cleveland-Cliffs has completed new dam at Lake Michigamme. Past summer was extremely dry and main storage basin on the Carp River does not hold water it did this time last year. Company now operating steam turbines at Maas mine and conserving water.

QUINCY (Hancock)—Operations conducted on economical basis as possible, alternative actual suspension. Mine enormous low-grade producer. Success depends practically upon large tonnage, for grade is not showing any inclination toward improvement with depth. In newer part of mine, Mesnard and Pontiac shafts, good deal of speculation as to just what copper content will be shown. Costs in 1913 higher than usual owing to partial suspension of operations. Management determined to keep mine in operation while possible to finance situation satisfactorily.

WINONA (Winona)—Captain Broan and trusty miners continue successful operations. Certain stockholders have asked pertinent question as to how it happens these men on tribute, can secure 22 lb. of refined copper per ton, while mine working full blast under own management, was able to secure little better than half of that amount. Assume Captain Broan is "picking the eyes out of her." This assumption is unfair all around. Lease covers section of No. 3 shaft from third to seventh levels inclusive. Section known to everybody at the Winona as rich in copper. Men are not having run of mine. Neither are they doing shoddy work. Underground conditions will be just as good when they get through as before they started. There will be no danger of falling walls, caused by insufficient timber.

CENTENNIAL (Calumet)—Despite rumors to contrary, management has no intention of suspending work. Confronted with actual loss in maintaining operations management went right to employees. Result of conference means that, commencing Dec. 1, Centennial will operate full time instead of three-quarters time as at present. Men accepted voluntary reduction in wages, with arrangement whereby all underground work now will be done on contract. Under new arrangement wages will amount to same as at Wolverine and Mohawk. Tonnage of rock will be increased at least 20% and possibly 30%. With this larger tonnage and practical assurance that there will be no diminution of copper content in rock, management can be fairly safe in figuring on breaking even with copper at 12c. a lb. or above.

OSCEOLA (Osceola)—Every time copper price declines seriously it requires greatest economy to operate old Osceola without loss. When war broke out management had well under way plans for rebuilding shaft and rock house and preparations for increasing tonnage greatly, figuring that large tonnage, even of extremely low grade, would make mine profitable. War spoiled plans and recently mine has actually been losing. In fact in one month alone, loss was $30,000. It was planned to close down this branch of Osceola company, but management was reluctant on account of the men; management recently called meeting of miners who gladly acquiesed in proposal to go on contract and to work full time instead of three-quarters as at present, accepting per diem reduction in wages with guarantee of better monthly total than they now receive. As in case of Centennial, men feared suspension. Old Osceola rock tonnage now will run over 35,000 a month with approximately 12 lb. of copper per ton; this can be handled without loss, as there will be no increase in overhead charges.

Iron

ATHENS (Negaunee)—Big shaft has reached depth of 340 ft. Going down at the rate of 40 ft. per week now. Place being prepared near shaft for storage of gravel.

BUCHOLTZ (Iron River)—On this small property adjoining village of Iron River on north, party of Green Bay and Marinette, Wis., capitalists has spent considerable money in equipment and unwatering under name of Eenterprise Mining Co. No ore yet mined or shipped. Work all consisted of drifting and crosscutting from bottom of shaft.

OGLEBAY-NORTON (Crystal Falls)—Company reported to have made large find of ore between Crystal Falls and Fortune Lake, where diamond drilling has been in progress several months. Known about month ago that formation had been cut. Large acreage being explored; churn drills used at start to test out formation and separate worthless land from that thought to contain ore. Diamond drills then set to work to prove up territory. Will be several months yet before work is completed.

MINNESOTA

Cuyuna Range

THOMPSON (Crosby)—Mine ceased shipments for season, having been range's largest and most regular shipper of year. First season as openpit, formerly underground mine. Ore will be removed next season by milling process.

LOCKER-DONAHUE PROPERTIES (Ironton)—After shipping complete stockpiles, Cuyuna-Mille Lacs and Cuyuna-Duluth shafts suddenly closed down completely. Mines shipped approximately 57,000 tons of high-manganese material. No reason for shut-down given out by management.

ROWE (Riverton)—Attorneys for Pittsburgh Steel Ore Co. have taken up with state and Federal officials question of feasibility of constructing dam across Rabbit Lake for power purposes in conjunction with concentrating plant which it proposes to construct on shores of lake opposite mine and town of Riverton. Lake is bayou of Mississippi River, hence necessity of securing Federal approval.

CUYUNA RANGE TONNAGE—Approximating small tonnage that may be shipped all-rail before Dec. 31, shipments from Cuyuna range total 882,430 tons for 1914, as against 733,021 for 1913. Individual shipments as follows: Armour No. 2, 288,029 tons; Barrows, 47,350; Cuyuna-Duluth, 50,000 (possibly additional small shipments); Cuyuna-Mille Lacs, 51,500 (possibly additional small shipments); Iron Mountain, 300 (estimated); Kennedy, 188,209; Rowe, 78,685; Thompson, 178,357; total, 882,430 tons.

Mesabi Range

SCRANTON (Hibbing)—Contrary to published reports, property will not be stripped. Deposit is within village limits of Hibbing, estimated at about 25,000,000 tons, owned by state and operated by Pickands-Mather as underground mine, although parts would be amenable to openpit extraction.

Vermilion Range

NORTH AMERICAN (Tower Junction) — Mine now permitted to fill with water. Officials on the ground state grade of product unsatisfactory.

SIBLEY (Ely)—Newspapers report all men recovered from recent cave. Five were dead, one alive. Latter, Joseph Skusik, imprisoned 112 hr. Accident occurred, Nov. 9, shaft caving for distance of about 135 ft. from collar. It had been in use for more than six years. Timber crew were at work replacing rotted section at about 130-ft. point, when shaft came together immediately below them, permitting cave from surface. Shaft was in solid ground and cause of accident not determined. Full-sized working shaft put down by rescue crew, stated this is already shifting and pinching badly. Only warning of cave was that cage was binding in certain places in shaft for some little time prior to accident. Operations not likely to be resumed until about Jan. 1.

MISSOURI—KANSAS—OKLAHOMA

SCOTT & CO. on Templar land has about 5000 tons of rich dirt to crush and clean, nolding for better price. Mines shut down for want of room to handle dirt. Expect to install steam hoist in near future.

MONTANA

Silver Bow County

TUOLUMNE (Butte)—Mine closed down Nov. 20. Found unprofitable to continue operations under present conditions.

NEVADA

Clark County

ORO AMIGO (Goodsprings)—Platinum now discovered in ores from this property, situated about ¾ mile north of Boss. Oro Amigo Platino Mining Co. incorporated by local owners to develop property; force of men now at work to be increased.

BOSS (Goodsprings)—Property under bond and lease to Peter Buol, of Las Vegas, and associates, at price said to be $150,000, first payment due Dec. 1. Further sampling indicates all ore contains platinum in considerable quantity; property attracting considerable attention. Same syndicate bonded adjoining property of Buys & Kunz, and intends to consolidate two properties under one management if deal is consummated. Report of sale to Seeley Mudd incorrect.

YELLOW PINE (Goodsprings)—Recent wreck of ore train between mine and Goodsprings resulted in damaging Shay locomotive to such extent that operations at mill have been suspended, pending completion of repairs. Some mill products which were on hand and some crude ore being shipped, but full operation will not be resumed until after Jan. 1. New two-compartment shaft has reached depth of 800 ft., and sinking continues. Foot-wall crosscut on seventh level has intersected vein, showing width of 12 ft., assaying over 40% zinc.

Elko County

EASTERN STAR (Gold Circle)—Milling plant will be built, to be in operation by next spring.

Esmeralda County

YELLOW TIGER (Goldfield)—Buildings and equipment, destroyed by fire Nov. 4, will be replaced at once.

ATLANTA MINES CO. (Goldfield)—Water on 1750-ft. level being drawn off through bulkhead to Merger shaft. With level unwatered work will be resumed.

GOLDFIELD CONSOLIDATED (Goldfield)—Drifting under way from Grizzly Bear workings across northern end of St. Ives claim toward Sunflower claim of Merger company. Shale contact to be explored, expected to open on its dip oreshoot developed in Jumbo Extension.

GOLDFIELD MERGER (Goldfield)—Trustees held meeting at Goldfield Nov. 14 to elect officers for coming year. Large pump recently installed giving good satisfaction. Atlanta ground being drained and results of development work there will determine future policy of company. Crosscut being driven on 1330-ft. level from shaft to Grizzly Bear workings of Goldfield Consolidated.

Humboldt County

IMPERIAL—Entire camp equipment and all supplies at this property on Winnemucca Mountain destroyed by fire. Fire believed of incendiary origin.

Mineral County

AURORA CONSOLIDATED (Aurora)—After 12-day shutdown for changes in milling process, mill again in operation at full capacity. Ore hauled from mine by electric locomotives, crushed and elevated to mill by belt conveyor. Forty 1600-lb. stamps crush 500 tons daily. Regrinding done in six 6x16-ft. tube mills. Dorr thickeners have been divided horizontally in middle, making two decks to each tank; this relieves weight of heavy slimes collected. Other equipment includes Dorr agitators, Knight-Trent filters and Merrill clarifying and zinc-dust precipitation systems. Mine 60 miles from railroad, at elevation over 7000 ft.; winter supplies all in, so no occasion for shutdown from snow blockade.

Nye County

MONTANA-TONOPAH (Tonopah)—Mill shut down temporarily on account of low price of silver. Reports from company's Commonwealth mine in Arizona stated to be encouraging.

Ormsby County

PITTSBURG-LIBERTY MINING CO. (Carson City)—Meeting of creditors of this bankrupt company held. Referee in bankruptcy approved offer of Stall Bros. to take property on lease and bond for $40,000; $10,000 to be paid in 10 months, remainder in 18 months. Work to start at once and at least 150 shifts' work per month to be done. Mill to be repaired; lessees may mill any ore. Property said to have produced $600,000 above 100-ft. level. Many Nevada men interested. Property situated at Masonic, Mono County, Calif.

Washoe County

LARGE PLACER FIELD DISCOVERED on eastern slope of Sierras, west of Reno, on rim of Gennessee Valley. Believed gravel is in bed of ancient river. Coarsest nuggets found in prospecting. Area of 1800 acres staked by Reno men; winter camp to be established and hydraulic or drift mining started next spring.

SIERRA STANDARD MINING CO. (Reno)—Articles of incorporation filed. Reno principal place of business. Captialization, $250,000, shares $1 each.

NEW MEXICO

Dona Ana County

GOLD STRIKE in Caballo mountains near Rincon proved to be bunco game, operators claiming mine was salted. Reports created wild rush to field and district was thoroughly advertised. Prominent operator declares false all reports of rich strikes.

Grant County

BONNIE (Lordsburg)—Putting in mining machinery. Six-drill compressor on ground and hoist shipped.

MUELLER & BOCK (White Signal)—Cleaning out shaft preparatory to shipping from winze on pay streak.

WARNOCK & WALTER (White Signal)—Hoisting outfit purchased for sinking on vein 250 ft.; now down 85 ft.

STAUBER & WRIGHT (Pinos Altos)—High-grade gold ore again found in Savanna workings. Ore banked in Silver City.

Socorro County

MOGOLLON MAIL CONTRACT from November, 1914, to June, 1819, let to Bennett Auto Co., of Silver City, N. M., at $10,000 per year. C. W. Marriott, for 16 years Mogollon mail and express hauler, will continue in express freighting. Mogollon telephone rate disputes will be settled, Jan. 1, when camp will have individual exchange.

UTAH

Juab County

UTAH MINERALS CONCENTRATING (Eureka)—A little ore sent through crushing machinery; other equipment being warmed up for complete trial run.

CHIEF CONSOLIDATED (Eureka)—Repairs to shaft completed and development work being carried on extensively. Planned to have as much ore as possible blocked out against time when shipping starts at normal rate, but output will be held down under present market conditions.

WASHINGTON

UNITED COPPER (Chewelah)—President Conrad Wolfe states company has decided to improve milling plant and increase size. New tube mill to be put in; investigation being made of Coeur d'Alene flotation process.

WESTERN UNION MINES CO. (Republic)—Company which was recently organized and acquired holdings of Republic Mines Corporation, San Poil Consolidated Mining & Milling Co. and Last Chance Mining Co. has authorized advertisement for bids for constructing central power-plant at Republic, capable of generating not less than 1000 hp. Equipment to consist of two 500-hp. Diesel engines, with direct-connected generators, and full complement of electrical appliances. Company plans to make proposed power station nucleus of large plant, capable of generating sufficient current to provide light for mines and camp, power for mines and for 1000-ton reduction works contemplated. Number of improvements made in San Poil reduction works since acquisition, and during period of rehabilitation plant was operated, about $24,000 in gold and silver bullion being produced. Mill now operating satisfactorily, and with output of company's mines increased to point anticipated, bullion production will approximate $30,000 a month. North Washington mill being repaired and enlarged, expected it will be increased to 225 tons capacity by Feb. 1, 1915, when it is believed new power plant will be operating.

CANADA

Ontario

EIGHT CLAIMS situated on east side of Wolf Lake, in Sesekinika area, bought by Dr. J. M. Bell, of Huronian Belt Mining Co. Price given at $150,000. Negotiations were under way for purchase of number of locations in this neighborhood, but were broken off on account of war, and this is first large transaction since then.

YORK ONTARIO (Cobalt) — Assets of company, which operated King Edward mine on lease seized for wages.

NORTH DOME (South Porcupine)—Assets will be sold by tender after Dec. 18. Company went into voluntary liquidation.

Yukon

CLAIM JUMPING not to be permitted when owners have enlisted. Government announces requirements regarding rental and labor will be waived.

ASSESSMENTS

Company	Delinq.	Sale	Amt.
Argenta, Ida	Nov. 21	Dec. 19	$0.0005
Atlantic, Ida	Nov. 28	Dec. 28	0.0005
Beaver Copper, Utah	Dec. 3	Dec. 22	0.005
Bullion, Ida. (post.)	Nov. 4	Dec. 7	0.005
Bullwhacker, Mont	Dec. 14	.....	....
Clear Grit, Ida	Jan. 12, '15	Jan. 29, '15	0.0015
Con. Imperial, Nev	Dec. 23	Jan. 15, '15	0.01
Consolidated Ores, Utah	Dec. 4	Dec. 20	0.25
Con. Virginia, Nev	Nov. 27	Dec. 18	0.10
Copper Chief, Ida. (post.)	Nov. 4	Dec. 7	0.005
Crown Point, Nev	Dec. 8	Dec. 29	0.05
Eagle Bird, Calif	.....	.....	20.00
East Hercules, Ida. (post.)	Dec. 1	Jan. 2, '15	0.001
Echo, Ida	Nov. 20	Dec. 15	0.0015
Emerald, Utah (three installments)	.....	June 9, '15	0.01
Exchequer, Nev	Dec. 21	Jan. 11, '15	0.03
Gold Bond, Utah	Nov. 24	Dec. 24	0.001
Hale and Morcorss, Nev	Dec. 14	Jan. 4 '15	0.03
Hider Nevada, Nev	Nov. 24	Dec. 10	0.015
Hilarity, Ida. (post.)	Oct. 12	Dec. 23	0.003
Hope, Calif	Dec. 15	Jan. 11, '15	0.05
Hypotheek, Ida	Dec. 17	Jan. 11, '15	0.006
Indian Pete, Utah	Nov. 30	Dec. 15	0.01
Lehi Tintic, Utah	Dec. 17	Jan. 16, '15	0.0025
Little North Fork, Ida. (post.)	.....	Dec. 12	0.001
Lynn Big Six, Utah	Nov. 21	Dec. 26	0.005
Majestic Idol, Nev	Dec. 15	July 20, '15	0.005
Mammoth Gold, Nev	Nov. 23	Jan. 4, '15	0.02
Maxfield, Utah	Dec. 9	Dec. 30	0.0016
Nevada Silver Reed, Nev	Nov. 24	Dec. 14	0.0015
O. K. Silver, Utah	Dec. 14	Dec. 31	0.00167
Ophir, Nev	Nov. 19	Dec. 11	0.10
Overman, Nev	Dec. 22	Jan. 11, '15	0.05
Phoenix, Ida. (post.)	Nov. 26	Dec. 26	0.005
Rainbow, Ida	Nov. 30	Dec. 31	0.002
Reindeer-Queen, Ida. (post.)	Sept. 21	Dec. 26	0.002
Revelator, Utah	Nov. 9	Dec. 8	0.005
Rexall, Utah	Dec. 1	Dec. 21	0.002
Seg. Beleher, Nev	Dec. 16	Jan. 11, '15	0.02
St. Francis, Calif	Dec. 8	Dec. 28	0.0025
Sonora, Ida	Nov. 30	Dec. 30	0.002
Sunset Banner, Ida	Nov. 26	Dec. 17	0.0005
Sunshine, Ida	Nov. 23	Dec. 22	0.001
Syndicate, Ida	Nov. 26	Dec. 28	0.001
Tarbox, Ida. (post.)	Nov. 25	Dec. 28	0.0025
Tuscumbia, Ida. (post.)	Nov. 20	Dec. 21	0.002
Wilbert, Utah	Dec. 3	Dec. 16	0.01
Wisconsin, Ida	Nov. 16	Dec. 21	0.003
Yankee Con, Utah	Dec. 17	Jan. 4, '15	0.01

The Market Report

METAL MARKETS

NEW YORK—Dec. 2

Copper has again been active and stronger. Spelter has been a little stronger by virtue of further progress in the export business. Lead has been weaker and mysterious. Tin has been about stationary.

Copper, Tin, Lead and Zinc

Copper—In the early days of our week of record there was rather a lull, although the buying continued to be substantial, including some round lots. On Monday some vigorous buying began again, which had the effect of causing a further advance in price. The aggregate of the business was perhaps not quite so large as in the previous week, but nevertheless was important. It would not be unreasonable to estimate a total of 20,000,000 pounds.

Throughout the week prices exhibited wide variations according to time of the delivery desired. Certain sellers have asked and received ⅛c. more for January than for December and ⅛c. further advance for February. For a little business beyond February fancy prices are reported, but such transactions are, of course, quite speculative and outside of the ordinary customs of the trade.

Buying during the last week was chiefly for domestic account, manufacturers in Connecticut, New York and in the Detroit district having all been in the market. At the same time there was a considerable demand from England and France.

Representatives of the copper producers visited Washington this week to confer again with the Department of State over the matter of copper seizures by the British.

Copper sheets were again advanced on Dec. 1 and the base price is now 18c. for hot rolled and 19c. for cold rolled. The usual extras are charged and higher prices for small quantities.

Brass Prices, base are announced by the American Brass Co. as follows, to date from Dec. 1: Sheets, high brass, 14½c. net per lb.; low brass, 16⅛c. Wire, high brass, 14½c.; low brass, 16⅛c. Rods, high brass, 14¼c.; low brass, 16⅞c. Tubes, brazed and open seam, 18¼c. Angles and channels, 18¼c. Scrap allowances are 9c. net per lb. for high brass; 10⅛c. for low brass.

Tin—The market has been firm. Spot is still scarce and commanding a premium. There are fair inquiries by consumers for futures.

Lead—In our last report we indicated the expectation in the trade that there would be no further advance in price right away. The reduction in price by the A. S. & R. Co. on Nov. 27, however, was more of a surprise than its previous advances had been. The reason given by the A. S. & R. Co. is that the metal had been found to move too slowly at the higher price and consequently a reduction was made in order to make things go more briskly. This explanation is accepted with some reserve among the independent producers. The consensus of opinion among them seems to be to characterize this recent action as mysterious and to await developments. None of them seems to have been desirous to sell and transactions outside of the leading interest have been but trifling in volume.

Spelter—Some further progress in the demand from abroad has stiffened this market a little more, but there have been no especially interesting features. Domestic demand has been small.

An increase in the freight rate on spelter from St. Louis to New York was supposed to go into effect on Dec. 1, but producers seem to be rather uncertain as to just what the new rate is to be. The common expectation is that it will be about 16½ cents.

Hegeler Brothers, a partnership, operating the zinc smelting works at Danville, Ill., has been incorporated as the Hegeler Zinc Co., which will continue the business under the same management and with the same policies as heretofore. Julius W. Hegeler is president of the new company.

Other Metals

Aluminum—The market has been quiet and business rather slow. Prices are a shade easier, 18½@19c. per lb. being quoted for No. 1 ingots, New York.

Antimony—The market has been dull, with small transactions. Ordinary brands are rather nominal at 13@14c. per lb. Cookson's is held at 17@18c. and is rather scarce.

Quicksilver—The market is rather quiet, but steady. Sales have been made at $52.50 per flask of 75 lb. London prices are unchanged.

Nickel—Ordinary forms—shot, blocks or plaquettes—are 40@45c. per lb., according to size and terms of order. Electrolytic metal is 5c. per lb. higher.

Bismuth—Current sales have been at $2.75 per lb., New York.

DAILY PRICES OF METALS

NEW YORK

Nov. Dec.	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.
26	.....	...	.....	...	....	.....	.....	.....
27	4.8888	49¼	12⅛ @12⅜	33¾	3.90	3.77½ @3.82½	5.27½ @5.30	5.12½ @5.15
28	4.8888	49⅛	12⅛ @12⅜	33½	3.80	3.70 @3.72½	5.27½ @5.32½	5.12½ @5.17½
30	4.8875	49¼	12⅜ @12⅝	33	3.80	3.70 @3.72½	5.30 @5.35	5.15 @5.20
1	4.8900	49¾	12⅜ @12¼	33	3.80	3.70 @3.72½	5.30 @5.35	5.15 @5.20
2	4.8875	49⅞	12.60 @12.85	33¼	3.80	3.70 @3.72½	5.32½ @5.35	5.17½ @5.20

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

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

LONDON

Nov.-Dec.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
26	22⅞	54⅞	11.92	55	*	142¼	141½	19½	4.18	25⅝	5.57
27	22 13/16	54⅝	11.76	54⅝	*	141½	140¼	19¼	4.18	25¾	5.59
28	22¾	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	22⅛	55⅜	11.87	54⅝	*	141½	141½	19¼	4.18	25¾	5.59
1	23	55¾	12.11	55⅞	*	144¼	143	19⅜	4.16	26⅛	5.68
2	23 1/16	56⅛	12.19	56¼	*	144½	142¾	19	4.13	26¼	5.70

*No quotations.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26¼c. = £25 = 5.44c.; £50 = 10.88c. Variations, £1 = 0.21¾c.

Selenium—Quotations are $2@3 per lb. for larger quantities; $4.50@5 per lb. for smaller lots.

Gold, Silver and Platinum

Gold imports into Great Britain, 10 months ended Oct. 31, were £49,362,977; exports, £29,712,990; excess of imports, £19,649,987, against £9,607,677 last year.

Platinum—Sales are reported at $43.50@44. Hard metal is held at $52.50 per oz. for 15% iridium.

Our Russian correspondent writes from Petrograd that conditions in the platinum market have improved a little. The Imperial Bank of Russia now makes advances on platinum at the rate of 18,000 rubles per pood of crude metal. Work at all of the platinum mines and placers in the Urals is now stopped. The production for 1914 will show a considerable decrease as compared with the previous year.

Silver—The market has shown more animation the past week and closes firm at 23 1/16d., in London. This price has not been reached since Oct. 17 last.

Exports of silver from London to the East, Jan. 1 to Nov. 19, as reported by Messrs. Pixley & Abell, in value:

	1913	1914	Changes
India	£9,001,500	£4,679,500	D. £4,322,000
China	752,000	42,000	D. 710,000
Total	£9,753,500	£4,721,500	D. £5,032,000

Imports of silver into Great Britain, 10 months ended Oct. 31, were £9,932,919; exports, £9,520,038; excess of imports, £412,881, which compares with the excess of exports of £1,309,582 last year.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Nov. 28

The base price paid this week for 60% zinc ore was $44@45 per ton. The base price paid for 80% lead ore was the same as last week, $45@46 per ton.

SHIPMENTS, WEEK ENDED NOV. 28

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	3,235,280	393,940	517,900
Year	152,186,990	4,838,890	30,664,650

Shipped during week to separating plants, 3,939,360 lb. zinc ore.

JOPLIN, MO.—Nov. 28

Blende high price is $48.50; assay base, 60% zinc, $43@46; metal base, 60% zinc, $42@44. Calamine, base 40% zinc, $22@24; average, all grades zinc, $42.55 per ton. Lead, high price, $48,60; base $47 per ton of 80% metal content; average, all grades of lead, $47 per ton.

Information received here is to the effect that the number of retorts now in operation is equal or greater than a year ago. With an evident shortage in ore production of 30,000 to 40,000 tons per month, over a like period a year ago, indications point to one of two things—zinc ore will soon command an exceptional premium or some retorts must soon be cooled. From any angle it looks good for the producer of zinc ore, and it is hoped the smelters will not get squeezed. With the midsummer surplus spelter all sold the smelter men should prosper, but spelter must advance or they cannot.

SHIPMENTS WEEK ENDED NOV. 28

	Blende	Calamine	Lead	Values
Total this week...	8,603,040	443,810	1,502,500	$227,730
Total 11 months...	471,249,590	35,460,580	81,466,100	$11,726,940

Blende value, the week, $186,770; 11 months, $9,411,590.
Calamine value, the week, $5670; 11 months, $416,370.
Lead value, the week, $35,300; 11 months, $1,898,990.

IRON TRADE REVIEW

NEW YORK—Dec. 2

The better feeling persists in the iron trade, though not much additional business is reported except in pig iron. There are more inquiries for finished steel, but few contracts closed.

The pig-iron buying movement is growing more general. Recent sales in Buffalo territory aggregating close to 250,000 tons have been followed by sales in the Pittsburgh district of fully 100,000 tons, while the East and the South are showing a somewhat better movement. Only slight concessions from previously quoted prices were necessary to start the movement.

The pig-iron buying has started a covering movement in Connellsville furnace coke, about 40,000 tons a month having been placed under contract, while there are active negotiations for fully 60,000 tons a month more.

Buyers are beginning to evince much more interest in finished-steel products, there being fairly large inquiry for first quarter contracts, particularly in sheets and merchant bars.

The steel mills of the country are operating at an average rate of not over 35% of capacity, but are probably down to the minimum rate, except as closures around the holidays may temporarily decrease production.

PITTSBURGH—Dec. 1

In bars, plates and shapes the mills are more actively soliciting business, and the very low price of 1.05c. is now relatively common for desirable orders, specifications with order for immediate rolling. For first-quarter contracts the quotation is 1.10c. and buyers are trying to secure contracts for first quarter at the prompt price.

The season price for tinplate is likely to be announced this week, forecasts being that it will be $3.25. There have lately been some sales, for first quarter only, at $3.10 and $3.15, but for the longer delivery the mills would require higher prices, on account of possible advances in the raw materials, steel and pig tin.

Pig Iron—Sales of pig iron in this district in the past 10 days aggregate fully 100,000 tons, the largest volume of pig-iron business in such a limited period for more than a year. More than half the tonnage was sold by a single interest, which made a special drive for business. The American Steel Foundries has taken 15,000 tons of basic (of which 7500 tons was reported last week) at $12.75, delivered Alliance and Sharon; two steel works in the immediate Pittsburgh district have taken 6000 and 5000 tons, respectively, of basic, the cast-iron pipe interest at Scottdale has taken 20,000 tons of foundry, and various other sales of basic, malleable, foundry and forge have been made. Bessemer has sold only in very small lots. Much of the iron sold was at full prices lately quoted, some being at slight concessions. The market is not quotably lower, and on the whole may be regarded as considerably firmer, as follows: Bessemer, $13.75; basic, $12.50; No. 2 foundry, $12.75@13; malleable, $12.75; forge, $12.50, at Valley furnaces, 95c. higher delivered Pittsburgh.

W. P. Snyder & Co. announce their computations of average prices in November, based on actual tonnage sales, at $13.6375 for bessemer and $12.477 for basic, representing declines from October of 30c. in bessemer and 37.3c. in basic.

Ferromanganese—The contract market is still $68, Baltimore, and it is believed that deliveries to actual consumers can be arranged, despite the English embargo, which seems to be subject to this condition. Prompt lots are available at between $68 and $75. There is very little demand, consumers being well stocked.

Steel—There is somewhat more interest in billets and sheet bars, and some fair-sized contracts may be closed within the next fortnight, particularly if regular contracting for tinplate for the new season opens up. We quote billets at $19 and sheet bars at $19.50, maker's mill, Pittsburgh or Youngstown.

IRON ORE

Lake shipments are practically at an end, the close having been hastened by a heavy storm on the upper lakes.

British Imports of Iron Ore 10 months ended Oct. 31, were 6,371,989 long tons in 1913, and 4,986,581 in 1914; decrease, 1,385,408 tons, or 21.7%. Imports of manganese ore were 484,253 tons in 1913, and 444,975 tons in 1914; decrease, 39,278 tons.
HOBART

COKE

Connellsville Coke—Contracting for 1915 furnace coke has suddenly opened up, and four contracts have been closed in the past few days, aggregating about 40,000 tons a month, one lot of about 5000 tons being for the first three months, another lot of 13,000 tons a month being for the first six months, while two other contracts are for longer periods. The contracting has been chiefly on the sliding-scale basis, referable to prevailing pig-iron prices, but with flat prices fixed for the first three months, the flat price being in the neighborhood of $1.70. For six months $1.75 is asked by the lower sellers. A lot of 12,000 tons for December has been sold at the prompt market, $1.60 at ovens.

Inquiries are out, and under active negotiation, from half a dozen consumers for a total of about 60,000 tons a month, and some of this is likely to be closed before the week is out.

The consumers interested in coke are almost wholly the merchant furnaces, the steel interests that usually buy some outside coke not having entered the market to any extent. The movement is probably due chiefly to the heavy sales of pig iron lately made.

CHEMICALS

NEW YORK—Dec. 2

The chemical markets are mainly without feature, as there is practically no business being done.

Arsenic—It is hard to grade prices, as there is so little business. Nominally they range from $3.87½ to $4 per cwt.

Copper Sulphate—Business continues fair, at unchanged prices; $4.35 per cwt. is asked for carload lots, $4.60 for small lots.

Nitrate of Soda—Business is extremely dull. Prices now stand at 1.85c. per lb., both spot and future.

PETROLEUM

Exports of mineral oils from the United States in October were 194,473,497 gal., being 23,930,678 gal. less than in October, 1913. For the 10 months ended Oct. 31, the total exports were 1,723,272,739 gal. in 1913, and 1,890,056,766 gal. in 1914; an increase of 166,784,027 gal., or 9.7%, this year.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1912	1913	1914	1912	1913	1914
January	56.260	62.938	57.572	25.887	28.983	26.553
February	59.043	61.642	57.506	27.190	28.357	26.573
March	58.375	57.870	58.067	26.875	26.669	26.788
April	59.207	59.490	58.519	28.284	27.416	26.958
May	60.880	60.361	58.175	28.038	27.825	26.704
June	61.290	58.990	56.471	28.215	27.199	25.948
July	60.654	58.721	54.678	27.919	27.074	25.219
August	61.606	59.293	54.344	28.375	27.335	25.979
September	63.078	60.640	53.290	29.088	27.986	24.260
October	63.471	60.793	50.654	29.299	28.083	23.199
November	62.792	58.995	49.082	29.012	27.263	22.703
December	63.365	57.760	.....	29.320	26.720	.....
Year	60.835	59.791	.....	28.042	27.576	.....

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

TIN

Month	New York		London	
	1913	1914	1913	1913
January	50.298	37.779	238.273	171.905
February	48.766	39.830	220.140	181.556
March	46.832	38.038	213.615	173.619
April	49.115	36.154	224.159	163.963
May	49.038	33.360	224.143	150.702
June	44.820	30.577	207.208	138.321
July	40.260	31.707	183.511	142.517
August	41.582	*	188.731	‡
September	42.410	32.675	193.074	‡
October	40.462	30.284	184.837	‡
November	39.810	33.304	180.869	139.391
December	37.635	.....	171.786	.....
Av. year	44.252	.....	206.279	.....

New York in cents per pound; London in pounds sterling per long ton. ‡Not reported.

SPELTER

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	6.931	5.262	6.854	5.112	26.114	21.533
February	6.239	5.377	6.089	5.228	25.338	21.413
March	6.078	5.250	5.926	5.100	24.605	21.460
April	5.641	5.113	5.491	4.963	25.313	21.569
May	5.406	5.074	5.256	4.924	24.583	21.393
June	5.124	5.000	4.974	4.850	22.143	21.345
July	5.278	4.920	5.128	4.770	20.592	21.568
August	5.658	5.568	5.508	5.418	20.706	‡
September	5.694	5.380	5.544	5.230	21.148	‡
October	5.340	4.909	5.188	4.750	20.614	‡
November	5.229	5.112	5.083	4.962	20.581	25.016
December	5.156	.....	5.004	.....	21.214	.....
Year	5.648	.....	5.504	.....	22.746	.....

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

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1913	1914	1913	1914	1913	1914
January	16.488	14.223	71.741	64.304	77.750	69.488
February	14.971	14.491	65.519	65.259	71.575	70.188
March	14.713	14.131	65.329	64.276	70.658	69.170
April	15.291	14.211	68.111	64.747	74.273	69.313
May	15.436	13.996	68.807	63.182	74.774	67.786
June	14.672	13.603	67.140	61.336	70.821	66.274
July	14.190	13.223	64.166	60.540	69.446	64.955
August	15.400	*	69.200	‡	74.313	‡
September	16.328	*	73.125	‡	78.614	‡
October	16.337	*	73.383	‡	79.250	‡
November	15.182	11.739	68.275	53.227	73.825	‡
December	14.224	.....	65.223	.....	69.583	.....
Year	15.269	.....	68.335	.....	73.740	.....

New York, cents per pound, London, pounds sterling per long ton. ‡Not reported.

LEAD

Month	New York		St. Louis		London	
	1913	1914	1913	1914	1913	1914
January	4.321	4.111	4.171	4.011	17.114	19.665
February	4.325	4.048	4.175	3.937	16.550	19.606
March	4.327	3.970	4.177	3.850	15.977	19.651
April	4.381	3.810	4.242	3.688	17.597	18.225
May	4.342	3.900	4.226	3.808	18.923	18.503
June	4.325	3.900	4.190	3.810	20.226	19.411
July	4.353	3.891	4.223	3.738	20.038	19.051
August	4.624	3.875	4.550	3.715	20.406	‡
September	4.698	3.828	4.579	3.658	20.648	‡
October	4.402	3.528	4.253	3.384	20.302	‡
November	4.293	3.683	4.146	3.585	19.334	18.500
December	4.047	.....	3.929	.....	17.798	.....
Year	4.370	.....	4.238	.....	18.743	.....

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

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1913	1914	1913	1914	1913	1914
January	$18.15	$14.94	$17.35	$13.23	$18.59	$13.99
February	18.15	15.06	17.22	14.12	18.13	14.08
March	18.15	15.07	16.96	13.94	17.53	14.10
April	17.90	14.90	16.71	13.90	16.40	14.13
May	17.68	14.90	15.80	13.90	15.40	14.27
June	17.14	14.90	15.40	13.90	15.10	13.96
July	16.31	14.90	15.13	13.90	14.74	13.90
August	16.63	14.90	15.00	13.90	14.88	14.90
September	16.65	14.90	15.04	13.90	14.93	14.03
October	16.60	14.84	14.61	13.75	14.80	13.97
November	16.03	14.59	13.91	13.43	14.40	13.83
December	15.71	.....	13.71	.....	14.28	.....
Year	$17.09	.....	$15.57	.....	$15.77	.....

* No quotations made. ‡ London Exchange closed.

STOCK QUOTATIONS

With the exception of Chollar, Iron Cap and Stratton's Independence, all the quotations given below have been established since Nov. 10. The New York Stock Exchange opened on Nov. 28 for trading in bonds, and it seems likely that complete resumption of trading is near at hand:

COLO. SPRINGS Nov. 30

Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con.	.007
C. K. & N.	.03
Doctor Jack Pot	.07½
Elkton Con.	.39
El Paso	.99
Findlay	.01
Gold Dollar	.02½
Gold Sovereign	.0085
Isabella	.10½
Jack Pot	.06
Jennie Sample	.02
Jerry Johnson	.02½
Lexington	.003
Old Gold	‡.01
Mary McKinney	.37
Pharmacist	‡.009
Portland	1.06
Raven B. H.	.03
Vindicator	1.16

SALT LAKE Nov. 25

Name of Comp.	Bid.
Beck Tunnel	.04½
Black Jack	.03½
Colorado Mining	.10
Crown Point	.00½
Daly-Judge	4.50
Gold Chain	.07
Grand Central	.61
Iron Blossom	1.10
Little Bell	.10
Lower Mammoth	.01½
Mason Valley	.50
May Day	.10½
Opohongo	.01½
Prince Con.	.16½
Silver King Coal'n	2.30
Silver King Cons	1.52½
Sioux Con.	.01½
Uncle Sam	.02½
Utah Con.	.01
Yankee	.02

SAN FRANCISCO Nov. 30

Name of Comp.	Bid.	Name of Comp.	Bid.
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.05	Belmont	4.20
Belcher	.74	Jim Butler	.82
Best & Belcher	.05	Lone Star	.14
Caledonia	.35	MacNamara	.04
Challenge Con.	.05	Midway	.11
Chollar	‡.02	Mont.-Tonopah	.35
Confidence	.15	North Star	.24
Con. Virginia	.16	Rescue Eula	.09
Crown Point (Nev.)	.36	West End Con.	.67
Gould & Curry	.01	Atlanta	.45
Hale & Norcross	‡.01	Booth	.11
Mexican	.34	C.O.D. Con.	.11
Occidental	.85	Comb. Frac.	.18
Ophir	.12	Jumbo Extension	3.50
Overman	.11	Pitts.-Silver Peak	.35
Potosi	.01	Round Mountain	.36
Savage	.04	Sandstorm Kendall	.14
Sierra Nevada	.09	Silver Pick	.29
Union Con.	.14	Central Eureka	‡.20
Yellow Jacket	.39	So. Eureka	‡1.80

TORONTO Nov. 30

Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.01	Foley O'Brien	.15
City of Cobalt	.30	Hollinger	18.50
Conlagas	5.50	Imperial	.01
Peterson Lake	.25	Jupiter	.13
Right of Way	.02	McIntyre	.23
T. & Hudson Bay	30.00	Pearl Lake	.02½
Timiskaming	.10½	Porcu. Gold	‡.06
Wettlaufer-Lor	.03½	Preston E. D.	.01½
Big Dome	6.37½	Rea	.20
Dome Exten.	.08½	Seneca Superior	1.50

N. Y. CURB Nov. 30

Name of Comp.	Clg.
Beaver Con.	.20
Big Four	.05
Blue Bell	.08½
Braden Copper	6½
B. C. Copper	.50
Buffalo Mines	11/16
Can. Cop. Corpn.	1½
Can. G. & S.	.04
Caribou	.67
Chambers Ferland	.14
Con. Ariz. Sm.	5/16
Coppermines Cons	1½
Davis-Daly	.85
Diam'field-Daisy	.10
Dia. Black B.	.07
Ely Con.	‡.01
Florence	1 1/16
Goldfield Con.	1 13/16
Goldfield Merger	.49
Greene Cananea	26
Kerr Lake	5
La Rose	13/16
McKinley-Dar-Sa	.70
Mines of Am.	2½
Mutual Min., pf.	2½
Nevada Hills	.35
New Utah Bingham	‡½
Nipissing Mines	5½
North Star	.23
Ohio Copper	.13
Oro	.19
Pacific Smelt	½
Stand'd Oil of N.J.	396
Stewart	1½
Tonopah	6½
Tonopah Ex.	2½
Tonopah Merger	.46
Tularosa	.12½
West End Ex.	.01
Yukon Gold	2½

BOSTON CURB Nov. 30

Name of Comp.	Bid.
Alvarado	.70
Bingham Mines	‡ 04½
Boston Ely	.15
Butte & Lon'n Dev.	23
Calaveras	.93
Calumet-Corbin	.10
Chief Cons.	.90
Corbin	‡.90
Cortez	.10
Crown Reserve	.90
Eagle & Blue Bell	.95
First Nat. Cop.	1 1/16
Houghton Copper	2
Iron Cap Cop., pf.	‡4.75
Majestic	.18
Mexican Metals	.18
Nevada-Douglas	.53
New Baltic	.90
Oneco	1.00
Raven Copper	.10
Smokey Dev.	‡.15
So. Lake	.04
Tonopah Victor	‡.17
Trethewey	.15
United Verde Ext.	1½

LONDON Nov. 19

Name of Comp.	Clg.
Camp Bird	£0 9s 0d
El Oro	0 11 6
Esperanza	0 8 9
Mexico Mines	4 0 0
Oroville	0 7 0
Santa Gert'dis	0 10 0
Stratton's	‡0 0 6
Tomboy	1 0 7½

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