Engineering and Mining Journal

McGraw-Hill Co., Inc. Price, 20c. New York, August 17, 1918

Engineering and Mining Journal

August 17, 1918

Volume 106 *Number* 7

POT HOLES CLEANED OUT PREPARATORY TO CONCRETING AT SITE OF DAM FOR CLEVELAND-CLIFFS IRON CO.'S NEW HYDRO-ELECTRIC PLANT ON DEAD RIVER, MICHIGAN

New Hydro-Electric Development On Dead River, Michigan

By MORGAN H. WRIGHT*

The new hydro-electric power plant of the Cleveland-Cliffs Iron Co., in northern Michigan, when completed, will generate from 5000 to 10,000 kw.-hr., and is designed to be operated by natural river flowage without storage equalization. The site of the dam is well adapted to economic construction, as sand and boulders for the concrete were easily procurable and a good anchorage for foundations was provided by the many pot holes in the river bottom. The current is to be paid for by the operating company on a meter basis, and will be used at its Marquette range mines.

THE hydro-electric plant of the Cleveland-Cliffs Iron Co., now under construction on Dead River, seven miles west of Marquette, Mich., should be interesting to all companies concerned with the elimination or reduction of coal consumption, for this development will put to work from 15,000,000 to 30,000,000 kw.-hr. annually that for years has run to waste within a few miles of one of the world's most important iron districts.

The development is unique in that the company building the plant neither owns nor leases the power, but will pay for the current generated in the same way as an ordinary current user pays the utility company, according to his meter reading. In the second place, a site was found with ideal dam footings and with the neces-

*Mining Engineer, Marquette, Michigan

sary sand, gravel and rock conveniently near. Furthermore, the site offers no opportunity for storage of water.

This valuable power was permitted to go to waste because there was no available water storage, because coal was readily obtainable in the region at a reasonable price, and because the power owners and the power users could not agree on the value of the power. For various reasons, in 1917, the ideas of the negotiators converged, and a deal was closed for the use of the power. It is of interest that when purchase and lease negotiations failed, a final agreement was reached on the value of the kilowatt, and the user will pay the land owner by meter, according to the amount of current actually generated.

Pot Holes Offer Good Anchorage for Concrete

In August, 1917, the Foundation Company, of New York, began the construction of the dam under a "cost-plus" contract. The dam site is in the S. E. ¼ of Sec. 14, T. 48, R. 26, and is situated seven miles from the mouth of Dead River, on Lake Superior. At this point the granite country rock cuts across the river, squeezing it into a 30-ft. channel, at the head of brisk rapids. The river bottom presented a rather remarkable anchorage for the dam, being of massive granite, practically without fissures; but the rushing water had seized hard boulders, and, whirling them on the granite, had gouged out a network of pot holes or pockets, which ranged from shallow saucers to holes six feet in diameter and up to eight feet deep. When cleaned out and concreted, these holes gave a singularly good anchorage to the concrete mass of the dam. The accompanying photograph shows holes being cleaned, preparatory to concreting.

Sand, Gravel and Boulders Used in Concrete Were Available at Site of Dam

The dam, already ponding water, is of the gravity type, 400 ft. long and 50 ft. high, and it contains about 16,000 cu.yd. of concrete. A Ransome tower and chutes were used in placing the concrete, the mixture being "sloppy." Masses of granite, quarried at the site, were bedded into the mixture, a high percentage of stone being used in the dam. Sand and gravel of excellent quality were found at the site, removed from the banks of the river by a McMyler excavator, and by means of a chute slid down the bank to the mixer. The equipment as furnished by the contractor consisted of a McMyler Interstate excavator, a Ransome concreting unit (consisting of mixer, elevator, suspended chutes and rock and sand bins) and a quarrying outfit (consisting of compressor and drills and three derricks, one handling rock from the quarry into the dam and two used to relay material, such as steel and forms, from the top of the bank to the dam), as well as the usual small tools and accessories.

By taking advantage of the facilities provided by an old railroad grade to lay track to the site, thereby avoiding road building and teaming of material over rough country, considerable time was saved. Labor was utilized to the utmost in a season of scarcity by working from 13 to 18 hours daily, with good pay and excellent board provided, so that remarkable progress was made, in spite of an extremely unfavorable winter.

The power house is 13,600 ft. from the dam. The water is to be conducted to the generators by means of a seven-foot penstock, the first 10,000 ft. being wood-stave pipe furnished by the Pacific Pipe Co., the lower 3600 ft. being steel pressure pipe furnished by the Walsh Boiler Works. The penstock will lie largely in a rock trench, and the steel pipe will be placed by means of a tramway, the track being laid in the trench and removed as the pipe is laid. The power house, 45 x 90 ft., is to be built of solid brick with limestone trimming, ornamental brick exterior and glazed tile interior. Equipment is to consist of two General Electric 5000-kv.a. units and two 6500-hp. waterwheels built by the S. Morgan Smith Company.

Plant To Utilize All Available Flow of Water

The actual pressure head is 420 ft., but with 20 ft. lost below the turbines, 400 ft. of effective head will be achieved. The plant is designed to take the natural river flowage, without equalization by storage, and is expected to generate about 5000 kw.-hr. during low water and about 10,000 kw.-hr. during high water, but it will be operated to use all the water, regardless of the volume of flow, according to current requirements.

Completion of the McClure plant, which is named for O. D. McClure, master mechanic of the Cleveland-Cliffs Iron Co., will secure a total of about 30,000 hydro-electric hp. for use at the company's mines in Marquette County, as they have already four other plants in operation.

Black Hills Gold Output Drops In 1918

The production of gold in the Black Hills district of South Dakota, for the first six months of 1918, shows a small decrease as compared with that for the same period in 1917. The Homestake mines and mills, which produce most of the output, have been operated steadily, according to Charles W. Henderson, of the U. S. Geological Survey. Of the other important properties, the Golden Reward mines and cyanidation mill are the latest to cease operations, owing to increased costs and low grade of ores. The Wasp No. 2 mill has been dismantled; the New Reliance and Bismarck mills remain idle; the Mogul mill has continued operations on custom ore; and the Trojan mill and mines have been active. Small shipments of lead-silver ore have been made from Galena, and small shipments of copper ore from the Hill City district.

Rights of Mine Owners

By A. L. H. Street*

In the suit of Copper State Mining Co. *vs.* Kelvin Lumber and Supply Co., 203 *Southwestern Reporter*, 68, the Texas Court of Civil Appeals recently adjudicated several phases of mining law, including a holding that actual possession of a mining claim under a void location is without legal effect as against another claiming under a valid location, supported by performance of all required assessment work. Incidentally, it is held that, since ore becomes personal property immediately upon extraction, it may be followed by the lawful owner wherever found, and that he may there maintain suit to recover possession of the ore or its value in money.

*Attorney at law, 820 Security Bldg., Minneapolis, Minn.

Efficiency Tests of Rock-Drill Accessory Equipment

By CHARLES F. WILLIS*

The inherently low mechanical efficiency of rock drills necessitates every possible economy of power. Each type of drill has a certain air pressure for maximum working efficiency, which may differ, however, from that of maximum economy. Tests show the importance of proper design of gaskets, selection of lubricating oils and the type and size of pipe valves, connections and fittings.

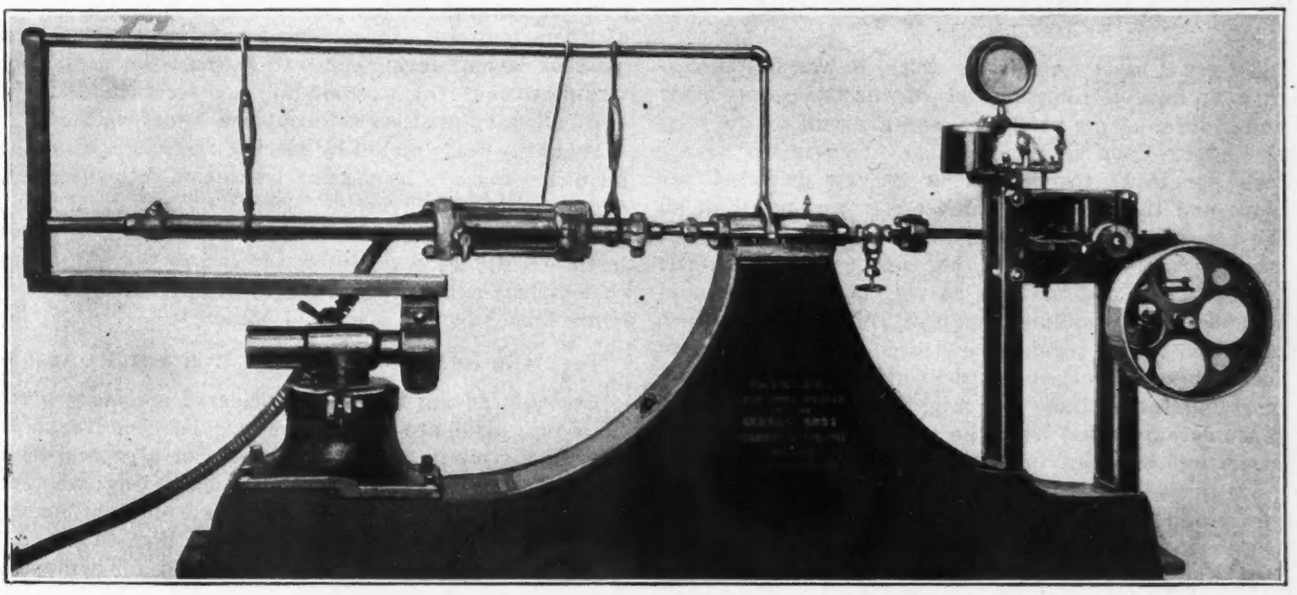
ALTHOUGH there has been considerable technical literature devoted to tests made on the efficiency of rock drills, little or nothing has been written regarding the efficiency of rock-drill accessory equipment with relation to the efficiency of the drill itself. Considering this to be a subject for research with opportunity for enlightening results, I undertook during the last year a series of exhaustive tests on rock-drill accessory equipment, coördinating all tests to the relative efficiency of the drill. While the possibilities are by no means exhausted, it was thought that some conclusions from tests made might at the present time indicate the importance of research in this field and stimulate further experimentation.

The air drill, as is well known, is one of the most inefficient machines, each drill requiring for continuous operation from 15 to 30 hp. at the compressor, whereas only from 10 to 20%, under the best working conditions, is delivered in striking the rock. Losses caused by waste of the heat of compression, by radiation from the air cylinders and air pipes, and by friction of air passing through pipes, are well known, but the greatest loss occurs by exhausting air from the drill cylinder at full pressure and without use of the expansive energy therein stored. Hence, with an already inherently inefficient machine, mechanical losses should be minimized, and in many cases most of the losses caused by poor equipment or care of accessory parts are avoidable.

It is well known and of record that air forced through a hose and pipe or a certain number of standard pipe fittings loses pressure by friction, although the volume of air is increased. I have never found in print any data bearing on this subject taken from direct measurements. In making these tests I also desired to study and demonstrate the real effects of carelessness in operation, the effects of poorly cut gaskets, of leaks, of inefficient or inadequate oil application, and, in fact, to make as complete a study as possible of all of the accessories of the rock drill. It was not expected that all of the tests would show spectacular results, but it seemed to be just as essential to know changing conditions that would give equal efficiency as to know the change of efficiency under different conditions. It was actually proved by the tests that some of the things that might reasonably be expected to influence rock-drill efficiency have really little or no effect.

Tests Made with Paynter Apparatus

The tests were made on a Paynter rock-drill tester, which is a device for direct measurement of the efficiency of a rock drill, consideration being taken of the number of blows per minute, the number of pounds pressure per square inch per blow, and the foot-pounds of energy expended per blow. The Paynter rock-drill tester shows, briefly, the energy of the blow transmitted through a column of oil against a flexible diaphragm which moves an indicator needle on a rotating drum, the whole device, when calibrated, giving the number



STOPER DRILL SET IN PLACE IN PAYNTER TESTING APPARATUS

*Consulting Supervisor, Phelps Dodge Corporation, Bisbee, Arizona.

of blows per minute, the number of pounds pressure per square inch per blow, and, by referring to the curve of calibration, the number of foot-pounds of energy expended per blow. The calibration was performed by allowing a sphere of known weight, suspended as a pendulum, to fall through measured distances against the plunger. The distensions of the diaphragm corresponding to the blows were noted. By forcing oil into the system with an attached pump, the diaphragm was distended to each of these points in turn, and the static pressure corresponding to each was read on the gage. The curve of calibration was then constructed with foot pounds as abscissas and pounds static pressure as ordinates. The air measurements were made on the Clark air meter, which is a positive displacement meter, the machine measuring correctly all compressed air flowing through it.

The drill used in the tests was a Chicago Pneumatic Tool Co. stoper, and was selected largely because of the fact that it is one of the fastest hitting stopers of the hammer type, and, being fast, is more easily affected by slight changes than many other types. It was essential that all tests be made on one machine, for the results of testing on several machines could not be compared, and it was desired to show the value of testing for accessories on individual types of machines. A stoper was chosen for the tests because of its easy adjustment and the fewer opportunities for error while using with the Paynter tester. This paper will not go into the details of the tests made, but will show in a general way some of the conclusions illustrating the importance of such testing.

Most Efficient Air Pressure for Each Drill Should Be Determined by Test

To get a basis for further work, it was first necessary to have a complete set of throttle tests, made under different air pressures, and a record of the relative effects upon air consumption, pressure per square inch per blow, foot-pounds of energy delivered per blow, and the blows per minute. It was noted in all the tests that the maximum consumption of air in the stoper was only 61 cu.ft. per min. In the throttle tests it was noted that the curves, as to air consumption, blows per minute and pressure per square inch per blow, varied regularly and evenly, while the curve for foot-pounds of energy delivered per blow was almost a straight line. As might be expected, the air consumption varied with the pressure on the throttle valve, although not in direct proportion—the throttle valve three-fourths open was fully efficient as to blows per minute, and about 90% efficient on the other three tests. It was particularly noticeable in all the tests that the blows per minute vary largely in a direct proportion with the amount of friction or the number of obstructions to the passage of the air through the various pipe fittings, hose, etc., in going to the machine, rather than with the pressure.

In the pressure tests it was desired to ascertain for all pressures the point of maximum efficiency under existing conditions. For instance, it was determined that at 50 lb. gage pressure the machine would not use over 50 cu.ft. of air per min., would not deliver over 960 blows per min. with 240 lb. per sq.in. force of blow, and would deliver only 7 foot-pounds of energy per blow. It was ascertained that the most economical pressure for this machine was 90 lb. gage pressure. At 100 lb. no greater efficiency was noted, and the cost of compressing the 61 cu.ft. of air necessary for the additional 10 lb. pressure would serve no useful purpose. The tests illustrated forcibly that the first thing for which a rock drill should be tested is the most economical pressure at which it will operate. There might be a consideration of cost involved, and it is possible to imagine conditions where the most efficient pressure would not be the most economical.

Temperature and Humidity Have Little Effect

It was considered possible that there might be some relation between rock-drill efficiency and the temperature of the place where the drill was operating, and to ascertain this a series of tests were made with the room at various temperatures from 70° to 100° F. These temperatures were created by means of stoves, and each temperature was maintained for a sufficient time to insure the drill itself becoming of the temperature of record. It was also thought possible that higher temperatures would increase the fluidity of the lubricating oils and possibly give greater efficiency for a shorter time with a lighter oil; and it seemed not improbable that increased temperatures would require different conditions of oiling and different kinds of oil. However, when the tests were made, it was found that the efficiency of the machine was slightly greater at 80° than at 70°, but above that temperature no changes could be observed. The increased efficiency from 70° to 80° was probably due to a loosening of the oil. The probable reason for no improvement with higher temperatures is that during the test, or during any period of operation, the air coming from the outside with more or less uniform temperature cools the drill, and, irrespective of the surrounding temperature, that of the drill is maintained at about the same degree.

Humidity was created by placing open pans of water upon the stoves or by passing live steam into the room, and tests were run at 70°, 80°, 90°, 100° and 110°, with increasing steam moisture. However, no changes in the results were apparent, and it was therefore concluded that neither humidity nor temperature has any appreciable effect on rock-drill efficiency.

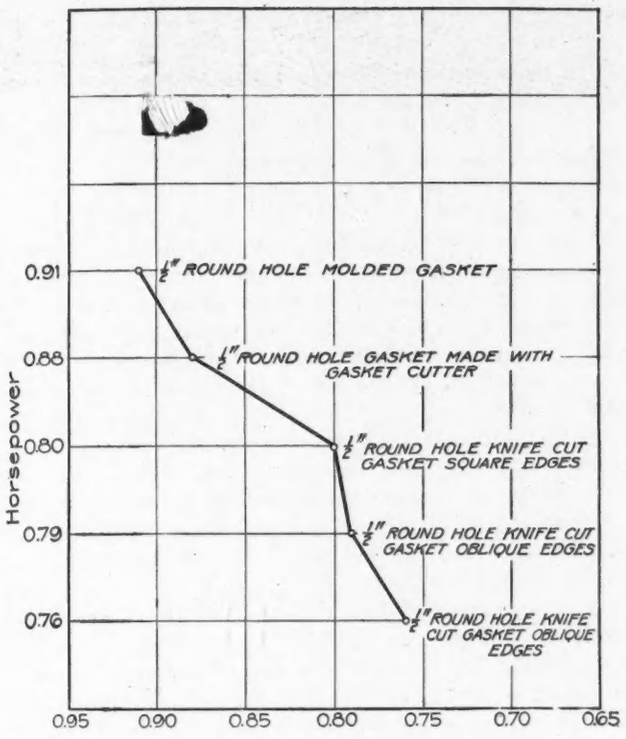
Type and Shape of Gaskets Important Factors

Probably among the least considered accessory parts of a rock drill are the connections between the hose and the air piping; whether a gasket or a ground-joint union should be used; the type of gasket if any; whether a gasket should be machine cut, knife cut or molded. In the first place, the most important thing is the size of the hole. Only definite quantities of air will pass through an orifice of definite size, and as it takes at least 60 cu.ft. of air at 90 lb. pressure to run the drill used in the tests, no orifice of size less than required for that pressure could be used. There is, however, a great difference as to the surface or shape of the orifice. Tables give the flow of air though an orifice, correct only for rounded edges or the ideal opening.

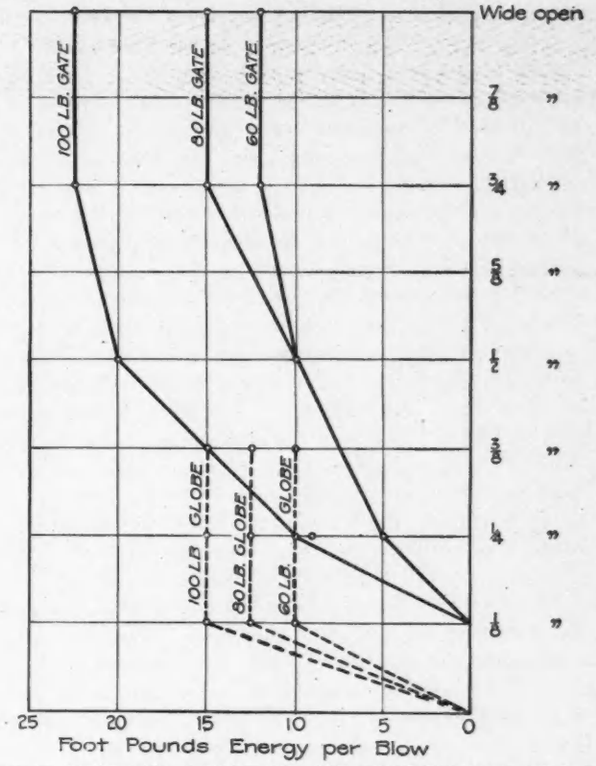
The usual way of cutting a gasket is directly from sheet packing, with a knife, and probably no operation is more carelessly done. The tests under review proved

conclusively that, even with the same size of opening, the most efficient operation of the drill was obtained by a molded gasket with rounded edges. The next most efficient type was a gasket made with a gasket cutter, giving smooth edges, with the cutting perpendicular to the face of the gasket. The third in order was a gasket cut with a knife, particular care being taken to make the walls perpendicular to the face of the gasket. The least efficient was a gasket cut with the walls oblique to the surface of the gasket.

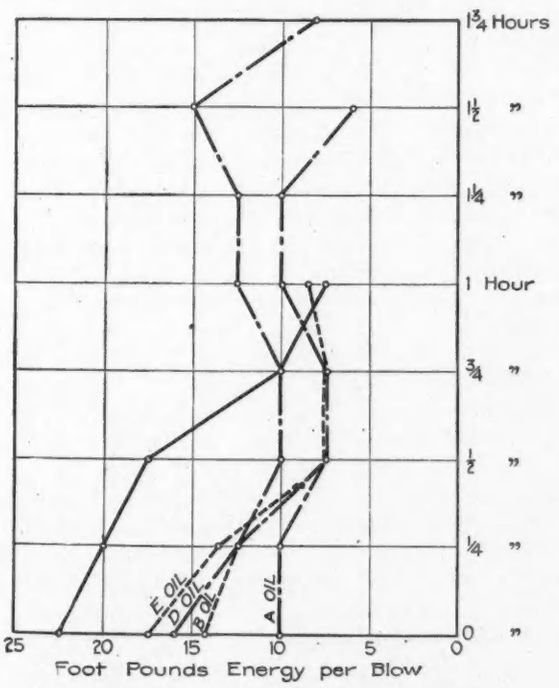
In practice it is found that the most common gasket is the last one mentioned—a gasket hurriedly cut with the knife not held perpendicular to the plane of the gasket rubber. Even in this case it made a difference in the operation of the drill whether or not the gasket was placed with the sharp edge toward the incoming



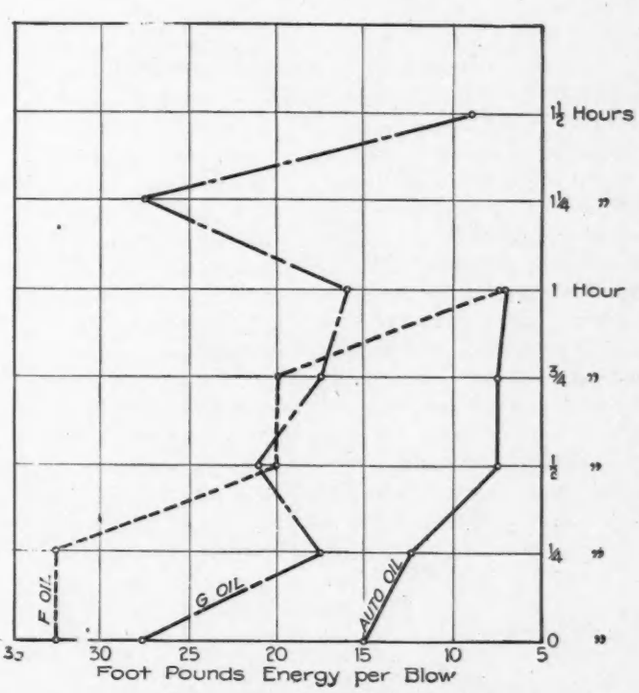
CURVE SHOWING RELATION OF DELIVERED HORSEPOWER TO GASKETS



CURVES SHOWING RELATION OF ENERGY PER BLOW TO VALVE OPENING



CURVES SHOWING RELATIVE EFFICIENCY WITH OILS A, B, C, D AND E



CURVES SHOWING RELATIVE EFFICIENCY WITH OILS F, G AND AUTO OIL

air. To be sure, the relative difference in efficiency is small, but, taken over the period of time that a drill is running, and then multiplied by the number of drills in operation, it shows that a poorly cut gasket is an expensive proposition, and that a molded one, although more expensive as to first cost, is in the end the more economical.

The greatest difference observed by the use of the different gaskets was in the blows per minute recorded. This was to be expected, as it was observed in all tests that friction and speed of drill operation are closely allied. The relative distance, however, is great if with one gasket the machine delivers 1320 blows per minute with 20 foot-pounds per blow, and with another it delivers 1380 blows per minute and the same force per blow. As opposed to this, and as an alternative, comes the use of the ground-joint union, thus doing away with gaskets. While new, the ground-joint unions were found to be more economical, provided great care was taken to have no leaks, for inasmuch as the particular drill on which these tests were made was not quite 10% efficient, the loss even of 1 cu.ft. of air per minute would make a perceptible increase in the cost of operation. Ground-joint unions would require as much care as gaskets, for the frequent removal and replacement of the union in changing drill places cannot but batter and scar a brass union, and with this condition leaks will inevitably occur. The conclusions derived from the tests made on gaskets indicate as first choice the use of molded gaskets; as second choice, ground-joint unions, and find nothing in favor of the home-made knife-cut gasket.

Couplings Tests Showed Little Variation

It was considered that there might be some effects on rock-drill efficiency by varying the type of coupling, and tests were made on 22 couplings of five different types, and, in order to accentuate the small results to measurable quantities, in many cases several couplings of the same type were used, great care being taken to maintain uniform conditions. Experiments showed, however, that in the twenty-odd tests made upon couplings no changes in the efficiency of the drill were to be recorded. The tests were negative all the way through, even when the size of the coupling was changed. This was probably due to some extent to the fact that even the smallest coupling had a sufficient aperture to pass the 60 cu.ft. of air necessary to run the drill, and the conclusion was that on rock-drill efficiency the type of coupling has no bearing. Of course, there are many other things to be taken into consideration in coupling tests, such as the ease with which couplings are put on and removed, the readiness with which the joints can be tightened and simplicity of construction and operation.

Oils Rated According to Initial Efficiency, Durability and Consumption

Probably the most important of the tests were those made on lubrication. For purposes of comparison the oils used will be denominated A, B, C, etc. With the exception of E, all were California asphaltum-base neutral lubricating oils, scientifically refined and filtered. The gravity of the California oils ranged from 17° to 22° Baumé; the flash test varied from 300° to 340° F.; the fire test from 330° to 410°, and the viscosity from 70° to 220° at 100° Saybolt; E was a Pennsylvania neutral lubricating oil. The object of these tests was to determine the efficiency of the drill under different oils, the quantity of each oil that should be fed to the drill for maintaining maximum efficiency and the effects due to insufficient lubrication. The method by which the tests were made was as follows:

Preparation for the Tests

The machine was first thoroughly cleaned, by the use of coal oil and gasoline, of all traces of carbon and the oil last used. Then a definite quantity of the fresh oil, in this case 25 c.c., was put in and the machine run two minutes to lubricate thoroughly all parts. An indicator card was then taken which should be the record of greatest efficiency on that individual oil. The drill was then made to strike against an endurance block for a period of 15 minutes without adding more oil, and another card taken. This process was repeated until the value of this particular oil as a lubricant was entirely nil. It was noted that one of the oils ran only 30 minutes under these conditions, while another ran one and one-half hours. All of these tests were carried to a point of low efficiency, but not sufficiently low to damage the mechanism of the drill. It was noted that at a point varying from 30 minutes to one hour the drill became more efficient in operation. This was undoubtedly due to heating and the emulsifying of the oil. Consequent upon the heating was the increased fluidity of the remaining oil, for in all cases the slump after the rise was rapid. It was also recorded on the indicator cards of these tests that the sticking of the valve due to lack of lubrication was the first effect noted and probably the cause of the inefficient operation of the drill.

The E oil was in many ways the best of the oils tested, giving a greater number of blows per minute and a greater force of blow than any other of the oils included in the tests. The chief disadvantage of this oil, however, was its lack of endurance, probably due to the fact that it is rather a thin product. It is evident that, in order to get its maximum efficiency, not less than 25 c.c. should be fed for every 30 minutes of running time. Particularly noticeable on E oil was the absence of the sticking of the valves that was so noticeable in the other tests. E is an excellent oil for the careful drillman who will not forget to add oil when necessary.

The D oil, during its initial operation, was almost as efficient as E, but fell off rapidly, and even at the end of 15 minutes of continuous operation had lost its real value. D was also a fluid oil, entirely too thin for rock-drill lubrication, unless such lubrication were automatic. In this case, however, E would be the better oil.

The oil designated C was the most durable of the oils tested, having virtually as great efficiency at the end of one and one-half hours of continuous running as in its initial operation. While its efficiency was only 80% of that of E, at the end of 45 minutes and from then on up to one and three-quarters hours it was much more efficient. C oil should be used at the rate of not less than 25 c.c. for each one and one-half hours of running time. It is an excellent oil for careless drillmen.

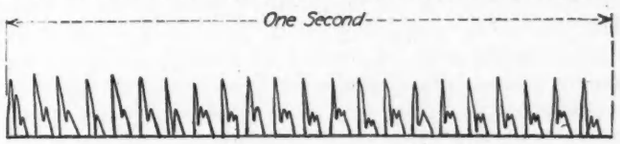
Throughout all of the tests on oils it was conclusively proved that lack of oil does not mean injury to the rock drill, but only to its efficiency, for insufficient lubrication merely allows it to deliver a less number of blows per minute at a less strength per blow. It is particularly noticeable on C oil that the efficiency is increased in the period between 45 minutes and 1½ hours. This, as stated before, is undoubtedly due to the heating of the drill and the increased fluidity of the oil thereby produced. The increased fluidity is therefore responsible for the rapid drop in efficiency after the rise to the point of highest efficiency.

Next of importance from the point of view of initial operation was B oil, although it had little endurance quality. If this oil is used, it should be fed at the rate of not less than 25 c.c. every 15 minutes. It shows its point of heating and increased fluidity at 45 minutes, although the increase was slight.

The A oil was remarkable for its endurance, maintaining almost a steady efficiency for 1¼ hours, its point of rise, so-called, being at the end of one hour. However, from the point of view of an enduring oil, it was most regular. This oil should be fed at the rate of not less than 25 c.c. every 1¼ hours.

Enduring Qualities Desirable in Lubricants

From the standpoint of initial efficiency, E was best, D second best. From the point of view of endurance, C was best, A second best. D had nothing to commend it from either point. Considering the horsepower



INDICATOR DIAGRAM TAKEN DURING FIRST TWO MINUTES RUN OF THE OIL TEST

delivered per cubic centimeter of oil, C excelled the others, largely on account of its endurance, although E, on account of its high initial efficiency, undoubtedly excelled A.

In oil selection it is undoubtedly more important to examine enduring qualities rather than initial efficiency, unless oils of enduring qualities are of low efficiency. Drillmen, for the greater part, are careless as to the use of oil, and drills either get large quantities of oil in irregular amounts or none at all. The tests have shown that larger quantities of oil than 25 c.c. added at one time are of no additional value, because of the fact that the excess is, in each case, passed through the machine and out the exhaust without serving any useful purpose.

For purposes of comparison two highly recommended rock-drill oils were tested, one of which may be called F and the other G. F proved to be a highly efficient oil, as to initial operation, maintaining its high efficiency for a period of about 10 minutes; had no point of rise due to heating, but at the end of one hour it had entirely lost its efficient action. It was shown to be necessary to feed the F oil at the rate of not less than 25 c.c. every 15 minutes. G, while an oil of high initial efficiency, was also an enduring oil, having its point of rise at 1¼ hours, which means that it should be fed at the rate of not less than 25 c.c. for a like period.

Tests were also made with high-grade automobile lubricating oil, but it was found to be inefficient both in initial efficiency and durability. This fact only serves to emphasize the need of correct selection of oil.

TABLE I. ROCK-DRILL OIL TESTS

Type of drill, Chicago Pneumatic Tool Co. stoper. Air pressure, 100 lb. gage. Temperature, 70 deg. F. Drill-steel rotation, none. Striking pin size, ¾ in.: diameter, 12 in. Hose size, 10 ft. length; ¼ in. diameter. Oil used, castor machine. Quantity, 25 c.c. Number of runs made, 8. Time of runs, 15 min., except run No. 1 (two minutes).

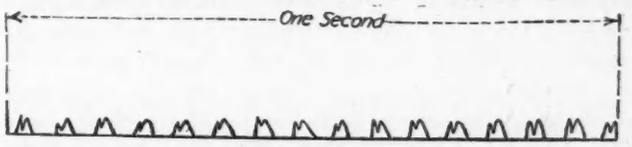
No. of Runs	Initial and Final Indicator Diagram: Time in Min.	Blows Per Min.	Force of Blow Lb. per Sq.In.	Foot-Pounds Per Sq.In.
1	2	1,380	500	27.5
8	15	960	175	4

Table II sums up the oil tests:

TABLE II. COMPARISON OF TESTS IN LUBRICATING OILS

Oil	Rating for Initial Efficiency	Rating for Durability	Point of Rise, Hours	Minimum c.c. To Be Fed Per Hour
F	1	7	¾	100
G	2	3	1¼	20
E	3	6	0	50
D	4	8	0	150
C	5	1	1½	16
B	6	5	¾	100
Auto	7	4	¾	100
A	8	2	1	20

Tables are available that show what may be expected as to drop in pressure of compressed air passing through pipes and pipe fittings. It was desired to determine whether or not there was any direct or indirect relation between these tables and the action of the drill itself, and experimentation demonstrated that through pipes the relation is direct and corresponds closely to the pressure tests shown at the beginning of this paper; that considering loss in pressure, caused by certain



INDICATOR DIAGRAM TAKEN DURING THE FINAL RUN OF THE OIL TEST

definite lengths of pipe of certain sizes, the air delivered would give as high efficiency to the drill as that same pressure would if supplied directly. This applied, however, only to straight pipes; the effects began to deviate radically with the use of elbows, for the efficiency of the drill was indirectly related to the fall in pressure created in changing direction of flow. The elbow curves were especially significant. It was found first of all that the air consumption, that is, the cubic feet of air per minute consumed, did not vary. The relation between the energy delivered in foot-pounds of energy per blow was directly in proportion to the tables showing the added length of pipe for each elbow of different size. The number of blows per minute, however, varied widely from a direct proportion, and consequently the actual horsepower delivered varied correspondingly. These and other tests demonstrate the fact that friction seriously affects the blows per minute on any drill, while it does not affect air consumption, foot-pounds of energy per blow or pounds pressure per square inch per blow.

Effect of Elbows On Drill Efficiency

Particularly noticeable is the varying efficiency of the drill on the passage of air through elbows of different sizes; although a 1½-in. hose was used, the drill with six 1½-in. elbows was only 60% efficient. If six elbows were to be used, the size should be 1¼-in. elbows

to have the drill maintain its highest efficiency, and, even then, the number of blows per minute delivered through six 1¼-in. elbows was lessened.

The conclusions from the tests on air transmission and its relation to rock-drill efficiency were that straight pipe has no other effect than that given in the many tables published, due to loss in pressure, but the other fittings that require the air in passing through them to change direction one or more times have both a serious and detrimental effect. This is more particularly noticeable in the comparison between globe and gate valves.

Gate Valves Preferable to Globe Valves

Following up the tests on elbows and the more or less direct relationship of friction to the efficiency of the drill operated, irrespective of air consumption or pressure, it was obvious that valves offered an excellent field for further tests. There is much difference between globe and gate valves in the amount of friction created by the passage of air. It was demonstrated, in the first place, that the amount of air passing through a valve was in direct proportion to the size of the orifice, irrespective of the shape of that opening; but a remarkable variation was observed in the operation of the drill, which was in no way related to the size of the opening but entirely to its shape and the change of direction in the passage of air.

In all the tests there was generally an increase in efficiency by use of a gate valve compared with a globe valve of the same size, particularly with regard to the number of blows per minute and less noticeable as to the energy delivered. This bears out the conclusion as to the relation of friction. It will be noted, however, that the differences in efficiency between the globe and gate valves was greater on the ½-in. valve, and the variation decreased with the increase in the size of the valve, until with the 1¼-in. valve practically no difference could be noted. These facts, however, do not apply to the earliest stages of opening the valves, for, on a ⅛ turn, a globe valve is actually wider open than a gate valve, owing to the lap due to the seating of the gate.

These tests demonstrate the importance of selecting the right size and kind of valves for the passage of air used in rock drills. While it has always been thought that, if a ½-in. hose were used, a ½-in. valve should also be used, this was shown by the tests here recorded to be a fallacy.

Believing that there might be some difference in efficiency caused by the direction of passage of air through a globe valve, tests were made to see if there was any difference between passing the air through the valve so that it entered from the bottom of the valve and passed out the top, and causing it to pass out at the bottom. The first condition is noted in the records as placing of the valve forward and the latter as placing the valve backward. It was found that in opening the valve a considerable loss in efficiency occurred in placing it backward, but after the opening became of sufficient size to allow a freer passage of air there was no difference, which results only serve to emphasize the influence of air friction upon the efficiency of the drill.

It is sometimes contended that the only test to which a rock drill can be subjected with any fairness is to put it to work under mining conditions for an extended period. This, however, is but one test, and possibly of importance only as to the relationship of durability and wear.

There are other things that seem to be equally pertinent. The kind of oil used is of great importance, for each oil acts differently under varying valve conditions. It is important, also, to determine the size of hose necessary to give the greatest efficiency, and to ascertain the size valve or throttle that gives the best results. It is of great interest to know the relative speed at which a drill attains its greatest power, or how much time is lost in stopping and starting, and how much of the power is consumed in the rotation of the drill, for under some conditions a greater rotative power is necessary. It is important to know whether or not an increased pressure will compensate for this power. Why use 110 lb. pressure at the drill when 90 lb. is as effective for that individual drill? Air and water consumption should be definitely known, and the relation between the applied horsepower and the actual horsepower delivered is also of material importance.

Marked Improvement in Mining Practice Noted

A great wave of scientific reform in mining is sweeping over the country, and much thought and study have been given to the operation of rock drills. The problem of determining the preferable type and size of rock drill, its steel, mounting, hose and accessories best adapted to existing conditions of ground, is receiving serious attention, supplemented by a study of the best methods for breaking the ground—the size and depth of the drill hole, the number of holes required, their relative position and angle, and the quantity, size and grade of powder required. A serious effort is being made to eliminate or minimize the personal equation. Probably no one is better qualified to advise as to the type and size of drill to be used under different conditions than the specialists representing the rock-drill manufacturing companies. These men have a knowledge of the requirements of different grounds gained by experience and observation, coupled with an intimate familiarity with rock-drill practice. But, after all these questions have been answered, there remain many factors that should be determined in order to get the greatest efficiency possible out of the type of drill selected.

Life Extension of British Patents

The following resolution was among a number passed at a recent meeting of the Association of Chambers of Commerce of the United Kingdom:

Resolved, That in view of the fact that many owners of patents have been entirely prevented from exercising their patent rights or exploiting their patents owing to the war, a provision should be made for the prolongation or extension of the life of such patents, and that in view of the fact that this necessity arises solely from the conditions of the war and will terminate on its conclusion, this association respectfully urges that any legislative proposals necessary to deal with the question should be embodied in a separate measure and passed into law as speedily as possible.

Further, that it is undesirable that this provision should be included with other amendments of a permanent character to the patent laws of the country, but that it should be treated entirely as a war emergency measure and dealt with on its merits.

The New American Spirlet Roaster

By F. J. HARLOW*

The de Spirlet furnace is a roaster of the turret type, but is characterized by movable hearths, the ore on each hearth being stirred by teeth projecting downward from the hearth immediately above. Many alterations were made in the foreign design to adapt the furnace for local conditions, with the result that the improved model is now giving satisfaction.

THE de Spirlet furnace was patented by M. Xavier de Spirlet, director of the chemical plant in Laecken, near Brussels, Belgium. This plant had contracts for roasting ore, and utilized the gases for making acid. Several kinds of roasters were used, such as the Rhenania furnace and the Delplace furnace. Experiments were started to develop a mechanical kiln, the result of this work being the de Spirlet furnace. This particular style of roaster was first introduced into the United States by Beer, Sondheimer & Co., of New York, and the first two kilns were built by Grasselli at Cleveland, Ohio. There are now three kilns of this type at the East St. Louis plant of the American Zinc, Lead and Smelting Co., and a battery of ten de Spirlets at Plant B of the National Zinc Co., Kansas City, Kansas. The purpose of this article is not to criticise the original design of the de Spirlet furnace, but to relate the history of the evolution of the foreign-designed kiln to one adapted to American conditions in construction and operation, consistent with economic practice.

The de Spirlet, or Spirlet, as the kiln is called, is a roaster of the turret type and is so arranged as to permit the removal of the gases of combustion by an independent passage that insures the non-admixture of the carbon dioxide and nitrogen with the sulphur dioxide resulting from the oxidation of the ore. In giving a description of the kiln, I will take the new style or American Spirlet as a basis of discussion, making reference to the foreign design only where necessary. The Spirlet kiln is built on three levels. The upper level is the charging or green-ore hopper runway, which runs the full length of the battery of kilns. The hoppers are charged with green ore from the dryers in small push cars, which are elevated on an electric lift. The second, or chiseling floor, carries the turret roaster. It is on this floor that all operating adjustments are made. The lower floor is known as the fire floor. This floor gives access to the roasted ore hoppers and fire box.

The Fire Floor

The furnace housing (see Fig. 1) is a rectangular brick compartment 15½ ft. long, 6½ ft. wide, and 7 ft. 2 in. high. This housing contains one fire box, two CO_2 down-takes, and two roasted ore silos. The fire box *J* is of the step-grate type, with grates 30 in. long, and is connected to the muffle by a 22-in. square fire-brick uptake *K*. The center of the fire plate of the fire box coincides with the center line of the combustion muffle, so that the flame has a straight upshoot into the muffle *L*. The combustion air is preheated and delivered to the fire box by passing through tunnels built in the side walls of the fire box.

The two cast-iron down-takes *M* are placed one at each side of the fire box and conduct the products of combustion from the muffle *L* to the flues *N*, which intersect in a common flue on the center line of the fire box. At the outside face of the back wall this common flue then connects with the main CO_2 flue to the stack. The cast-iron down-takes have radial iron fins on the outer surface.

Preheating Air

The air for oxidation enters the preheating chamber *P* through opening *O*, absorbs radiation from down-takes *M* and ore *G*, passes through opening *Q*, is baffled around air muffle *P*, absorbing more heat from radiation through floor of fire muffle *L*. The preheated air then enters the roaster by ore-pass *F*, and is controlled by a slide register at *R*, which is operated from the outside by a rod. Thus the preheating of the air is complete and utilizes only waste heat. The preheating air muffle *P* is 8 in. high and is incased in the same 13-ft. diameter cylinder with the fire muffle *L*. The cylinder is insulated with a 9-in. wall for the air muffle and a 20-in. wall for the fire muffle. The temperature in the air muffle is about 600° C. The combustion or fire muffle is 12 in. high and is baffled so that the flames from the fire box must completely cover the surface of the muffle before being discharged to the down-takes *M*. This insures uniform heating of the lower hearth of the roaster.

The Roaster

The roaster sets upon the muffle *L*, the floor of the lower hearth *E* forming the arched roof of the muffle. The arched roof above the lowest hearth, the distance between being only 6¾ in., is composed of special tile, every alternate one being prolonged so as to serve as a rabble arm. The prolong reaches to within an inch of the hearth. The entire arch is built in a steel ring 14 in. in diameter, constructed of standard steel shapes, which in turn is supported by lugs riveted to its periphery. These lugs rest in cast-steel stirrups or hangers, which are hung over the ball of a circular steel rail, which is made of a 90-lb. standard T-rail bent with its base cut. To the outside of this T-1 rail circle is bolted, with fillister head bolts, a segmental cast semi-steel circular rack of 300 teeth. There are 12 segments to this rack, and should a tooth become broken or worn a segment can be replaced in ten minutes.

The T-rail ring, with its rack, is supported on six flanged wheels, one at each column. A pinion to a vertical shaft meshes with this circular rack and revolves the roof of the lower hearth at a speed of one revolution every nine minutes. There are four ore hearths or roasting chambers, two of which are movable, as just described, and two of which are stationary.

*Resident engineer, National Zinc Co., Plant B, Kansas City, Kansas.

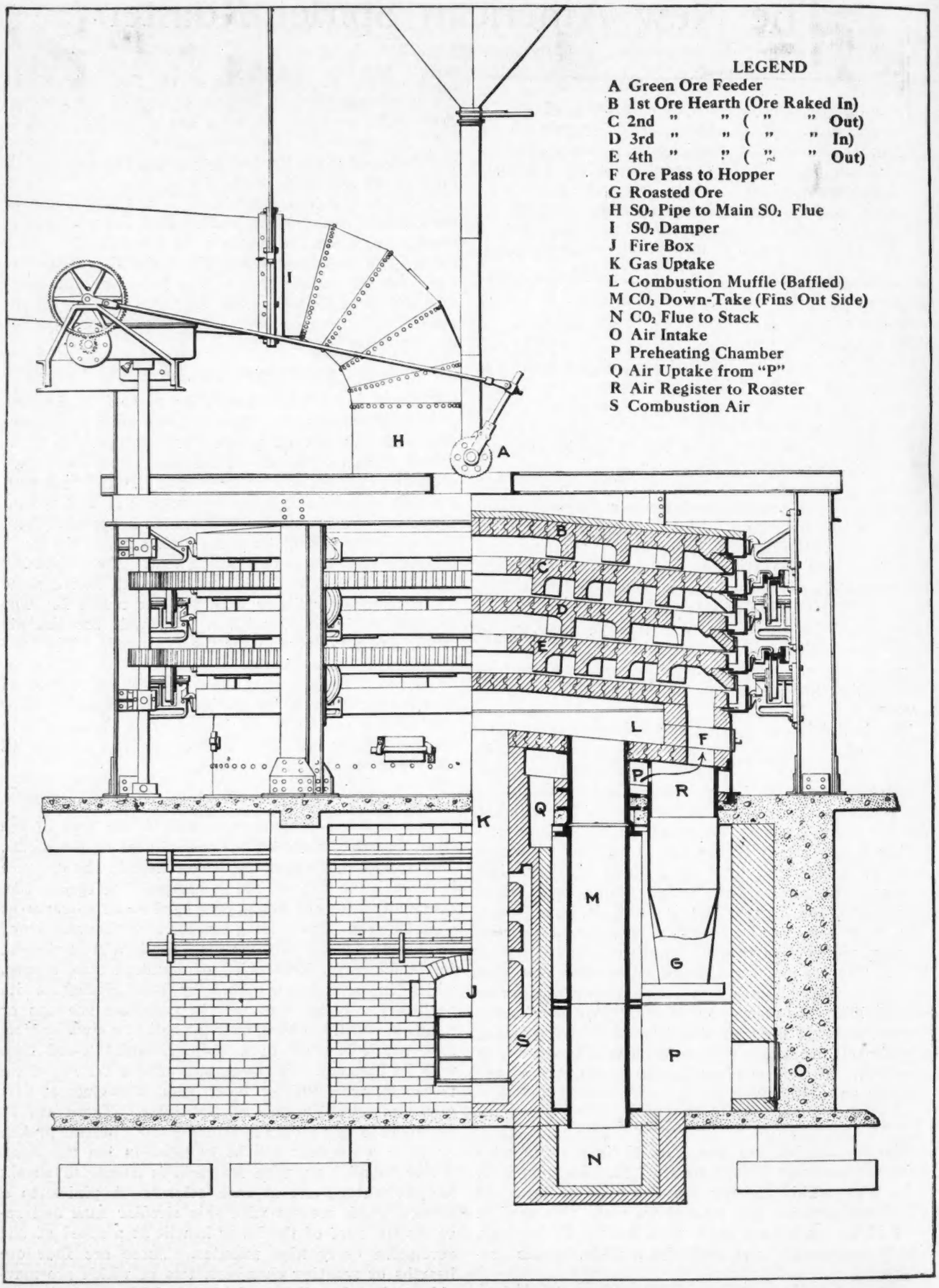
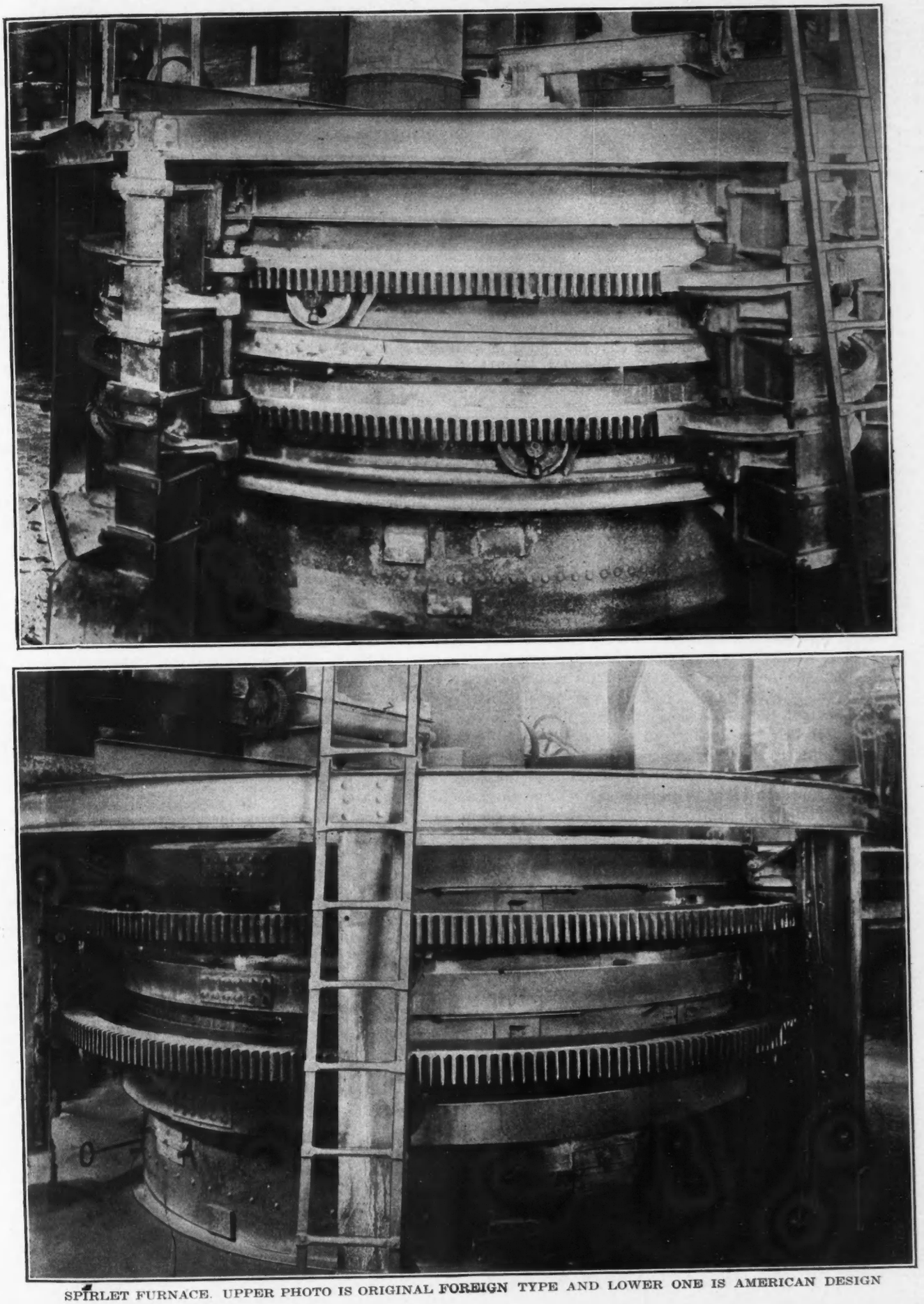


FIG. 1. AMERICAN SPIRLET ROASTING FURNACE



SPIRLET FURNACE. UPPER PHOTO IS ORIGINAL FOREIGN TYPE AND LOWER ONE IS AMERICAN DESIGN

The direction of rotation is clockwise; and the roof of the furnace, which is the roof of the upper ore hearth, is stationary.

Every third tile of the roof of hearth *B* is prolonged and acts as a rabble blade. The ore is fed through the roof to hearth *B* about 3 ft. from the center, and is rabbled toward the center. Thus the movement of *B* below the stationary rabbles in the roof causes the ore to be rabbled and transferred to the center discharge opening leading to hearth *C* below. The roof of hearth *C*, which is the under side of the floor of hearth *B*, is movable and is provided with rabbles, or teeth, as they are called. These teeth, due to the movement of the roof, push the ore to twelve 3 x 9-in. discharge openings on the periphery of the hearth and leading to hearth *D*. In hearth *D*, the roof of which is stationary and carries rabbles for *D*, the ore is moved by its action against the teeth by virtue of the moving floor of hearth *D* to discharge at center of hearth *D* into hearth *E*.

The floor of hearth *D* forms the roof of hearth *E* and carries rabbles which move the ore to the outlet holes *F*, of which there are two pair of peripheral openings, 10 x 10 in. each, into the roasted-ore hoppers *G*, one at each side of the furnace. The hoppers *G* have an ore-luted swinging gate, which is air tight, so that no cold air can enter the roaster. The removal of scale is accomplished through twelve 4 x 6-in. doors on the periphery of each hearth. Scale is not dragged out of the kiln, but is merely loosened and carried through the kiln by the rabbles.

Method of Sealing Openings

Both stationary and moving hearths are sealed by an ore lute, which is carried in an annular trough surrounding the periphery of the hearth. A thin steel plate, which is fastened on the lower side of each trough except the lower one, dips into the ore trough of the arch below and makes an air- and gas-tight seal. The ore is fed from the green-ore hopper, through a vertical pipe, into a ratchet-driven worm feed into the uppermost hearth. The SO_2 gas is taken from the kiln at the periphery of the roof of the roaster by a 30-in. brick-lined pipe *H* of 24-in. inside diameter. The draft of the kiln is regulated at the base of uptake *H* by a butterfly damper, which is pivoted in the cast-iron thimble set in the hearth opening. There is also a cut-off damper, which slides down in casting *I*. This damper is slipped in whenever a kiln is under repair and cuts the kiln off from the main SO_2 flue. After the damper *I* is in place, the uptake and attached elbow *H* may be removed with the crane. The thimble at the base is sand luted, insuring a gas-tight joint at the connection of roaster and flue; the joint at *I* is a tight slip joint and is loamed up with yellow clay. The SO_2 flues enter the main flue at an angle of about 30 degrees.

The power for rotating the roaster is obtained from a 5-hp. slow-speed 300-375 motor, by a 6-in. belt to a 42-in. pulley on a $2\frac{7}{16}$-in. worm shaft that carries a bronze worm, which meshes with a 40-tooth worm wheel. The worm wheel and worm are inclosed in a dust-proof cast-iron gear case with inboard thrust bearings. The worm and wheel run in an oil bath and are noiseless. The worm shaft carries a pinion which meshes with a gear on the crankshaft that drives the feeder ratchet by means of a pipe connecting rod, the amount of feed being regulated by means of a slide on ratchet bar which regulates the length of the effective stroke of the pawls. The worm-wheel shaft carries the pinions which mesh with the circular rack that carries the rotating hearths. The average power used to drive a Spirlet furnace is about 2 horsepower.

Dust Collection

The reason for feeding the ore only about three feet from the center of the uppermost hearth, instead of at the edge of the hearth, is to allow the gas a free passage around the ore to the SO_2 outlet. The baffling effect caused by the teeth in this hearth collects a great deal of the dust. This is precipitated upon the hearth, and when the dust beds to a depth of an inch—sufficient height to engage the teeth—it is moved up to the center drop-hole in the same manner as the ore; and, as the dust is continuously being fed back to the roaster in small amounts with the green ore, the amount of sulphate is insufficient materially to affect the quality of the calcined product. The purpose of the kiln, apart from its function as an ore roaster, is to provide a furnace gas as rich in sulphur dioxide and even in tenor as possible, the sulphur dioxide being used for sulphuric-acid manufacture.

The roasters are dismantled by picking up the hearths with a three-legged spider attached to a 5-ton hand-operated differential chain block, which is hung to a traveling crane with a hand-chain traction device. When a kiln is dismantled, only the circular arches or shelves are removed, the gear circles and driving mechanism being left undisturbed. One of the great advantages in this form of construction is that a kiln can be taken apart while still hot, whereas a kiln of the cast rabble arm type would not be cool enough for masons to work inside. At the National Zinc Co. plant spare circles are available, which are interchangeable; and as soon as a shelf shows signs of failure an extra one for this particular kiln is built. When the men are ready to make the shift, it can be done before the kiln cools off.

The coal consumption for one Spirlet kiln based on a duty of 191 furnace days showed an average consumption of 0.7 ton per day of 24 hours. The daily charge of ore to the kilns, averaged over a period of ten months, showed 7800 lb. of green ore and 1800 lb. of spill. The Spirlet kilns not only work over their own chisel lumps and screenings, but a great part of the lumps from the large kilns. The Spirlet can be operated successfully on a sulphur content as low as 25%, but is usually operated at Plant B on about 26%. At present the plant is running on 25½%, because taking over a large amount of spill from a shut-down on the larger kilns. Another advantage with the small unit is that should one lose the output of one kiln, there has been lost only one-tenth of the output of one large kiln. I have roasted Elm Orlu fines as low as 0.3% fault sulphur; 0.8 to 0.5% are common results. This may not seem low to some users of Joplin ore, but to any one handling a flotation product 80% of which passes through 200 mesh the results are satisfactory.

The sulphur dioxide gas from the Spirlet furnaces is of even tenor and will vary only a few tenths of 1% in a day. Plant B Spirlets are operated at about 7.5%, but the gas can be run up and held at as high as

10%, though this amount is not conducive to a good roast. The SO_2 content of the gas is controlled by readings on an automatic sulphur-dioxide recorder.

The following description brings out the peculiar difficulties that had to be overcome in installing a battery of de Spirlet furnaces at Plant B of the National Zinc Co., in a building already constructed. The improvements required upon the original plan indicate the importance of thorough mechanical design.

The furnaces were erected in a building which had previously contained two lump burners and four Herreshoff pyrites burners, all on heavy concrete foundations, which now had to be removed. The roof trusses of this building were of wood and were entirely too low for the proper installation of a crane-run and other overhead equipment. The building had a central line of concrete columns, which prevented an efficient sulphur-

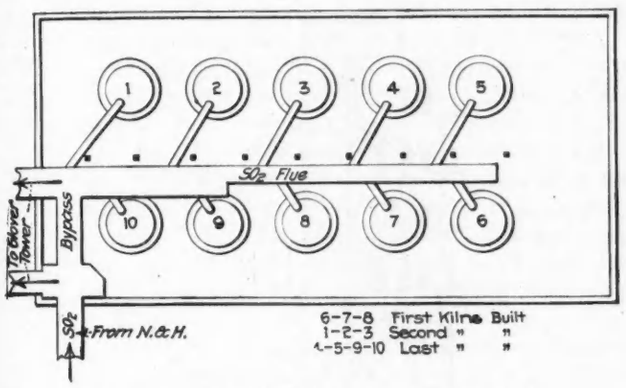


FIG. 2. GENERAL SPIRLET FURNACE LAYOUT

dioxide gas-flue layout. When the first three furnaces were built, not enough consideration was given to the possibility of a future enlargement of the battery.

The underground carbon-dioxide flue, built from motives of economy in such a position as to miss the foundations of the old burners as much as possible, was found unsatisfactory and inadequate when the battery was enlarged to ten furnaces. It was difficult to incorporate this first flue in the completed scheme so as to get a compensated draft which would be equal at each unit of the battery. The sulphur-dioxide flue layout was not consistent with good practice for the completed battery of ten kilns, because of the location of the old lump burner flues and their dust chambers, which were incorporated in the new layout. The flue was not compensated uniformly in cross-sectional area for the increased volume of gas carried as it approached the Glover towers.

The conditions enumerated resulted in excessively high velocity in the main flue, which was imperative in order to insure sufficient local draft on the most remote kilns. This condition necessitates a great deal of draft control, as it is necessary to keep the kilns regulated so that the gage shows only about .4 mm. suction on the up-take of the local flue. This regulation is made by a butterfly damper in the thimble of the out-take hole of the top shelf.

The height, being only 27 ft. to the bottom of the wooden trusses, was not sufficient for the best crane-run installation, because the crane could not be placed in the clear above the ore-charging hoppers. This causes extra expense when dismantling a kiln, as it is necessary to take down all feed pipes between the crane, wherever it happens to be, and the kiln upon which we wish to use it. All these conditions were caused by the installation of new kilns in an old building.

In making references to the different units, the numbers will be used as shown in the plan in Fig. 2.

No. 8 was the first kiln built, and the first change was in the supporting lugs and rollers. In the original foreign design, the moving hearth was supported on the gear circle by 16 cast-steel lugs, which rested in cast-steel seats, which in turn rested on a lug, which was merely a widening of the horizontal web section of the cast gear circle. Each one of these cast-steel lugs had a semicircular indenture in the under side, which was supposed to rest on a small roller, which, in turn, was designed to rest in the cast-steel seat, or dogs as they were called. The difficulty of keeping sixteen ¾-in.

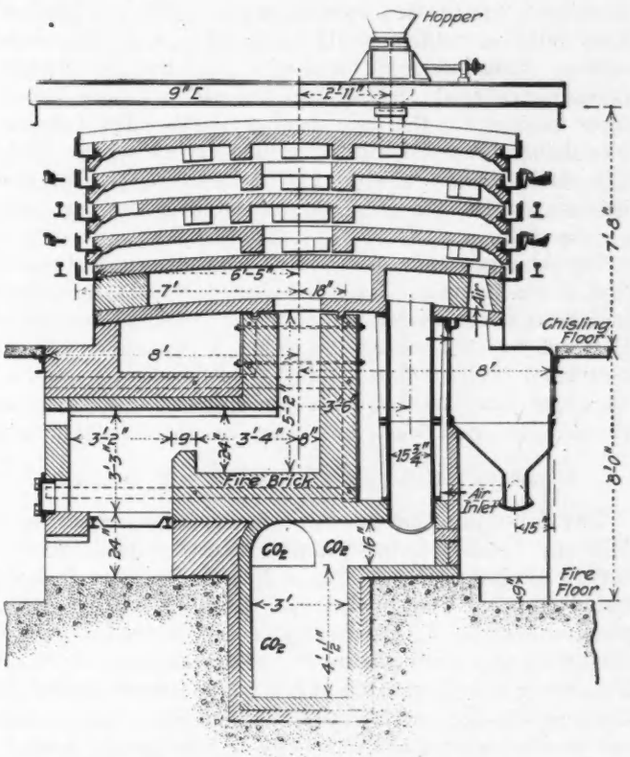


FIG. 3. SECTION OF ONE OF THE FIRST SPIRLET ROASTING FURNACES ERECTED

rollers in place while trying to land a circular hearth 14 ft. in diameter and weighing about five tons can readily be understood. The change was to omit eight of these supporting lugs and to lose sixteen ¾-in. rollers. The stationary shelves had only six lugs, so no reason was apparent for 16 on the moving shelf. If the six lugs would withstand the strain of rotation imposed by the load, or in case of conflict between the two hearths, eight lugs would certainly drive the hearth. The new American design has only six lugs on each hearth.

The second change was in the worm-gear drive of the vertical shaft. The kiln is worm driven, that is, the local driving shaft, which is $3\frac{15}{16}$ in., carries two pinions (of fifteen 1½-in. pitch teeth, with 5-in. face) that engage the above-mentioned gear circle of 316 teeth. This is the old design. The local driving shaft carries a worm wheel, and the shaft from the source

of power carries the worm. The worm and wheel were inclosed in a cast-iron gear case with cover. The designing engineer placed this worm and case below the floor and in a recess in the preheating air chamber, thus making it impossible to work on the contents of the worm case without dismantling the whole drive mechanism of the kiln. By putting the worm case at the upper end of the drive shaft the defect was remedied.

The third change was in the motor drive. The specifications called for a rotation period of from eight to twelve minutes, and the designer obtained this speed by a series of reducing gears and a high-speed motor. These gears were noisy and troublesome. A low-speed motor of 300-375 r.p.m. and a 42-in. pulley on the worm shaft was adopted. The fourth change was in the feeder, a cam-action device of the shaker type that was unsuitable for the ore, consisting, as it did, of flotation fines 80% of which would pass through a 200-mesh screen. This cam feeder was noisy and was also always becoming clogged. It was replaced with a rabble feeder that worked on the top moving shelf. This feeder was later discarded for a ratchet-driven worm feed. The fifth change was to put a local damper in the thimble on the top shelf for controlling the fan pull on the kiln.

The changes thus far described were made in the first three furnaces, Nos. 6, 7 and 8, before the kilns had been three weeks in operation. Bar grates were changed to step grates in order to handle the coal better. I had nothing to do with the changes noted, as I was unacquainted with the Spirlet furnaces until the company had decided to construct three more kilns.

Additional Changes in Furnaces 1, 2 and 3

The following changes were made in furnaces Nos. 1, 2 and 3: Not being faimliar with the kilns at the time, I hesitated about materially changing the design, but one thing that struck me forcibly was the expensive brickwork that composed the furnace housing and preheating air chamber. The old-style furnace housing required 384 mason-hours; the new American furnace housing requires 64 mason-hours. Also, I was not satisfied with the construction of the furnace framework, as the six columns which supported the kiln proper started at the fire-room floor level and projected up through the chiseling floor of the kiln. The concrete chiseling floor was carried on steel beams, which were framed into the furnace columns by poor connections. To get around this feature, I poured the concrete chiseling floor and the columns below the chiseling floor in one mass; and also poured the preheating air chamber of concrete, leaving out a space in one side for the fire box, which I built of brick.

The three large cast-iron ore hoppers, which received the roasted ore, were replaced by sheet-steel hoppers, which were only a plate and sheet throat, the sides and outside face being of concrete and brick. The columns carrying the furnace were then placed on the working floor and were made shorter, and therefore did not vibrate like the columns of Nos. 6, 7 and 8. The next change was in the profile of the hearth. The original hearth was the section of a sphere, having a rise from the outer edge to the center of 4 in. This was changed to a conical hearth with a total rise of 7 in. in building up to a circle, which was 17 in. from the center. It was topped out with a spherical section, that brought the actual height to 6 in. This was later discarded, because a 6-in. rise was too great for ore traveling from the edge to the center of the hearth. Now a conical hearth of 4½-in. rise is built, and it works well.

The shape of the rabble, or tooth, as it is called, was changed by cutting out on the back face to insure more clearance for the ridges of ore to pass between the teeth. The bottom of the tooth was also given ¾-in. rake. The next change was to re-design all furnace tile, making the sides of the tooth-block radial, instead of parallel to each other. This eliminated a number of special shapes. All plain-hearth tile was lengthened 8 to 12 in. and tongued and grooved on the ends. In the original design, only the sides were

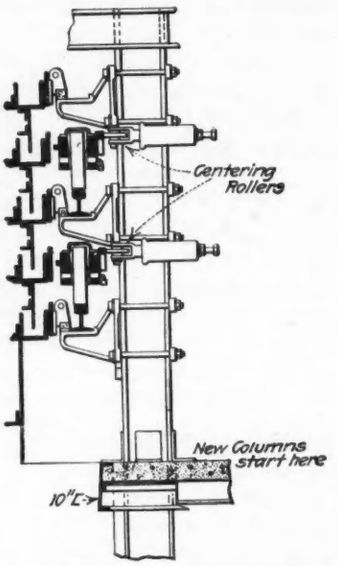


FIG. 4. DETAIL OF HEARTH SUPPORT

tongued and grooved. This change gave a tighter and stronger hearth, with fewer joints. I also changed the structural shapes which were used in fabricating the hearth ring.

Operating troubles at the plant were, however, only partly solved. New mechanical difficulties began to appear, the greatest being inability to keep the moving hearths centered. In the original European-designed furnaces this was accomplished by running an idle roller on the shroud of the large cast-steel gear ring. This roller was about 5 in. in diameter and only about 1½ in. thick and was held in place against the shroud of the gear by being axled in a yoke on the end of a plunger, which was backed up by a helical spring and disc. The plunger and spring were incased in a closed-end cast-iron cylinder, the closed end of which was drilled and tapped for a ⅜-in. bolt, which could be screwed up against the disc, forcing up the spring and thereby increasing the pressure against the shroud of the gear circle. Two of these roller-plunger devices were fastened to each column at the proper levels to meet the gear circles. It was found that when the bolt was screwed in the cylinder enough to keep the hearth centered, the spring was compressed to solidity; and when this was done, the roller could not stand the stress, and it was necessary to replace axles

or rollers continually. The wear in the axles was attributable to uneven wear on the roller face, causing it to rotate in a plane out of the horizontal, thus cutting out the axle on one side.

The first attempt to remedy the difficulty was to put two idle pinions with a 5-in. face (the same face as the gear) on one shaft, one pinion being at each gear circle level, at each column; but it was found that the tangential thrust of the gear, due to the drive trying to push the gear off at tangent, caused excessive wear and poor meshing of the teeth of the idle pinions. These were discarded for plain rollers, having a 2-in. face and an 8-in. hub-bearing on the shaft, and working against the shroud of the gear, as the first rollers had done; but all springs were discarded, because it was essential that the gear circle remain accurately centered. The arrangement worked well.

The gear circles next gave trouble. These were cast in four segments and were connected by four $\frac{7}{8}$-in. bolts at each joint, but the connection was weak, because the bolts were spaced too close together radially; that is, the joint had a tendency to spring in. This was owing to the tangential driving thrust and because the bolts would stretch, on account of the long lever arm, which in this case was the cord of a quadrant of the gear. The trouble still continues and the only remedy found is to watch the bolts and keep them pulled tight, and replace them all when repairs are made. This trouble has been eliminated by the 90-lb. 5-rail continuous rail circle of the American Spirlet.

After the completion of kilns Nos. 6, 7 and 8, and 1, 2, and 3, orders were received to build four new kilns. The old drawings were discarded, and the new American Spirlet as herewith depicted is the result. The most important item in building a Spirlet kiln is the making of the arch tile. Great care should be taken in moulding and in burning out all shrinkage, because the low crown of the arches will not admit of much shrinkage.

Mr. Chase, in a recent article, gave the average life of a Spirlet kiln at only three months. At Plant B there is one kiln that has run continually 15 months and is still doing good work, and the life of the kilns is placed at one year, and with careful operation it is expected that they will last longer.

Yuba No. 17 All-Steel Dredge

By Lewis H. Eddy*

Yuba No. 17 all-steel California-type bucket-elevator dredge, built by the Yuba Manufacturing Co. at Marysville for the Yuba Consolidated Gold Fields, at Hammonton, Calif., began digging on May 5, 1918. It is the second dredge in the state to be equipped with 100 buckets of 18-cu.ft. capacity. The first was Yuba No. 16, which is the only two-stacker dredge designed for reclaiming a waterway[1]. Yuba No. 17 is, like all other dredges built solely for gold dredging, equipped with one stacker. Details of dimension and equipment were described in illustrations and text on pages 374 and 375 of the *Journal* of Feb. 23, 1918.

The dimensions and equipment of Yuba No. 17 are practically the same as those of Yuba No. 15, which started digging July 3, 1916[2]. The differences are chiefly in the size of the buckets and the length of hull. Yuba No. 15 is equipped with 100 buckets of 17-cu.ft. capacity, and the hull is 10 ft. longer than Yuba No. 17. The digging ladders and the stackers are the same length, and, though Yuba No. 15 was designed to dig 82 ft. below water line and the Yuba No. 17 to dig 85 ft., both boats will exceed the designated depth when the occasion requires. The photographs which appear on the next two pages of this issue were taken after the dredge began digging and are so similar to the photographs of Yuba No. 15 that the differences are not discernible and one might easily be taken for the other dredge. They are practically twin boats. Whether Yuba No. 17 will excavate a greater yardage of gravel in a given time remains to be decided after it has been given a fair trial in similar ground.

The time occupied in construction of Yuba No. 17, from the laying of the first steel, on Aug. 4, 1917, to the date when operations began, May 5, 1918, might require some explanation in any other than present times. From the beginning of construction to the launching, on Nov. 14, 1917, only 76 days were occupied in actual construction work. But from the day of launching to the date of completion there were continual delays in receiving material, which interrupted and retarded construction work in the field as in the shops. Situated, as California is, at such great distance from the steel manufactories, the Yuba Consolidated Gold Fields is most fortunate to have the dredge now completed and in operation.

*Associate editor, "Eng. and Min. Journ.," Sran Francisco, California.

[1]"Eng. and Min. Journ.," Dec. 1, 1917, p. 945.

[2]"Eng. and Min. Journ.," Aug. 19, 1916, p. 329.

Malarial Fever in Brazil

Steps to combat malarial fever in Brazil are seen in the recent establishment of a sanitary and prophylactic service, the first official act of which will be to insure a supply of quinine, of guaranteed purity and at a minimum rate, to the public. Vice Consul Richard P. Momsen, in *Commerce Reports*, gives a translation of the decree creating the official quinine service, from which the following articles, of more than local interest, are abstracted:

The tablets shall be of the exact weight of 10 and 20 cgm., and of 1 gm., packed in glass or similar tubes, hermetically closed with a capsule or seal of guarantee, and labeled with exact directions for use, together with the official cost of the product.

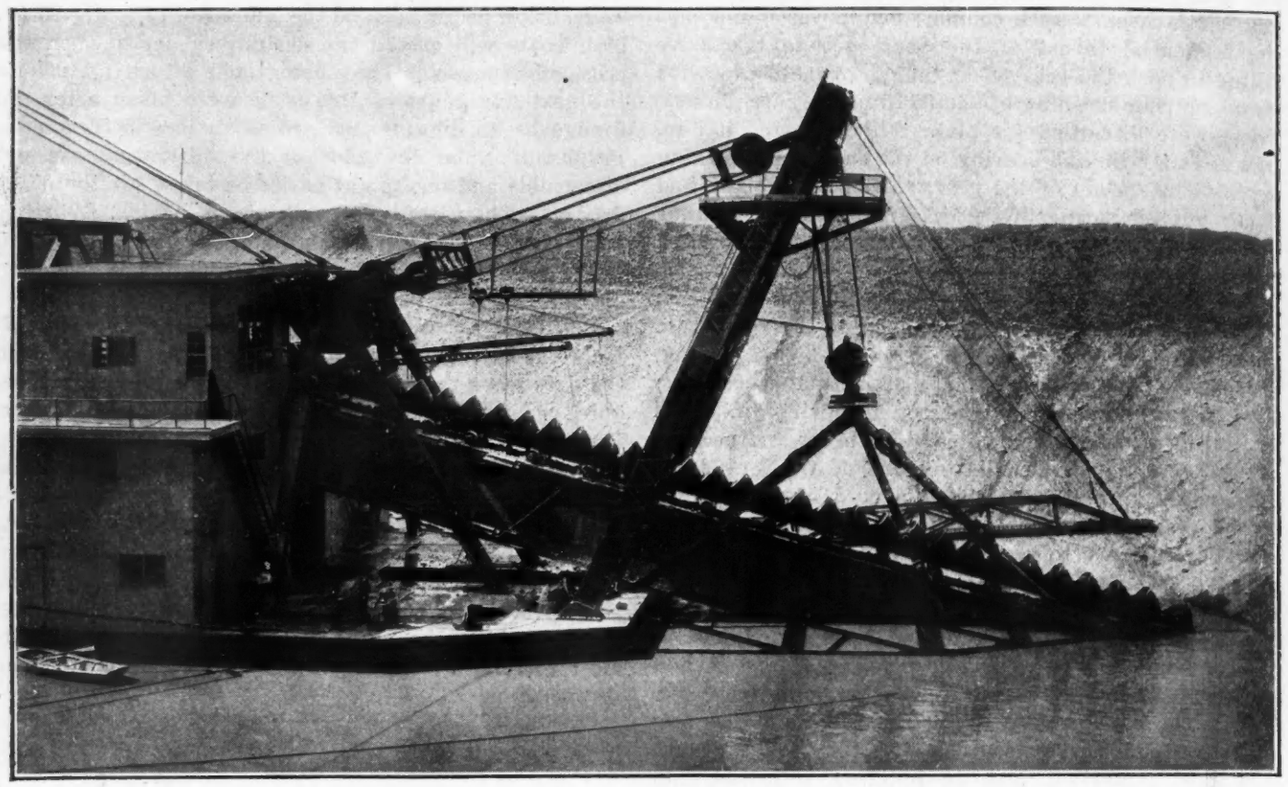
The solutions, sterilized according to the requirements of the medical profession, must be put up in doses of 1 cc., to be injected at one time under the conditions of ordinary medical practice, and with the same guarantees of seal and label of contents.

The official quinine shall be sold in all domestic territory at the same price, fixed by the government and estimated according to the variations of the world's markets, and mentioned on the respective labels.

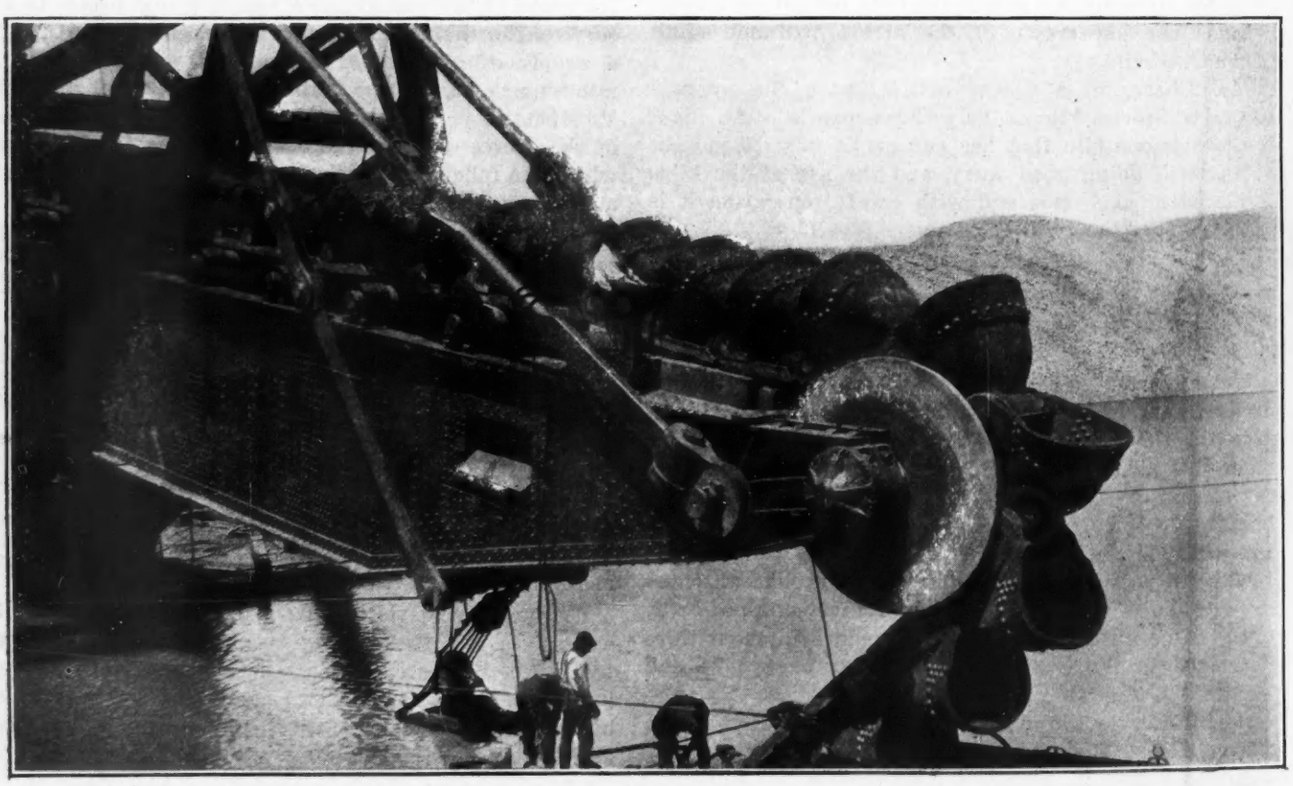
The price of quinine will be fixed by the average price of sulphate of quinine in the Amsterdam market during the preceding fiscal year, the selling price to be fixed at the next monetary denomination above the cost thus established.

Engineers who visit malarial districts of Brazil will appreciate the steps being taken by the government to reduce the destruction and loss caused by the fever, both by means of the service mentioned above and also by the organization of medical commissions which were authorized at the same time.

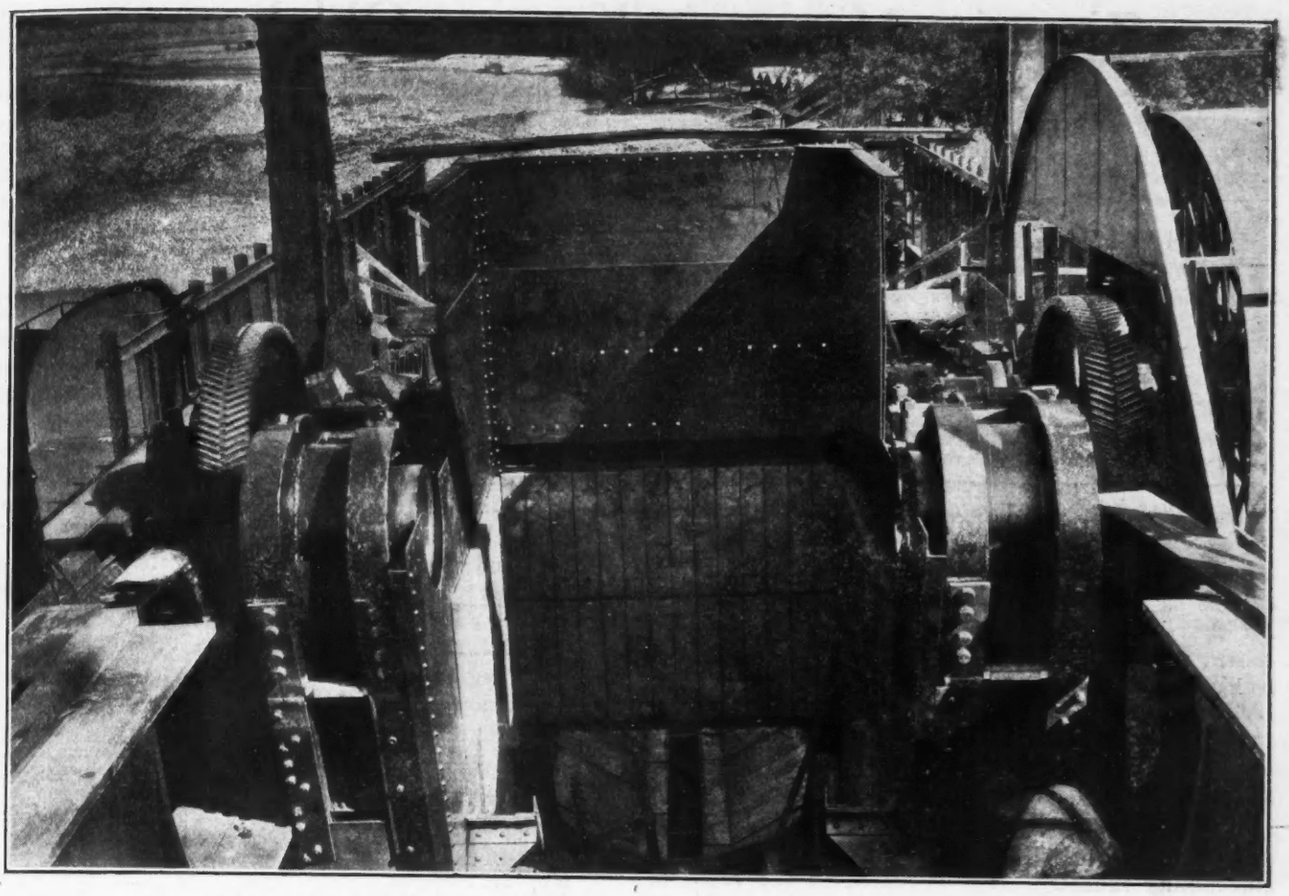
Yuba No. 17 All-Steel Dredge



DIGGING LADDER OF YUBA NO. 17 ALL-STEEL DREDGE IN POSITION OF DIGGING AT SHALLOW DEPTH



DIGGING END OF DIGGING LADDER, SHOWING DESIGN OF BUCKETS AND ROUND TYPE LOWER TUMBLER



INTERMEDIATE GEARING OF MAIN BUCKET DRIVE ON YUBA NO. 17 ALL-STEEL DREDGE

SAFETY GUARDS FOR GEARING ON YUBA NO. 17 DREDGE, WHICH BEGAN OPERATIONS ON MAY 5, 1918

Zinc in Missouri, Kansas, Oklahoma And Arkansas*

BY OTTO RUHL

A comparison of production figures and a forecast of future operations in four important zinc-producing states. Factors causing uneconomic production are detailed; prices of product and cost of operation tabulated, and the labor question, the problem of the increasing cost of supplies, and the effect on efficiency of the influx of new and sometimes inexperienced workmen are discussed.

DETAILED discussion of the subject of zinc mining and production of Missouri, Kansas, Oklahoma, and Arkansas would have so many ramifications as to make the subject too involved and long for the purpose of this meeting; therefore, only the salient features will be considered and the subject will be handled in a general way.

PRESENT SITUATION IN MISSOURI AND ARKANSAS

Present production throughout Missouri and Arkansas is below normal. Oklahoma and Kansas are supplying the bulk of the output from the four states named, and show the greatest activity now to be recorded in the zinc-mining industry. The situation in the State of Oklahoma, however, is unique in that present production is the fruition of effort begun two years ago. But even in Oklahoma the situation is growing more difficult, and production in many cases is being maintained at a loss—a feature which is bound to result in disaster when this economic law is violated. Bound up inextricably with zinc mining is the byproduct lead, a byproduct which, in the Oklahoma field, is much more important than elsewhere in the district. This, too, has had its effect upon maintaining production in that district as opposed to others.

A decline in the Missouri production is markedly noticeable, and is exemplified by the different shipments from the principal camps of the district. Formerly the Webb City-Carterville sheet ground camps produced, on an average, 3000 tons per week and seldom less than 2000 tons. At present this camp is shipping on an average less than 500 tons. The Joplin camp formerly shipped from 1000 to 1500 tons, whereas 300 tons per week is now seldom exceeded. The same effect may be noted upon the other mining camps of Missouri. It is apparent that the Missouri district has been cutting down its output radically.

Kansas production, so far as the old Galena camp is concerned, has shown a tendency toward curtailment; but to take the place of the old camp there have come into prominence two new sections of the state, which have more than made up for the deficiency. The Waco-Lawton field has increased output to from 100 to 400 tons per week; and in the area north of the Kansas state line, and north of the Picher, Okla., camp, a number of producers have made an output of from 250 to 500 tons per week. There is, therefore, a net gain in the Kansas district, in spite of the bad conditions prevailing in the market.

The Oklahoma district has shown a consistent and steady growth, until today it is, or will be by the end of the year, the leading producer of the four states named. Its shipments are now running from 3000 to 5000 tons per week; and, owing to the number of new producers whose development work is not yet completed, but which is still under way, there is likely to be a continuance of output even in the face of untoward conditions. Shipments of ore for the entire Missouri, Kansas, and Oklahoma district, for the first seven months, have averaged approximately 9125 tons per week, of all grades of zinc ores. Shipments during the months of January and February were the lightest of the year; beginning with March and extending through to the last part of June they have been heavy. The shipments of all grades of zinc ores by months are as follows:

Month	Tons
January	32,995
February	22,250
March	47,955
April	45,810
May	44,315
June	43,900
July	33,510

This makes a total of 270,735 tons for the first seven months of the year, and is 16,785 tons less than the output for the same period last year.

PRODUCTION AND PROSPECTING DECREASED IN ARKANSAS

Conditions in the Arkansas fields are practically the same as in Missouri. There has been a decided slowing down in new prospecting, as well as in actual production. Always a comparatively small factor in the production of zinc ores of the country, it has become still less a producer since the advent of higher mining costs and lower prices. I have no statistics of the production for the seven months just closing.

CALAMINE OUTPUT IN JOPLIN DISTRICT DECLINES

There has been a decided drop in the calamine output of the Joplin district. From a ratio of 10% of the blende ores five years ago, there is now less than 3%. In other words, of the 270,000 tons of ores produced the first seven months of 1918, considerably less than 6000 tons was calamine. Of the blende ores, the ratio of first grades to all other grades has been a question of investigation for the last four months. The High-Grade Ore Producers' Association of the Joplin district undertook a census of the field, based upon assays of the ores produced, and found that approximately 3400 tons of such ores really existed, or were potentially possible, in the field. This grade was established upon the basis of less than two tenths of 1% lead, less than 2% iron and 60% minimum for zinc. It has been shown by the actual working of the agreement between the ore pro-

*An address to the American Zinc Institute at St. Louis, July 30, 1918.

ducers and the sheet-zinc producers, that it is possible for many second-grade ore producers to place their product, or a large portion of it, in the first-grade class by the proper method of milling and care in selective mining. Of the production shipped during the first part of 1918, approximately 100,000 tons of the blende ores was of first grade, and the remainder intermediate or second grades and calamine.

Prices of the Product

The markets for the year have been exceedingly unsatisfactory, from a profit standpoint. A glance at the average prices paid for the year discloses the trend of the market. The following table shows the average prices of all grades of blende ores by months:

Month	Blende	Calamine
January	$57.02	$32.67
February	55.00	33.00
March	50.14	34.73
April	42.03	32.93
May	47.79	31.00
June	52.07	31.77

As compared with the previous year, the average of blende-ore prices is $16 lower and calamine $11 lower.

Cost of Production and Changes To Be Noted in Mining Conditions

At the meeting of the American Institute of Mining Engineers at Joplin in October, 1917, a report was presented, based upon a careful examination of mining costs and the conditions then prevailing, which showed a rapidly rising cost of production, brought about by rising costs for supplies and labor. In a report then made to the War Minerals Committee, the rock cost of mining in the Joplin camp was given at $1.46; in the Webb City camp at $1.27, and in Oklahoma at $1.89, without including royalty, depreciation, and depletion. With these added and on the basis of 2½%, 3%, and 5% recoveries for the various camps, the concentrate cost became $64.40, $65.30, and $54.80 per ton, respectively. Since that time, cost of supplies has advanced, labor has become more scarce and less efficient, and many of the mining organizations are disrupted by reason of so many of the younger men being taken into the Army. It is now believed that a similar census would disclose costs from 10 to 20% higher, and there is no end in sight with regard to advances in materials and supplies.

Labor Conditions Affect Efficiency

The shortage in labor has been growing week by week. Especially has this been true of the shovelers. The shovelers are the younger men, and it is this class that the draft has taken. This makes it inevitable that older men must do the work, which in turn means less efficiency and higher costs. The actual inability to replace men at all is becoming really serious, and it now appears certain that this factor alone will result in curtailment on a fairly consistent scale. It also probably means the beginning of the district's labor problems. Driven to seek other labor, some of the mines have undertaken to hire Mexicans on jobs where white men refuse to work, but the native Americans immediately threatened them with trouble. There is therefore little hope for importation of labor. Some of the mine operators are seeking to solve the labor problems by installing shoveling machines. The experiments seem promising from the point of view that the machines at least do the work, but, so far, at no less cost. That shoveling machines will be utilized in increasing numbers seems certain, and they constitute, so far as any one can now observe, the only avenue for labor relief.

Added to more expensive labor is a marked increase in the cost of supplies. Not only have supplies advanced, but a shortage is developing which may seriously affect production. The replacement of machine parts, certain kinds of steel, rope and cable, pipe and many other necessary supplies, is an uncertainty for the future, and already has been extremely difficult in some cases. Then there is the ever-growing difficulty of obtaining fuel; and, added to that, higher freight rates. Verily the zinc-ore producer needs not only the patience of Job, but an ability to perform miracles, in order to keep his plant going in the face of the conditions now prevailing.

It is evident that an automatic cutting off of production will result in those mines whose cost of production goes above the average market price received. This reduction would be in direct proportion to the rise in the cost of mining and the percentage of ore recovery if the Joplin producers were running their operations entirely upon business principles. But they have within their ranks a large proportion of men who "live by faith alone"—who can instill optimism in their stockholders and obtain leniency in the matter of credit with supply men. There is also a considerable number who have no cost system, and they really do not know they are going broke until the Creditors' Association takes charge, and even then they doubt it, so strong is their optimism. Therefore, calculation based upon an elimination table, in which the factor of cost and ore recovery enters, would have to be discounted, on account of the above-mentioned personal factors.

Influx of Inexperienced Men

One other feature entering into production estimates, especially in Oklahoma, lies in the fact that so many new men have entered the industry. All these new men have not had either the experience or received the competent advice which would make them as efficient as the common standard of the district. Naturally there have been many mistakes in building certain plants which will never be factors in production, but which appear to have potential plant capacity. In reality such monuments create a false impression; they have burdened the industry with additional capitalization, and have absorbed useful material and sorely needed labor. The promoter has done a wonderful work for zinc mining in Oklahoma, but his ever-optimistic prototype is leaving behind him a heritage of difficulty which it will take considerable time to alleviate and a much longer time to correct. From the above-mentioned conditions, it is easily noted that apparent potential production is not always realized; and that from it may come an output based on mistaken economic facts that have injured the industry as a whole.

Some months ago the surplus stock of zinc ores in the bins of the ore producers totaled in excess of 30,000 tons—the highest figure, to my knowledge, in the history of the industry. It has been reduced by the shutting down of plants, curtailment to single-shift operation, and sales, to approximately 18,000 tons, or the equivalent of two weeks' average shipments. But beginning with March, 1918, the serious conditions outlined had

so struck home to the operators of the Joplin field that even the greatest optimist realized that production below cost could not go on, and that some remedial measures must be taken.

It was at this juncture that the High-Grade Ore Producers' Association was formed, and took up the work of securing Government help in stabilizing the market of the mining industry. Through Pope Yeatman came the suggestion that there should be coöperation between the smelters and the producers of high-grade ores. After some weeks of effort, such an agreement was made between the sheet zinc manufacturers and the Joplin high-grade ore producers, which resulted in disposing of approximately 1300 tons of high-grade ore weekly on a $75 base, or a little above the cost of production. This materially helped the fortunes of the ore producers of the district; and it is hoped that the result of that beginning in coöperative action will bear fruit in the larger organization planned at this meeting.

SUMMARY

Summed up, the conditions in the production of ores in the four states of Missouri, Kansas, Oklahoma, and Arkansas are as follows:

1. Production is now running behind that of 1917, but shipments have averaged 9125 tons weekly.
2. Production activities are greatest, and will continue to be so, in Oklahoma.
3. Present economic conditions favor curtailment.
4. The peculiar factors of over-optimism and new and inexperienced operators have complicated any intelligent estimate as to future production, have added burdens, and have absorbed needed supplies and labor.
5. Coöperation on a small scale has helped to stabilize production, and lends hope for greater success with more extensive organization.

The American Sheet-Zinc Industry*

BY E. H. WOLFF†

The use of sheet or rolled zinc in the United States has been restricted to well-defined limits, and the commercial growth of the product has been slow as compared with other sheet metals. During a period of 40 years or more, practically the entire requirements of this country had been produced by the two principal companies; and for many years prior to the war there was not sufficient business to keep these mills in operation to more than 60% of their capacity. The war has created a demand for sheet zinc in those foreign countries which Central Europe had supplied during peace times; and this demand, together with the needs of this country for war purposes, has brought other American mills into the producing field. The capacity of one of the Illinois mills is now being increased about 50%. The other Illinois mill can be increased in like proportion.

One of the functions of the Zinc Institute should be to appoint a strong committee on research or metallurgy, to coöperate with the companies directly interested, and to find new and practical uses for rolled zinc, in order that all these mills may be kept in operation after the war. Another function should be the operation of a well-organized export and import department. During the pre-war period our American industry could not export to the present consuming countries outside of Europe, because of competition at lower prices. During the war period Japan has been the principal buyer of sheets in thin gages, but knowing that Japan is at this time endeavoring to market its electrolytic spelter in America, and knowing, too, that it is preparing to roll sheets for home consumption, that country can be disregarded as a possible consumer after the war.

There are, however, other countries now using the American product whose business we might retain for some years. It may not be generally known that our industry was seriously invaded by the German and Belgium sheet producers during the few months prior to Aug. 1, 1914. The base price then prevailing in this country was 7c. per lb., less usual trade discounts, which was about the cost of production. The foreign product was delivered at New England ports, ocean freights and duty paid, at the rate of 15% ad valorem, at ½c. per lb. lower than that realized by the American producers. The tariff law enacted by Congress in the autumn of 1913 reduced the protection afforded prior to that time, giving an advantage to the foreign producers, of which they soon availed themselves. The American industry was thus face to face with a condition that would have meant ruin had it continued for a space of time, but the competition was cut short by the beginning of the war in Europe.

As a national body, the Zinc Institute would be an organization to present properly the claims of the industry for a protective tariff on all zinc products, but more especially on sheet zinc and spelter. The necessity for such a tariff will undoubtedly come, and this organization should be in a position to meet the situation. That benefit may be derived from coöperation was clearly demonstrated several months ago when the high-grade ore producers and the purchasers of these ores adopted a working basis for grades and prices. This arrangement, to the best of my knowledge and belief, has been continued up to this time with satisfaction to all concerned.

I heartily endorse the organization of the American Zinc Institute on a national basis, with all branches of the industry represented, and congratulate the group of men who conceived it. I predict for the industry, through the medium of the organization, the beginning of an era of advancement that could not otherwise be attained. Every one in any manner connected with the production of zinc, from the ore producer to the fabricator, should be urged to subscribe to its membership. A spirit of coöperation for the general good of the industry should prevail. Trade publications should be urged to coöperate by upholding the American zinc industry as an American institution. The war has taught us many things, but none of more significance than that hereafter we shall all be for American products, first, last, and always!

---

*Slightly condensed from a paper read before the American Zinc Institute at St. Louis, July 30.

†Secretary and general manager, Illinois Zinc Co., Peru, Illinois.

Today is an opportune time to send a check for the Comfort Fund of the 27th Engineers.

The Use of Pulverized Coal*

By H. R. COLLINS†

Methods of preparation of pulverized coal detailed and the advantages in the adoption of the system enumerated. The principal features of modern practice are presented in condensed form, and the economies said to result from the substitution of pulverized coal discussed, with details of savings effected in various types of furnaces.

THE purpose of pulverizing coal before burning it is to make available every heat unit that it contains. Machinery has been developed which will pulverize coal in one operation, delivering it to bins in front of the furnaces at an expenditure of about 17 hp.-hr. per ton, in a medium-sized plant. The cost of the operation depends upon the amount of moisture that must be expelled before pulverizing, the wages of labor, and the price of coal delivered at the plant. At a small plant, requiring a pulverizer with a capacity of only ½ ton per hour, the cost per ton pulverized will naturally be greater than at a plant requiring the largest pulverizer, possessing a capacity of seven tons per hour.

Preliminary Crushing and Drying

The first step is to reduce large lumps to a size suitable for drying uniformly, before passing to the pulverizing mills; this is done in rolls, at a single pass. The second step is the elimination of moisture, in order to facilitate pulverizing to great fineness, while also increasing the heating effect and the temperature attainable when the coal is burned. There are other mechanical advantages in the handling of dried coal. Driers are now manufactured which are able to eliminate moisture without distilling any of the volatile combustible matter in the coal. They are fired by hand or with pulverized fuel. The heat first surrounds the shell of the drier, being confined within a chamber where complete combustion takes place; the heated gases are then led through a duct to the discharge end of the drier and enter the inside of the shell at a temperature not exceeding 300° F. This temperature is maintained by the operator and is indicated by a pyrometer. Volatile combustible matter is not likely to be distilled until the temperature rises above 400° Fahrenheit.

Elimination of Iron and Pulverizing

On discharging from the drier, the coal is usually passed over a magnetic separator in order to prevent pieces of iron from going to the pulverizer. Two types are used: a magnetic pulley which automatically discharges its collection of iron, and a lifting type, from which the iron is removed by hand when convenient. In the operation of pulverizing, the coal should preferably be reduced until 95% will pass through a 100-mesh and 70% through a 300-mesh sieve. Such a product is obviously an almost impalpable powder. After pulverizing, the fuel is conveyed by one of several methods to the point where it is to be used. In several installations the pulverized coal is conveyed a distance of over 900 ft. Where possible, a bin should always be installed at the furnace, in order to guard against interruption of supply.

Feeders are practically indispensable for regulating the passage of the fuel from the bin to the burner. They are now made of simple design and are highly efficient. They deliver the pulverized coal in definite quantities into an air current of fixed volume, where the air disseminates the pulverized fuel, surrounding every particle and putting it into condition to develop all its energy. The first to ignite are the volatile gases; these raise the temperature to the ignition point of the solid carbon, and before leaving the zone of heated air every particle has released its last heat unit. It is entirely possible to obtain temperatures ranging between 1900° and 3500° F.; the highest temperature (3500°) I have observed was in an openhearth, when the average temperature of the furnace itself at some time ranged from 3100° to 3200° Fahrenheit.

Advantages in Pulverizing Coal

To justify the expense of erecting a special building and installing special machinery to pulverize coal, the following advantages in its use may be enumerated:

1. Conservation of the country's fuel, by utilizing every heat unit in the coal, made possible by this method of consumption.

2. Reduction of labor for handling coal to the point of consumption, handling by the fireman, and the removal of ash and unconsumed fuel from the ashpits; practically all this expense is avoided when fuel is burned in pulverized form. All the coal is received at one point, and thereafter it is handled entirely by automatic machinery, the human element being thereby eliminated, except for supervision, adjustment, and necessary repairs.

3. From actual experience with many grades of coal, I believe that every carbonaceous fuel in solid form, from lignites to the graphitic anthracites of Rhode Island, will yield its maximum measure of heat if burned in a truly pulverized condition.

4. Coal in pulverized form can be injected into a furnace on a column of air at very low velocity, thus allowing the expanding gases to liberate their heat without erosion of the refractories.

5. Pulverized fuel permits the maintenance of a constant temperature in a furnace when the relative amounts of fuel and air have once been set and the body of the furnace has been brought up to the desired temperature. It will continue thereafter under what is known as a test condition. Furnaces can be operated in this manner hour after hour, as shown by charts of recording pyrometers. The correct relationship between the amount of pulverized fuel and the volume of air, for any desired temperature, can be controlled automatically, after adjustment to the particular grade of

*From a paper to be discussed at the Colorado meeting of the A. I. M. E., September, 1918.

†Mechanical engineer, Fuller Engineering Co., Allentown, Pennsylvania.

coal in use, thus using a minimum of excess air. Gas analyses have been obtained showing as high as 17% of CO_2.

Pointers in Pulverized Coal Practice

Many questions are asked on the subject of pulverized coal, and I have arranged the answers to them in the following order:

1. *Grades of Coal Used Successfully*—For kilns, boilers, or metallurgical furnaces, coals of about 35% volatile, 50% fixed carbon, 8% or less ash, and 2% or less sulphur, are preferable.

2. *Experience with High-Ash and High-Sulphur Coal*—Coals analyzing 25% ash and 5% sulphur have caused no trouble in kilns, boilers or metallurgical furnaces. Experience shows that sulphur is entirely consumed by burning in suspension, none of it being absorbed by the metal or other liquid bath, as occurs in the usual copper reverberatory furnaces used for melting electrolytic copper.

3. *Provisions for Storage*—Storage bins for pulverized coal should be dust-tight and have steep hoppers, enabling old coal to leave the bin completely; accumulations of old coal are liable to fire, smolder, and coke, causing more or less annoyance.

4. *Why Coal Should Be Dried Before Pulverizing*—(*a*) To facilitate the pulverizing operation, giving the finest product with the least power consumption. (*b*) To permit high temperatures with the least consumption of fuel. Drying of the coal also promotes uniformity of temperature. (*c*) Dried coal will flow more easily from bins and through the feeders and burners. Coal should be dried to 1% of moisture, or less when possible, except that lignites can be readily handled with 5 to 8% combined moisture.

5. *Fineness of Grinding*—The finer the coal the more rapid its combustion, with relatively higher efficiency. It is commercially and economically possible to grind coal so that at least 95% will pass a 100-mesh sieve and 70% will pass a 300-mesh sieve.

6. *Cost of Handling, Grinding, and Upkeep*—The cost of preparing pulverized coal depends largely on the price and on the moisture content of the coal to be used. On the basis of 200 tons per day of coal containing 7.5% moisture, at present rates of wages and supplies and with coal ranging in price from $1 to $8 per ton, the cost of pulverizing will be between 30 and 40c. per ton, not including overhead charges, interest, depletion or depreciation.

7. *Danger From Dust Particles Floating in the Air*—A mixture of coal-dust particles in air will not ignite until it reaches a certain density; on the other hand, a mixture that it too rich in coal dust has a tendency to smother flame. Dust clouds should naturally be avoided outside the furnace chambers, and all sparks or flames should be kept away. Pulverized coal should be conveyed from mills to bins in as compact condition as possible; air currents should not be used to convey pulverized coal if any other method can be devised. Leakages should be stopped, to prevent uncleanness and accumulations in inaccessible places. Carelessness in the handling of pulverized coal and poorly designed plants are the only causes of so-called explosions.

8. *Essentials of a Good Feeder*—It must absolutely control the flow of pulverized coal to the burner, and prevent any rush or flooding of the fuel. This is essential for the positive control of predetermined temperatures.

9. *Essentials of a Burner*—A good mixing projector, or burner, should be so designed that it will receive the pulverized coal in regulated quantities, break up the stream of fuel, and so distribute it that each particle is surrounded by the correct proportion of air. It must also project the fuel into the furnace at the velocity required by the operation, and must be so proportioned as to deliver the necessary volume of air at the proper velocity. Four types of burners are employed: (*a*) Induction type, in which a high-velocity jet induces and entrains the necessary additional air, and projects it into the furnace at low velocity; this type has the high-velocity air under control as well as the induced air. (*b*) Positive type, in which the high-velocity air induces and entrains the fuel and projects it into a positive, larger column of low-velocity air, thereby breaking up the fuel stream evenly, and disseminating it through the larger column of low-velocity air before it enters the furnace. The larger column of low-velocity air is usually preheated, in stoves located in a chamber through which the waste gases from the furnace pass; temperatures of preheating range from 100° to 600° F. in the better-designed system of stoves. Both columns of air are positive, being generated by fans or pressure blowers, and gates regulate the quantity. (*c*) Single type, in which the high-velocity air first induces and entrains the fuel stream, after which a high-pressure jet of air, applied usually in the center of the stream, gives a sharp projection of flame and quick distribution of the fuel through a larger volume of preheated air at low velocity. This type of burner is usually adjustable in direction. The heated air ranges in temperature from 2200° to 1300° F., as in openhearth practice; usually 10 to 15% of the air enters with the fuel, and 85 to 90% from regenerators. The stack draft through the regenerative chambers is regulated by a valve. (*d*) Single type, in which the high-velocity air induces and entrains the fuel and projects it into the furnace, as in rotary-kiln practice, under usually 5 to 6 oz. pressure from a fan. The additional air required for combustion is induced by stack draft, and enters around the hood and through the kiln discharge opening.

10. *Air Pressure and Effect of Stack Draft*—Air pressures of $\frac{3}{8}$ oz. entering the combustion chambers of some types of furnaces, from air and fuel mixing burners, up to 2 lb. in pressure jets of other types, have been in successful and constant use for years. Stack draft should be of only sufficient intensity to create a partial vacuum in the furnace, thereby helping the fuel and air into and not out of the chamber; its strength must be enough, however, to extract all the products of combustion.

11. *Design of Furnace*—Fuels low in volatiles but high in fixed carbon, as anthracite and coke breeze, require a special furnace in which the incoming fuel and air pass through the flame and the products of combustion, in a water-cooled, arched firebrick chamber, on their way to the furnace or boiler. When the volatile constituents of the fuel range from 1 to 3.5%, it is difficult to support combustion unless a temperature above 900° to 1000° F., the flash-point of carbon, is

maintained. The water-cooled arch, rear wall, and side walls are made of a special form of firebrick, which slips in place over the water tubes. After circulating through the tubes, the water passes to the hotwell or heater at approximately 190° F., entailing no appreciable loss of heat. Lignites and bituminous coal require no special furnace. As the volatiles ignite between 600° and 700° F., from the radiant heat of the walls, the flame is self-supporting, and every heat unit in the fuel is liberated before coming into contact with any cold surface.

12. *Ash or Furnace Slag*—Anthracite, coke breeze and lignite ash do not slag. Bituminous coal ash will slag on the bottom of the furnace chamber if not blanketed with cooler air, properly admitted, and if allowed to remain too long in the furnace. Most of the ash from pulverized coal passes away through the breeching to the cyclone, where the ash is separated from the gases. That portion which settles to the floor of the furnace should be removed from time to time; the quantity is small and light.

13. *Furnace Temperatures and Slag Formation*—Temperatures between 1800° and 3500° F. can be maintained in the flame. Slag forms more readily at high temperatures, necessitating proper blanketing with cooler air, always remembering the advisability of obtaining the maximum percentage of CO_2. From 16.5 to 17% of CO_2 is frequently obtained under operating conditions.

14. *Checkerwork in Metallurgical Furnaces*—Experience seems to point to the necessity for vertical baffle walls where the waste gases enter the regenerative chambers. Turning the direction of the gases up and down several times tends to discharge the dust tangentially, allowing the major part to settle in the bottom of the passages, whence it is easily removed through proper cleaning doors at the sides, not interfering with the operation of the furnace. The gases then filter through checkerwork, properly spaced and installed. The narrow side of the brick tile should be laid vertically and on rider walls, to permit the use of longitudinal scrapers to remove the ash which may have passed by the vertical baffle walls. This arrangement will undoubtedly give the regenerating chambers a life equal to the best record ever attained, as the narrow edge of a vertical tile presents little surface for the flocculent ash to rest on and thus close the gas passages.

15. *Furnace Life*—The life of furnaces in which pulverized fuel is used is equal to that of hand-fired, stoker, oil, or gas-fired furnaces. By absolute control of the quantity of coal and air, the velocity of the expanded gases can be reduced until erosion of refractories becomes hardly discernible.

16. *Economy of Pulverized Coal*—In this connection, all the benefits of pulverized coal should be taken into account: labor saving, increased fuel efficiency, ability for closer adjustment, and absence of smoke.

Comparative Costs and Economies

The efficiency of hand firing depends upon the skill and reliability of the fireman. With the best of attention, a loss of 20% heating value is frequent, and it often reaches as high as 40%, taking into consideration the analysis of the ash and of the flue gas. Stoker firing is relatively more efficient and more regular than hand firing, but the feeding of moist coal wastes part of the heat in the most undesirable place. Losses also occur in breaking and removing the clinker, in the discharge of unburned fuel, and in the flue gas.

Producer-Gas Firing: Referring to W. H. Blauvelt's results[1] and as quoted in Kent, page 819, it will be noted that 131,280 cu.ft. of gas was produced from one ton of coal, and contained 20,311,162 B.t.u., or 155 B.t.u. per cubic foot, or 2270 B.t.u. per pound of gas. The composition of the coal from which this gas was made was as follows: water, 1.26%; volatile matter, 36.22%; fixed carbon, 57.98%; sulphur, 0.70%; ash, 3.78%. One ton contains 1159.6 lb. carbon and 724.4 lb. volatile combustible, the energy of which is 31,302,200 B.t.u. Hence, in the process of gasification and purification, there was a loss of 35.2% of the energy of the coal. Producers are built today which will do slightly better than this.

Oil and Natural-Gas Firing: Coal, properly pulverized and burned, is on exactly the same basis as far as thermal capacity is concerned; and the price of the coal prepared and delivered into the furnace is directly comparable, on the heat-unit basis, with the cost of fuel or gas delivered into the furnace, plus the slight additional cost for ash removal.

Savings by the adoption of pulverized fuel in the operation of various types of furnaces have been attained as follows: heating and busheling furnaces, 20 to 25%; puddling furnaces, 30 to 50%; openhearth furnaces, compared with gas producers, 30 to 40%; copper reverberatory, smelting ore, 30 to 45%. In other furnaces, the consumption has been reduced to the following figures: continuous billet heating, 160 lb. of coal per ton of billets; desulphurizing iron ore in rotary kilns, 296 lb. of coal per ton of ore; drying and nodulizing iron ore in rotary kilns, on basis of 30% free moisture and 11% combined moisture, 477 lb. of coal per gross ton of ore. The figures given are from actual operations over extended periods, and confirm the contention that coal burned in true pulverized form is the only method by which every unit in the fuel can be made to develop its full value.

The Metallurgy of Antimony in France*

In considering the metallurgy of antimony, it is to be remembered that all conditions are subject to the constant fluctuations of the world market for the metal. Before the war the metallurgy of antimony had received little attention. It was the rule to treat, by a simple process of liquation, only the richest ores, and at points best situated for economical reduction, notably in England. Later, in France, where the deposits were relatively lean, a simple method of volatilizing roasting was adopted which converted the antimony contents into the oxide Sb_2O_3, which was then either sold direct or converted to regulus by reduction in small reverberatory furnaces. Despite the discovery of an important deposit of rich gold-bearing stibnite

[1] Trans. A. I. M. E. (1889), 18, 614.

*Abstract of report by M. Biver, "L'Echo des Mines et de la Metallurgie," Mar. 10, 1918.

in Mayenne, the French orebodies gradually became exhausted, and the producers of Auvergne were forced to import increasing quantities of rich Chinese stibnite ores, brought in under heavy freight charges, in order to keep their industry alive. Thus France was almost entirely dependent for antimony upon foreign ores when the war demands for the metal arose in 1915. A new company was then formed, which opened up in Algiers large deposits of oxidized antimonial ores, which were shipped to Haute-Loire, where they were smelted directly with the proper fluxes in a reconstructed lead blast-furnace plant. The development of this new source of antimony was extremely rapid, and, during the first months of the year 1917 the French antimony industry produced from Algerian ore more than 300 tons monthly—a quantity sufficient to cover the greater part of the military needs of France, and equivalent to approximately half of her total production. It is estimated that about 35% of this total production still came from the treatment of native stibnite ores by the old method.

Manganese Deposits in White Pine County, Nevada

An examination of deposits of manganese ore in White Pine County, Nevada, in the Ely (or Robinson) district and the Siegel (or Schellbourne or Aurum) district, was made by J. T. Pardee, a geologist of the U. S. Geological Survey, early in June of this year. His reconnaissance covered an area about 50 miles long from north to south and 20 miles wide, comprising part of Steptoe Valley and the mountains that border it on the east and west.

The manganese ore extends from the surface to a depth of 50 ft. or more. Practically all the deposits occur in limestone and are associated with bodies of jaspery quartz. The manganese minerals have replaced both the wall rock and the quartz. The orebodies are irregular pipes, pockets, and lenses that range from a few feet to 70 ft. or more in length and from a few inches to 10 or 20 ft. in width. Several of the larger bodies contain from 500 to 1000 tons or more. Water level has been reached only in the Siegel mine, where it stands 200 ft. below the surface.

The bulk of the ore is composed of the softer manganese oxides, pyrolusite being predominant in some mines and wad in others. The wad is generally rather compact and tough and can be whittled like wax. Psilomelane and manganite, though widespread, occur in subordinate amount. Fairly large masses of a hard, compact black manganese oxide, tentatively regarded as braunite, are found in the Bowen and Holmquist mine. The ore below water level in the Siegel mine is composed of rhodonite, rhodochrosite, and alabandite. Jaspery quartz, calcite, and iron oxides are generally associated with the manganese minerals. In the Siegel mine cerusite and massicot were observed above water level and galena and pyrite below. Most of the ores contain more or less silver.

The ore mined contains from 36 to 45% of manganese, 3 to 16% of silica, 3 to 5% of iron, a moderate amount of lime, and a little phosphorus. Parts of the orebodies not now mined or rejected in sorting ore for shipment contain more than 16% of silica. Ore containing 25 to 30% of manganese and 15% or more of iron occurs in several places. A total output of 2108 short tons of 40% manganese ore was produced by seven operators up to June 1, 1918, the first shipments having been made late in 1917. In addition 1200 tons was produced by the Siegel mine from 1902 to 1908, but this ore, though high in manganese, was smelted for silver and lead, the manganese content being lost in the slag.

About 550 tons a month are now being shipped from the Ely and Nevada districts. Additional equipment now being installed by one of the operators is expected to increase the production by 100 tons a month, and if the Siegel mine becomes active it will produce an additional 250 tons a month, so that the total monthly output will be 900 tons. Most of the orebodies are near the surface and can be mined by open pits or shallow shafts and tunnels. Water usually has to be hauled, and mine timbers, machinery, and general supplies are said to be rather expensive and difficult to obtain. Wages are $5 a day, and miners are reported to be fairly numerous and to prefer employment with the manganese or other small mines rather than with larger corporations. Board is $1.25 a day.

The cost of hauling the ore from the Ely district to the railway, a distance of two or three miles, is about $2 a ton. The cost of hauling by motor truck from the Nevada district to East Ely, a distance of 10 miles, is about $4 a ton. The distance from the Siegel district to the railroad is 30 miles by one and 40 miles by the other of the two most available roads. Estimates as to the probable cost of transportation from this district to the railroads range from $6 to $10 a ton.

The high-grade manganese ore (40% manganese and low silica) now in sight is estimated at 5450 tons; the ore containing 15 to 40% manganese and high silica, at 5000 to 12,000 tons; the ore having 15 to 40% manganese and high iron, at 1650 to 4000 tons; and the sulphide and silicate ore carrying 20 to 35% manganese and 20 to 37% silica, at 1000 to 3000 tons.

Copper in the Belgian Congo

The mineral industry of the Katanga is practically confined to the operations of L'Union Minière du Haut Katanga, states the acting British vice-consul at Elisabethville in the *Board of Trade Journal*. The company holds the mineral rights over a large area of country, which is known to contain copper, tin, and gold, but only the first named is at present being worked on a large scale, and practically the whole of it has been obtained from the richer ores of two mines, the Star of the Congo and the Kambove. The blast-furnace process of extraction has been employed since 1911. The central smelting plant is at Lubumbashi, near Elisabethville, and at present consists of five blast furnaces, of which four are in continuous operation. Two additional furnaces are in course of construction, and will be ready for use soon. The completed plant will have a daily capacity of 100 tons of copper. The output of the furnaces during the first nine months of 1917 was 19,766 metric tons, as compared with 21,273 tons in the calendar year 1916, and 13,483 tons in 1915. It is estimated that the output for the year 1918 will be 40,000 tons.

Enormous quantities of ore have been proved of a lower grade than is possible to treat economically by smelting; and, after exhaustive experiments, a plant is in course of preparation for the treatment of these ores by leaching and the electrical deposition of the copper. This plant is to have a yearly capacity of 50,000 tons of copper. The program of expansion and development up to the year 1921 provides for an expenditure of £3,000,000.

From 1911 until the outbreak of war, the whole of the company's output was sold to Germany. Since the beginning of hostilities it has been sent to the United Kingdom. The company employs 450 Europeans and 7000 natives. The scarcity of labor during 1917 was serious.

Furnace Plants Using Pulverized Fuel

The following names of companies are given by F. P. Coffin in the May, 1918, issue of the *General Electric Review*, and are found among an extensive list of users of pulverized coal in various industries:

ORE ROASTING AND NODULIZING

Algoma Steel Corporation, Sault Ste. Marie, Ont.
Bethlehem Steel Co., Lebanon, Penn.
Carolina Ore Co., Winston-Salem, N. C.
Central Iron and Coal Co., Hold, Ala.
Charleston Ore Co., Charleston, S. C.
Eastern Nodulizing Works, Newark, N. J
General Chemical Co.
International Nickel Co., Copper Cliff, C
Lackawanna Steel Co., Buffalo, N. Y.
Mississippi Valley Iron Co., Waukon, Iowa.
Northern Iron Works, Standish, N. Y.
Pennsylvania Salt Manufacturing Co., Natrona, Penn.
Pennsylvania Salt Manufacturing Co., Philadelphia, Penn.
Princess Furnace Co., Glen Wilton, Va.
Spanish-American Iron Co., Cuba.
Virginia Coal and Coke Co., Middleboro, Ky.

COPPER ORE ROASTING AND SMELTING

American Smelting and Refining Co., Garfield, Utah.
American Smelting and Refining Co., Hayden, Ariz. (*a*)
American Smelting and Refining Co., Maurer, N. J.
American Smelting and Refining Co., Tacoma, Wash. (*a*)
American Smelting and Refining Co., Mexico.
Anaconda Copper Mining Co., Anaconda, Mont.
Anaconda Copper Mining Co., Great Falls, Mont.
Braden Copper Co., Valparaiso, Chile.
Canadian Copper Co., Copper Cliff, Ont.
Furukawa Mining Co., Tokio, Japan. (*a*)
Lake Superior Smelting Co., Dollar Bay, Mich.
Nevada Cons. Copper Co., McGill, Nev.
River Smelting and Refining Co., Florence, Colo.
United Verde Copper Co., Clarkdale, Ariz. (*a*)
United Verde Extension Mining Co., Jerome, Aliz.

ZINC INDUSTRY

Bartlesville Zinc Co., Collinsville, Okla.
Edgar Zinc Co., Cherryvale, Kan.
River Smelting and Refining Co., Florence, Colo.
Société des Mines du Djebel, Ressas, Tunis, North Africa.

(*a*) Under construction.

Antimony in Oklahoma County, Washington

BY OLAF P. JENKINS*

Antimony has actually been mined at two places in Okanogan County, in north central Washington. One of these is seven miles north and a little west of Tonasket, and is known as the Lucky Knock mine. The other is situated on Gold Creek, not far from Methow, in the southwest part of the county. Here several deposits are situated in the same neighborhood. Chief among the claims on these deposits are the Dixie Queen and the Minnie, which have previously been mined and the product converted, in part, into white oxide before shipment.

At the Lucky Knock mine, stibnite occurs in irregular pockety masses in limestones and calcareous shales. Some of the limestone beds are entirely white, others are bluish gray, and still others are black, more shaley, and with coal-like material between the layers. The deposit is a whole appears to lie along a locally disturbed, crushed and possibly faulted area. The stibnite evidently is a replacement in the limestone. Near the surface the sulphide is oxidized to a heavy, earthy rock. Several hundred feet of tunneling has been done, and the ore shipped, amounting to a carload or so, is said to have been used mostly for experimental purposes in connection with the manufacture of enamel in the bathtub industry, the work having been carried on by the Standard Sanitary Manufacturing Co., of Pittsburgh.

On Gold Creek, 25 miles by road from Pateros, the nearest railroad station, is a group of claims controlled largely by the Gold Creek Antimony Mines and Smelting Co. It is said that a thousand tons of ore was shipped during 1915 and 1916, and also several hundred tons of the oxide, which was made near the mine. The ore is mostly stibnite, occurring in metamorphic sedimentary formations, largely slaty shales, sandy shales and calcareous rocks. The orebodies are irregular, pockety or lenticular in form. In places, oxides of antimony occur near the surface. These are obviously of several varieties, and are yellow, red and white. They occur only as surface oxidized portions of the sulphide bodies.

On the whole, there are indications, in connection with work on the Washington State Geological Survey, that if a better knowledge of the nature of ore deposits in general had been applied, as well as better methods and management of mining, both properties might have been put on a commercial basis. This is especially probable now that the Government desires to encourage the domestic production of antimony ores.

*Assistant professor of economic geology, State College of Washington, Pullman, Washington.

Plan To Conserve Sulphur

In recent years several processes to treat phosphate rock by calcining to make it suitable for fertilizer have been under development and test. The first of these, the Newberry-Fishburne process, was tried out on a commercial scale some years ago, and later tests have been made of a similar process developed by W. F. Downs, an industrial chemist, of New York. By the calcining process, the use of sulphuric acid is entirely avoided and a product of greater phosphoric-acid content per ton is secured. It is claimed that this product, though not so "available," to use the trade term, as the acid-phosphate product, will, however, yield its phosphoric content to the plant in a suitable form and with sufficient promptness to conform to good agricultural practice.

In the present stress for sulphur for sulphuric-acid purposes, the use of these processes is being considered by the authorities, to save the large amount of acid now regularly used in the fertilizer business in the treatment of phosphate rock.

Correspondence and Discussion

Taxing the Mining Industry

An article appeared in your issue of Apr. 6, 1918, reviewing that feature of the Federal Income Tax Law which is applicable to the mining industry by a committee appointed for the purpose by the American Institute of Mining Engineers, and I think it can safely be said that the report of this committee was an unqualified endorsement of the measure as it now stands.

How this conclusion was reached, in view of the fact that the provisions of the act are confiscatory in the highest degree, it is difficult to comprehend. Perhaps it was thought that any attempt to remodel it might lead to more serious consequences, but if such were the case, the committee surely overlooked the fact that unless it is remodeled, and remodeled promptly, a further decline in the output of gold and silver is inevitable.

The following interpretation of this freak measure is by a consulting engineer of the Bureau of Mines, at Washington, and appeared in a later issue of the *Journal:*

> When the net revenue obtained is between 7 and 9%, there is no tax to be paid. If above 10%, it progressively mounts until a rate of 60% of all net returns can be imposed.
>
> To illustrate: Let us assume an investment of $1,000,000 and a net income of $1,000,000 in sight in the mine. If taken out in one year, the company would have to pay the Government $479,400; if taken out in five years the rate would be 20% per annum, or a total tax of $119,500; if taken out in 10 years the rate is 10% per annum, or a total tax of $14,000.

It seems almost unbelievable that a committee representing an organization composed exclusively of mining engineers could have lent its endorsement to such an unjust measure, had any logical process of reasoning been pursued. The same also may be said of the gentlemen who framed this measure and who seem to have had but one thought in mind—the raising of revenue—which they went at with a vengeance, taking a shot at everything in sight, assets as well as profits.

Under the Constitution and laws, the method of acquiring a Government title to mineral land is similar in all respects to the law governing the patenting of a homestead. Both patents convey title to real property, and the same rules and regulations governing matters of taxation must be strictly adhered to. An orebody is an asset that when worked out cannot be replaced, and any form of taxation that demands a division of the assets, instead of a percentage of the profits such assets yield, is unsound in theory as well as practice. Nevertheless, Congress seems to think it is justified in classing dividends paid by mining corporations on a par with those paid by commercial and manufacturing enterprises, and does not seem to grasp the fact that orebodies represent real instead of personal property, and that so-called dividends paid by mining corporations are in reality a distribution of corporate assets to the stockholders, though dividends paid by commercial and manufacturing corporations represent profits.

For Congress to assume, as an illustration, that the owner of a mine, with ore valued at $100,000 in sight and favorable prospects of further discoveries, will hasten to remove this ore and recover the values under a system of taxation that would allow him at the most but 40% of the value of his net assets, is to misjudge human nature. Neither will any democratic form of government think of asking him to do so, any more than it would think of asking the farmer to convert his farm into cash and apply the proceeds in a like manner. Such a procedure means confiscation. Nevertheless, Congress, in its infinite wisdom, has passed such a law, and the American Institute of Mining Engineers has virtually approved it. That its enforcement will not provide the revenue anticipated is a certainty. That it will greatly hamper the industry and retard output is also a certainty.

With the world's total gold reserve only 10½ billions of dollars and a war debt climbing up toward the two-hundred-billion mark, it would seem that the paramount question confronting the belligerent nations and threatening the financial structure of the whole world is how to increase materially the output of the money metals—gold and silver—which has shown a steady decline for the last four years.

No one familiar with the mining situation and the maximum annual output of gold for the last decade will undertake to prove that the output can be materially increased under the most favorable circumstances. Neither will an attempt be made to prove that the available gold reserve of the belligerents (except that of the United States, which is approximately one-third of the grand total) is adequate to meet the present and constantly increasing credit demands made upon it.

What, then, is to be done to meet this extraordinary situation? Gold has long ago disappeared from circulation and silver never shows itself in denominations larger than a fifty-cent piece.

"Bryanize" silver and you solve the problem. It is presumed, however, that this suggestion is just as distasteful to the "Gold Bugs" of Threadneedle Street now as it was 20 years ago, but with all due deference to the gold monopoly that these benevolent old gentlemen have enjoyed for so many years, one should not lose sight of the fact that your Uncle Samuel is now the man behind the pie counter. Your Uncle Samuel can also produce the silver, and produce it in sufficient quantities to meet the existing unprecedented demand, if Congress will just forget about taking the lion's share of the output for war purposes.

When silver went to $1.08½ a few months ago, the "Gold Bugs" of Wall Street found ways and means, through Congress, of forcing the price down to $1, and they have so far succeeded in keeping it from rising above that figure. If Uncle Sam wants more silver—

and we think he does—he would better make up his mind to pay a price at least equivalent to its coinage value ($1.29), to make sure of getting it.

It would seem that the "Gold Bugs" have had their day, but it has taken a world war to bring that fact home to them. F. H. ALLEN.

New York, July 23, 1918.

Grinding of Ore in Ball Mills

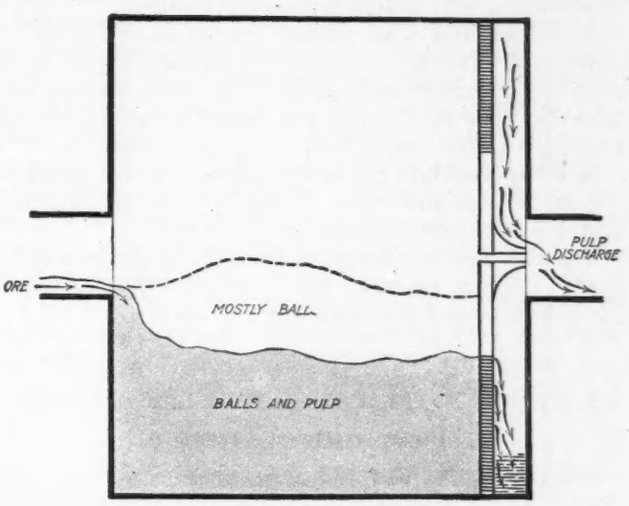
The continued discussion of the principles of the grate type, or quick discharge, ball mill, as compared to the central discharge, or, preferably termed, trunnion overflow ball mill, has progressed to some extent without apparently arriving anywhere. In all fairness to each type of mill, let it be said that there is a field for both. The particular case is up to the judgment of the engineer or engineers in charge. However, owing to the plainly biased opinion of the writer of the article appearing in the *Journal* for July 6,[1] I am of the opinion that a few general remarks would be of considerable assistance to those interested.

In judging reports that come by hearsay from various mining camps it must be remembered that in many instances the operators of the grate-discharge type of mill do not learn to operate such a mill at once. This is not always true, of course; nevertheless so many instances have come to my attention that it is suggested that a careful consideration of bad reports coming from such an installation should be made before they are taken as fact. Within the last week the general manager of a Colorado company operating a Marcy ball mill remarked to me that for about four months they had been disappointed with the operation of their mill, but that in an exceedingly abrupt manner the operation changed and they obtained almost double the tonnage through their ball mill that they were formerly getting. It was simply a case of the operators learning how to handle the mill.

One correction must be made regarding the diagram of the grate-discharge mill submitted with the article above mentioned. The cut accompanying this article shows the correct position of the pulp level in the mill. The level indicated is, of course, approximate, because the depth of the pulp depends upon how heavily the ore is fed into the mill. The point to be emphasized is that the pulp level is approximately horizontal in position and does not taper down to a thin edge at the grates, as one might be led to believe. If such were the case the fundamental principle of this grate-discharge mill would be inactive. By "fundamental principle" I mean to say that the operation of the mill, especially when reducing ores to a fine mesh, depends largely upon there being a difference between the level of the pulp within the mill and the level in space on the opposite side of the grates. This difference in level causes the pulp within the mill to flow by gravity and to be squeezed by its own weight, and the weight and action of the balls, through the grates and into the space between the grates and the head of the mill. From this position it is lifted and allowed to slide down the lifting blades, as they become perpendicular, and so passes out through the trunnion.

[1]"Grinding of Ore in Ball Mills," by Algernon Del Mar.

To judge from the screen analyses submitted in the article referred to, the operator of the grate-discharge type of mill was not operating it in an efficient manner. There is no reason that the discharge should have such a percentage of oversize in it if the operator were familiar with the principle and operation of the mill. Proper regulation of pulp density and other simple adjustments would improve results greatly, I believe. It would be interesting to know what the ratio of ore to water was in each test. A screen analysis of the discharge of a ball mill means nothing for comparative purposes unless the necessary data, such as the ratio of water to ore, are given.



GRATE-TYPE BALL MILL

Examination of grate-discharge mills stopped in operation has shown without exception (as far as my knowledge goes) that the pulp level is practically horizontal in position. Furthermore, these examinations also have shown that the liners are not worn in an uneven manner. I have seen a number of sets of liners that have been removed from such mills, and have also viewed photographic evidence that, without exception, showed the wear to be in an even manner from feed to discharge end of each liner section. The only exception to this even wearing is found in the natural tendency for the liners to wear more rapidly around the bolt holes.

Though it is possible that one may deduce that my preference lies in the grate-discharge type of ball mill, in all fairness to the other types it must be said now and will become generally admitted before long that there is no one "cure-all" for the crushing and grinding of ores. DONALD H. FAIRCHILD.

Denver, Colo., June 10, 1918.

[It is difficult to understand the designation of "quick discharge" when given to a mill where a grating permits the passage of pulp only when it is "squeezed" through the apertures "by its own weight and by the weight and action of the balls," as compared with the free displacement discharge in an ordinary mill.

The "exceedingly abrupt manner" in which improved results were obtained after four months of disappointing operation would suggest an opportunity for a fuller explanation of the cause of the trouble than that given by our correspondent in rebuttal of Mr. Del Mar's conclusions.—EDITOR.]

Events and Economics of the War

Allied troops have forced a passage of the Vesle, between Braisne and Fismes, and, later, made extensive advances on the Somme front, taking many prisoners and gaining much booty. The new positions have been consolidated and counter-offensives repulsed.

American and other Allied forces have landed at Archangel. Ostracism of the Soviet government, if it persists in supporting Germany, is threatened by the Entente. The Bolsheviki have caused arrest of British and French diplomats. Britain has retaliated.

Another hospital ship was torpedoed. Lloyd George's threat of economic fight irritates Germans, whereas Lansdowne's sentimentalism is welcomed.

The first ship was launched from the Hog Island shipyard, statistics showing the month's output from all yards to exceed that of any previous year.

Copper Producers and Price-Fixing Committee Agree

The text of the War Industries Board's statement in regard to the new agreement concerning the price of copper is as follows:

The President has approved an agreement, made between the producers of copper and the price-fixing committee of the War Industries Board (after investigation by this committee in conjunction with the Federal Trade Commission as to cost of production), that the maximum price of copper shall be 26c. per lb., taking effect Aug. 15, 1918, for shipments after that date, but subject to revision after Nov. 1, 1918, f.o.b. cars or lighters at Eastern refineries, f.o.b. cars or lighters at Pacific Coast refineries for Pacific Coast destinations, and f.o.b. cars or lighters New York, if shipped to Eastern or interior destinations from Pacific Coast refineries and from refineries in the interior of the United States. All shipments made after Nov. 1, 1918, are subject to any change in price made by the price-fixing committee, to take effect after that date. This maximum price is subject to the additional charges on copper shapes approved by the price-fixing committee on June 5, 1918.

The conditions are, (1), that the producers of copper will not reduce the wages now being paid; (2), that they will sell to the U. S. Government, to the public in the United States, and to the Allied governments at not above the maximum price; (3), that they will take the necessary measures, under the direction of the War Industries Board, in the distribution of copper to prevent it from falling into the hands of speculators who might increase the price to the public; and, (4), that they will pledge themselves to exert every effort necessary to keep up the production of copper so as to insure an adequate supply so long as the war lasts.

Control of Sulphur-Bearing Materials

The committee on production, distribution, and control of sulphur-bearing materials has been holding meetings each week in Washington, completing plans for taking over the distribution of all pyrites and brimstone shipments on Aug. 1. A questionnaire has been sent to all consumers of sulphur materials, asking for figures for the month of July, which, if not already forwarded, should be sent immediately, addressed to the committee, No. 15 William St., New York City.

The committee is working under the instructions of the War Industries Board, which requires figures covering all plants using brimstone and pyrites, and all uses, whether for acid or other products. Data have been submitted to the Railroad Administration and Shipping Board with regard to the tonnage required to be moved by rail and water, and the committee has been assured that everything will be done not only to make the necessary monthly deliveries, but that during the last five months of this year an attempt will be made to move sufficient additional tonnage to assure every consumer enough material to continue full operations should there be an interference with railroad transportation similar to that experienced last winter. The War Industries Board has also requested the committee to procure figures on pyrites cinders and the sintered and nodulized product, in the interest of iron and steel manufacture, for which purpose pyrites cinder is a valuable raw material. Questionnaires have been forwarded to sulphuric-acid manufacturers recently, and the committee requests that prompt replies should be sent, so that full and final report can be made to the War Industries Board at the earliest possible date.

Cinder should be carefully conserved and guarded against mixture or contamination with other material, especially phosphate rock, which would be unfitted for use as a low-phosphorus iron material if mixed with or contaminated by other substances. It is the hope of the committee that through the organization it is now developing it will be possible to provide sufficient sulphur materials to keep every sulphuric-acid plant in full operation.

New Bureau Handles Material From Canceled Orders

A new bureau has been established in the purchase and supply branch of the General Staff. It will have charge of what is to be known as the surplus inactive supply service, and its work will be carried on, through General Hugh S. Johnson, as a branch of the office of Major-General George W. Goethals, assistant chief of staff and director of purchases, storage, and traffic, by direction of the Secretary of War.

Much war department material and equipment becomes available for needs other than those originally intended, owing to changing conditions at the front in France or elsewhere.

The new bureau will have a current list of all surplus material which may be regarded as inactive. A copy of this will be kept in the current desk files of all the purchasing divisions of the War Department, where the new bureau will have representatives. The lists will be consulted to see what the War Department has on hand, before purchasing or the letting of new contracts. If a contractor turning out Government work is run-

ning short on his supply of certain material, he will be able to get in touch with the new bureau to find out whether it is on the list of so-called inactive supplies; or it will be ascertained for him if there is a likelihood of the material becoming available.

When material or equipment is found which is not wanted by any branch of the War Department, the case is taken up with the War Industries Board, and advice is sought as to where it can be used to the best advantage in war or other essential industry. Steps are then taken so that the particular branch of industry most affected may have the opportunity of purchasing under the system of competitive bids.

Questionnaires for the purpose of taking a census are now being sent out. Aside from the saving of hundreds of millions of dollars to the taxpayers and the Government, it is expected that the work of the new bureau will save a tremendous amount of time, labor, and material, more essential to the winning of the war than the mere money involved.

The Development of Domestic Potash Resources

In the manufacture of cement there is a loss of potash from the kilns, which is carried away in the form of flue dust. Plants are now being designed and erected to recover this as a byproduct. The Cottrell process is used for precipitating the dust with high-tension electrict current, and rotary vacuum filters are being found suitable for the separation of potash solution from valueless residue after the dust is pulped with water. With regard to the potentialities of potash production from this source, the Bureau of Soils has recently completed an investigation of the subject, and finds that from 0.35 to 5.34 lb. of potash per barrel of cement manufactured escapes from plants in the manner mentioned, or an average of 1.9 lb. Assuming an annual production of 90,000,000 bbl. of cement, it may be estimated that the amount of potash being lost (other than in the few instances where byproduct plants have been erected) amounts to about 86,000 tons annually. Experimental work and data from actual byproduct plant operation show that about 80% of this is recoverable by existing methods of treatment, so that an output of nearly 70,000 tons of potash would be possible in the United States from the cement industry alone. An additional advantage in the installation of a byproduct plant in this case would be the elimination of flue dust from the atmosphere in the neighborhood of the works.

Expansion of War Industries Increases Fuel Demands

The demand for fuel is growing by leaps and bounds. Estimates of the coal consumption for the year which were judged high in April are now proving inadequate. Despite the increase in the rate of production at the mines, the strictest fuel economy must be enforced if the country is to escape a serious coal shortage next winter. Every means of coal conservation must be observed; waste must be eliminated.

The increased demand for coal for the Navy reached almost 100% in July. By the end of the calendar year 1919 it is estimated that approximately 8,000,000 tons will be required to cover these demands.

With the launching of new ships, the requirements of the Shipping Board have grown beyond all expectation, and, as demonstrated by experience, the figure is now placed at 13,000,000 tons. Coal for bunkering purposes has grown in demand until present calculations call for 21,000,000 tons. Aside from the requirements from new or enlarged plants, many old plants are now demanding still more coal.

The source of supply for the new requirements is within a limited coal area. The extra demands call for coal from New River and Pocahontas low volatile fields of West Virginia; the low volatile fields of Pennsylvania and Maryland; and the high volatile fields of West Virginia, Pennsylvania and Kentucky. These fields produce the grades of coal especially needed for the war work. And it is from these same fields—with the exception of Kentucky—that the enormous calls of New England and the Atlantic States for coal for war use must be answered.

The U. S. Fuel Administration faces the difficulty of meeting greatly increased demands for coal, not from the nation's big coal pile, but from a much smaller pile, representing the output within a small area. The war necessities must be cared for by coal from these fields, and non-war industries will be given coal from them only after the war plants designated by the War Industries Board for Preferences are supplied.

Sulphuric Acid in Great Britain

The British Minister of Munitions orders that from June 1 the maximum prices for sulphuric acid specified below will be substituted for those specified in the schedule to the order dated May 29, 1917:

1. Weak acid; that is, acid of all strengths up to and including 90% H_2SO_4:

Class A.—Arsenical acid, maximum price per ton, 83s. ($19.70), for acid of 140° Twaddell at 60° F., with an increase or reduction of 6d. (12c.) in respect of each complete degree Twaddell by which the specific gravity is more or less than 140° Twaddell at 60° Fahrenheit.

Class B.—Non-arsenical or de-arsenicated acid, maximum price per ton, 98s. ($23.27), for acid of 140° Twaddell at 60° F., with an increase or reduction of 7d. (14c.) in respect of each complete degree Twaddell by which the specific gravity is more or less than 140° Twaddell at 60° Fahrenheit.

2. Concentrated acid; that is, acid of all strengths over 90% H_2SO_4:

Monohydrate (H_2SO_4) Content of Acid, Per Cent.	Maximum Price Per Ton — Class C. Arsenical Acid	U. S. Currency	Class D. De-arsenicated or Non-arsenical Acid	U. S. Currency
	£ s. d.		£ s. d.	
90 to 91	5 9 0	$25.90	5 19 0	$28.25
91 to 92	5 15 0	27.30	6 5 0	29.70
92 to 93	6 1 0	28.75	6 11 0	31.10
92 to 93½	6 7 0	30.15	6 17 0	32.55
93½ to 94	6 10 0	30.90	7 0 0	33.25
94 to 94½	6 13 0	31.60	7 3 0	33.95
94½ to 95	6 16 0	32.30	7 6 0	34.70
95 to 95½	7 1 0	33.50	7 11 0	35.85
95½ to 96	7 6 0	34.70	7 16 0	37.05

Over 95% in both classes, an addition of 1s. (24c.) per ton, for each complete one-tenth of 1% of additional monohydrate.

Gasoline Conservation Chief Appointed

W. Champlin Robinson, director of the Bureau of Oil Conservation of the U. S. Fuel Administration, announces the appointment of C. C. Winningham, of Detroit, as chief of the gasoline section and director of publicity of the oil division. Under the Mr. Winningham's direction will fall the work of eliminating the waste of gasoline by distributors and users, the use and conservation of lubricating oils, and the inauguration of methods for the reclamation of used oils.

The oil division, by education and publicity, is seeking to avoid the necessity for enacting drastic rules which would result in the regulation of sale of these essential products.

The demands of the war call for a tremendous increase in the supply of gasoline, kerosene, and lubricating oils, which can be met, it is believed, if the public will only eliminate the waste now existing. If this is done, it is hoped there will be sufficient gasoline and lubricating oil to meet war needs without interfering with the operation of passenger cars at home. But failure on the part of those who have anything to do with the production, handling, and use of oil products will necessitate drastic regulation, that would probably mean gasolineless days and insure other methods of conservation.

President Issues Warning and Appeal To Coal Miners

The seriousness of the coal situation has been gaged by President Wilson, who states, in a proclamation recently issued, that the threatened shortage of coal would constitute the greatest obstacle to the winning of the war. Operators are called upon to insure high efficiency by every means in their power; miners are urged to work steadily and faithfully, unless prevented by unavoidable causes. Essential laborers in the industry will be given deferred classification in the draft; and the community must hold them patriotic in accepting this decision. Complete and harmonious coöperation between all engaged in the industry, and unflagging effort, will alone secure the desired results and achieve the gratitude of the nation.

Furnace Slag Used Largely as Fertilizer

The economic uses of blast-furnace slag have been greatly developed the last few years, states the *New York Times* in outlining the recent researches of William H. Ross, of the Department of Agriculture. Formerly this was an incumbrance, and its disposal was often a matter of considerable expense. Of much more value as fertilizer is the slag obtained in the preparation of steel from high-phosphorus pig iron. To remove the excess of phosphorus, the iron is melted in converters lined with limestone, and quicklime is added. At a certain stage air is driven through the molten material, which leads to an accumulation in the slag of the phosphorus originally present in the metal. This slag is drawn off and cooled, and when finely ground is placed on the market under the trade name of basic slag. The phosphoric acid in the slag prepared in this way varies from 11 to 23 per cent.

For a time the fertilizing value of the slag was not recognized, but it has now become one of the most popular of commercial fertilizers. In fact, on account of its freedom from acidity, many prefer it to any other phosphatic material. The slag produced for the fertilizer trade amounts to about 2,000,000 tons annually.

Portuguese Fix Price of Wolfram

The following prices have been fixed, according to the *Iron and Coal Trades Review*, by the Portuguese government for the sale of various grades of wolfram ore under the terms of the decree of Mar. 14, which reserves to the government the sole right of purchase and export of all minerals employed in war industries: 50% tungstic-acid content, 95 fr. per unit of tungstic acid; 51%, 98 fr.; 52%, 101 fr.; 53%, 104 fr.; 54%, 107 fr.; 55%, 110 fr.; 56%, 112 fr.; 57%, 114 fr.; 58%, 116 fr.; 59%, 118 fr.; 60%, 120 fr.; 61%, 122 fr.; 62%, 124 fr.; 63%, 126 fr.; 64%, 128 fr.; 65%, 130 fr.; 66%, 132 fr.; 67%, 134 fr.; 68%, 136 fr.; 69%, 138 fr.; 70%, 140 fr.; 71%, 143 + 10 fr.; 72%, 146 + 10 francs.

Britain To Ration Coal Supply

The German advance in France this year has cut off or otherwise disorganized the French coal supply to the extent of 8,000,000 tons per annum. Nearly half a million British miners have been drafted into military service. These two facts are causing concern, and Great Britain must make up France's deficit of coal while hampered by a severe shortage of miners. Economy in coal consumption will be imperatively necessary in England, and a system of rationing to householders and other consumers is predicted.

Conditions Governing Entry of Mexican Labor Into the United States

With regard to the revocation of parts of the immigration act, for the duration of the war, to permit Mexican laborers to enter the United States and relieve the labor shortage in the south, the following sections are to be inoperative; illiteracy, contract labor, and head-tax clauses.

Mexicans admitted are compelled to open a postal savings account at the place or port of entry. Twenty-five cents is to be withheld weekly from each Mexican's wages by the employer, and this sum is to be deposited in a savings bank, from which it may withdrawn, with accumulated interest, when he leaves the country.

The need for ships in Australia has stimulated the demand for locally manufactured materials. Steel plates are now being produced at the Broken Hill Proprietary Co.'s plant at Newcastle, N. S. W., and an initial output of 200 tons in the first month of operation is reported. Although minor modifications may be found necessary before maximum output is attained, the results so far show that the construction of ships in Australia, entirely from Australian materials and products, is now possible. The iron ore used is shipped from Spencers Gulf, South Australia.

Industrial News from Washington

By Paul Wooton, Special Correspondent

National War Labor Board Makes Important Decisions

Awards by the National War Labor Board in the controversies which had arisen at the Herculaneum smeltery of the St. Joseph Lead Co., and at the mines and furnaces of the Sloss-Sheffield Steel and Iron Co. at Russellville, Ala., are of more than usual significance, as they indicate a policy which doubtless will be followed in other decisions. In the case of the St. Joseph Lead Co., the award grants the workers a general increase in wages, establishes a minimum wage, and provides a system of collective bargaining between employer and employees. The award is made retroactive to Apr. 21, the date on which, at the suggestion of the striking employees, the two parties jointly submitted their dispute to the jurisdiction of the board. The board's synopsis of its decision reads as follows:

The arbitrators found the increase in wages to be necessary in order to maintain, in full health and efficiency, the workers in this primary war industry, which produces one-ninth of all the lead mined in this country. The product goes chiefly into bullets and shrapnel. It was found that the workers, who are peculiarly subjected to the danger of lead poisoning, had suffered an alarming number of workless days through sickness, and were often supported during such periods from the funds of their labor union, since their wages were frequently too low to make possible any savings. For the same reason, many workers were obliged to default in their Liberty Loan payments. The efficiency of the plant had likewise suffered from an enormous labor turnover, sometimes as high as 200% per annum, due partly to the low rate of wages.

The arbitrators granted the wage increase on a sliding scale, in harmony with the principle recently applied by the Railroad Wage Commission, giving to the $3-a-day men a flat raise of $1, or 33⅓%, and graduating the rate of increase down to 10%, or 50c. a day, for those earning $5. For those earning more than $5 a day the increase was merely nominal. In thus favoring the least skilled workers, and in establishing a minimum wage of $4 a day, the arbitrators were guided by the board's principle that "minimum rates of pay shall be established which will insure the subsistence of the worker and his family in health and reasonable comfort." As in all other awards made by the board, it is here provided that these rates of pay may be readjusted at intervals of six months, in conformity with the change in the cost of living.

The arbitrators also granted 50% additional pay for the first two hours worked in excess of eight hours a day, and double pay for additional hours, as well as for Sundays and holidays. The plant during the war has been working on a seven-day basis. The arbitrators refused the request of the employees that their union be recognized and dealt with as such during the war, but provided for the election of committees of the men to facilitate collective bargaining. The board thereby maintains the pre-war status of the plant in relation to unionism, while protecting the workers in their efforts to adjust complaints without undue friction, through chosen representatives. The right of the men to membership in their union is affirmed. The administration of this award will be placed in the hands of a representative of the board, whose decision will in every case be binding, pending appeal.

In the case of the Sloss-Sheffield dispute, the award grants wage increases to all classes of workers; upholds the right of the workers to organize and bargain collectively; condemns the so-called "permit system" by which, it was alleged, companies in the district agreed with each other not to hire a man until he could produce a permit from the company which last employed him; directs the discontinuance of the company's practice of exacting 20% discount for cashing advance pay checks for employees; provides for payment for overtime work; establishes a system of wage readjustments at six-month periods on basis of changing living conditions in the community, and directs the appointment of an examiner to supervise the fulfilling of the award.

A statement issued by the board setting forth the principal features of the award is as follows:

A hearing in St. Louis developed the following to be the demands of the workers: That the prevailing scale of wages, varying from $1.85 to $4.25 a day, with the bulk of the employees receiving from $2 to $3 for a 10-hour day, be increased by $2 a day for all employees in the mines; that the 8-hour day be applied, with time and a half for all overtime; that the company consent to the establishment of a system of collective bargaining; that the payment of insurance, for which, it was charged, deductions were made from the worker's pay, be made optional with the workers; that the permit system be abolished; that orders for money due be paid at face value, with no discount; that the company be prohibited from discriminating against union employees. The testimony also developed that the company operates a store from which the workers purchase virtually all of the necessities of life, and that many of the workers receive less than a dollar in their pay envelopes every two weeks by reason of the deductions for these necessities and other charges made upon them. These other charges include $1 per month for the service of a physician employed by the company; 50c. per month for the maintenance of a school; and $1.25 a month for insurance. A collection of bi-weekly pay checks, some calling for as little as 15c., was presented as evidence. Charges were made that the services of the physician were not obtainable when he was needed and that the workers frequently had to contribute to send a stricken fellow to Birmingham to a hospital.

The award established a wage schedule by which no worker shall receive less than $3.99 for a 10-hour day. The highest wage provided for in the award is $6.30 a day for lathe men in the machine shop. It places upon the company the responsibility to select a physician with care and to see to the proper administration of the school fund, and suggests that the establishment of a small hospital would not be unreasonable.

The Sheffield Iron Corporation and the Suwanee Iron Co., operating in the same district, after difficulties with their employees, asked that the award in the Sloss-Sheffield controversy be made applicable to the entire district, comprising the three companies, which has been done. The arbitrators in this case acted by agreement of the company and the employees, following a serious strike in May. The award as to wages is made retroactive to Apr. 17, 1918.

The next Liberty Loan, possibly for $6,000,000,000, will be open for subscription on Sept. 28, and the campaign will be continued for three weeks. Arrangements are under way to achieve even better results than in previous instances, and unprecedented efforts will be made to educate and convince a large proportion of the people. Interest payable to investors in the new loan will probably be 4¼%, but the actual rate is not considered likely to affect the success of the issue.

Imports and Exports of Metals and Ores

Imports of the more important minerals and metals during June, 1918, as reported to the Department of Commerce, with the figures for the corresponding month of 1917, as finally revised, are as follows:

METAL AND ORE IMPORTS, JUNE, 1917, AND JUNE, 1918

Metal and Ore:	June, 1917	June, 1918
Antimony ore, contents, lb	1,855,584	360,814
Antimony matte, regulus or metal, lb	2,815,235	1,951,044
Copper:		
Ore contents, lb	10,799,784	5,079,450
Concentrates, content, lb	3,666,734	4,195,525
Matte, regulus, etc., contents, lb	1,141,067	2,349,300
Imported from (in part):		
Canada, lb	3,315,921	2,650,674
Mexico, lb	3,320,166	5,415,753
Cuba, lb	6,656,676	1,613,116
Chile, lb	961,974	1,629,185
Peru, lb	782,230	.....
Unrefined black, blister, etc., lb	44,779,479	13,801,332
Refined, in bars, plates, etc., lb	320,935	282,432
Old, etc., for remanufacture, lb	3,454,978	100,696
Composition metal, copper chief value, lb	15,548	19,640
Lead:		
Ore, contents, lb	4,019,973	2,302,941
Bullion, contents, lb	7,610,683	16,479,770
Imported from (in part):		
Canada, lb	214,630	1,252,460
Mexico, lb	8,738,159	17,050,868
Chile, lb	.....	479,383
Pigs, bars and old, lb	275,187	.....
Manganese ore, long tons	62,778	38,427
Imported from (in part):		
Cuba	5,842	1,817
Brazil	47,000	31,481
British India	7,450	4,550
Pyrites, long tons	63,133	31,172
Imported from:		
Spain	41,027	13,881
Canada	22,106	17,291
Zinc:		
Ore, contents, lb	15,135,827	4,053,254
Imported from:		
Canada, lb	520,000	1,142,422
Mexico, lb	8,387,181	2,910,832
Australia, lb	6,228,646	.....
Blocks or pigs, and old, lb	29,567	1,425
Zinc dust	145,600	.....

Exports of copper, lead and zinc for June, 1918, as reported to the Department of Commerce, with the figures for the corresponding month of 1917, as finally revised, are as follows:

EXPORTS OF COPPER, LEAD AND ZINC, JUNE, 1917, AND JUNE, 1918

Metal and Ore	June, 1917	June, 1918
Copper:		
Ore, contents, lb	573,357	109,335
Contentrates, contents, lb	14,000	129,428
Unrefined, black, blister, etc., lb	.....	1,069,737
Refined in ingots, bars, etc., lb	89,677,585	70,902,177
Exported to (in part):		
France, lb	28,558,059	31,929,488
Italy, lb	23,480,238	9,829,605
Russia in Europe, lb	4,892,127	.....
United Kingdom, lb	24,109,099	26,921,159
Canada, lb	6,636,859	1,550,962
Composition metal, copper chief value, lb	.....	24,299
Old and scrap, lb	36,054	73,805
Pipes and tubes, lb	.....	447,842
Plates and sheets, lb	700,920	303,592
Wire, except insulated, lb	1,957,903	1,758,328
Lead:		
Pigs, bars, etc., produced from domestic ore, lb	6,666,210	12,557,348
Produced from foreign ore, lb	8,035,416	5,473,282
Exported to (in part):		
Denmark, lb	234,475	.....
Italy, lb	227,970	1,299,200
Canada, lb	13,850,906	7,033,706
Argentina, lb	.....	307,199
Brazil, lb	.....	131,189
Zinc:		
Dross, lb	928,516	3,761,844
Spelter:		
Produced from domestic ore, lb	19,645,431	12,828,218
Produced from foreign ore, lb	4,486,104	833,925
Exported to (in part):		
France, lb	5,905,252	8,320,822
Italy, lb	4,150,885	1,706,189
United Kingdom, lb	12,178,566	2,267,296
Canada, lb	1,821,514	1,217,219
Zinc sheets, strips, etc., lb	4,971,352	1,919,789

Canada has been producing refined spelter and copper for some time, and recently there has been an increase in the output of refined lead. The manufacture of brass in the Dominion quickly followed the production of refined copper and spelter and opened up extensive avenues of new industry.

Mining Taxes in Mexico

Mexican export duties on metals were slightly modified by a decree of Apr. 26, 1918, which contains, according to *Commerce Reports*, a consolidation and reënactment, with certain changes, of other laws relating to mines. A stamp tax of 8% ad valorem is specified for exported gold or silver in the form of ore or mixed with substances other than metals, though gold and silver in bullion or mixed only with other metals are subject to a tax of 7% on the official values. The duties on copper are fixed at from 2½ to 5% of the value, depending on the form and copper content, but for lead, tungsten, molybdenum, manganese, graphite, and mercury the rate is 3%, as heretofore. Zinc, tin, antimony, and other metals or minerals not specifically provided for are subject to a duty of 1% ad valorem upon exportation. The monthly schedules of export duties on metals issued since the decree of Feb. 26 show slight decreases in the actual rates on lead, zinc, and antimony. In the case of silver, however, the new rates are approximately 66⅔% higher than those formerly in force.

The mint is directed to receive gold for coinage at a fixed price without limit; but as regards silver special permission must be secured from the Mexican Treasury Department, and the price to be paid will depend on the New York quotation for silver. A reduction is made in the "pertenencia" tax on the ownership of mining properties. Another provision of the same decree admits free of duty the following materials when imported for use in the treatment of ores: zinc and aluminum in ingots, filings, grains, or wire; sulphur, alkaline cyanides; hyposulphite of sodium; saltpeter, or nitrate of potassium or sodium; acetate of lead; and perforated sheets of zinc.

Errata—July 20 Issue

We have been asked to make the following corrections: "Notes on Recent Metallurgical Progress," page 143, line 2 of paragraph 3, instead of 70%, read 60%; page 143, line 9 of paragraph 3, read 8 lb. instead of 6 lb. "Practical Notes From the Anaconda Reduction Works," page 134, Fig. 3, the truck shown does not enter the furnace, but is used to transport the arms from the furnace. A special two-wheeled carriage receives them inside the furnace and delivers them to the truck illustrated, which stands outside.

In the article on "Blast Furnace Plant for Smelting Copper Ore," in line 6, page 122, the word "capacity" should be substituted for "production," and in line 8 from the bottom of the column the word "hardly" should be placed between "would" and "be." The last sentence of this paragraph would thus read: "A site for a reverberatory furnace is shown on the plan, as a 3000-ton blast-furnace plant without a furnace of this type attached would hardly be complete under present conditions."

July Mining Dividends Erratum

In the table of mining dividends published in the *Journal* of Aug. 3, the amount of the payment by the Butte Copper and Zinc Co. should have been entered as $300,000, instead of $205,850.

July Pig-Iron Production

Pig-iron production in July was 3,420,988 gross tons, as compared with 3,323,791 tons in June, according to *Iron Age*. The daily rate for July was 110,354 tons for a 31-day month, as against 110,793 tons daily in June, a 30-day month, or a decrease of 439 tons a day. Although the pig iron produced in the seven months of this year, amounting to 21,423,660 gross tons, is less than the 22,412,330 tons and 22,634,966 tons for the corresponding periods of 1917 and 1916, the daily rate of 110,354 tons exceeds the rates for July, 1917 and 1916, by 2534 tons and 6337 tons, respectively. A total of 51,762 gross tons of ferroalloys was produced, of which 29,996 tons was ferromanganese. Nineteen stacks were blown in and 11 blown out, a net gain of eight furnaces.

Examinations for Commissions in Engineers' Reserve Corps

Examinations of candidates for commissions in the Engineer Reserve Corps are being conducted by a board of officers now touring the country. Applicants must be engaged in the active practice of some branch of engineering, and be in good physical condition. Those accepted by the board will be given a course in military training at Camp Humphreys, near Washington, previous to their assignment to duty with engineer troops. The board has already held examinations in Buffalo, Detroit, Cincinnati, Louisville, Indianapolis, St. Louis and Kansas City. Other points to be visited are: St. Paul, Aug. 19 and 20; Denver, Aug. 22; Salt Lake City, Aug. 24; Butte, Mont., Aug. 27; Seattle, Wash., Aug. 29 and 30; Portland, Ore., Aug. 31; San Francisco, Sept. 2, 3 and 4; Los Angeles, Sept. 5, 6 and 7; Deming, N. M., Sept. 10 and Dallas, Tex., Sept. 13. The board will return to Washington on Sept. 16.

Lake Superior Iron-Ore Shipments Show Increase

Record ore shipments continue to be made from upper Lake ports. According to *Iron Trade Review*, July shipments totaled 10,659,203 tons, compared with 10,241,633 tons in July, 1917. This is breaking the record of July, 1917, by 417,570 tons. As last year's figures established a record never before attained on the Lakes, it is a record worth beating. Up to that time the fleet had never carried more than 10,000,000 tons in any one month. By Aug. 1, last year, 26,376,768 tons of ore had been brought down. This was a decrease of 2,988,956 tons as compared with the 1916 tonnage of 29,365,724. This year's figure shows an increase of 3,232,165 tons over the 1917 shipments and of 243,209 tons over the 1916 shipments.

The Relative Value of Terms

Maybe some of our readers are shy in contributing to the 27th Engineers' Comfort Fund because they have a mistaken idea as to what the fund does. "Comforts, forsooth! There are mighty few comforts about these days." This gives us a chance to explain.

Do you understand that what the boys over there consider comforts and luxuries are looked upon as bare necessities over here? Few of us realize how well we are off, because we don't have to go without. In France it is different, and the little that can be done through the agency of the Comfort Fund is small enough service to those brave fellows whose pluck and skill are making history—such history as makes you tingle all over to read about.

If we all do our best, the material result must be pitifully small in any case—in comparison—but the spirit of the thing is what counts. Send along what you can spare. You needn't wait until you are in a position to emulate the other fellow who sent us such a big check. We want your personal interest in the fund.

HOW THE COMFORT FUND STANDS

Previously acknowledged	$13,664.00
Students of Wisconsin Mining School	50.00
A. M. Plumb	5.00
C. W. Snow	2.50
Charles A. Mitke	5.00
A. A. Hassan	10.00
A. A. Hassan, Jr.	5.00
Emin A. Hassan	5.00
Bernard MacDonald	5.00
C. F. Rand	50.00
Calumet & Arizona Mining Co. and New Cornelia Copper Co.	400.00
Oscar Lachmund (fourth contribution)	10.00
C. N. Bell	10.00
C. S. Witherell	25.00
W. G. McBride	25.00
Karl Eilers	50.00
R. T. Hancock	5.00
E. E. White	100.00
S. Ringlund	10.00
H. Foster Bain	10.00
Marc Bailey	10.00
Charles Le Vasseur (second contribution)	10.00
William Wraith	25.00
H. A. Wheeler	10.00
Nevada Mine Operators' Association	100.00
Louis R. Wallace	50.00
H. P. Bowen	5.00
H. L. Brown and M. W. Hayward	16.00
Iron Cap Copper Co.	50.00
W. N. Smith	10.00
E. S. Geary	5.00
H. J. Wolf	10.00
F. H. Siebold	10.00
H. A. Kee	10.00
W. S. Grether	5.00
Marion J. Thomas	10.00
E. F. Eurich	10.00
Liberty Bell Gold Mining Co.	200.00
H. De Witt Smith	15.00
Associated Miners of the University of Idaho	10.00
New Idria Quicksilver Mining Co.	100.00
F. P. Burrall	25.00
Livingston Wernecke	5.00
E. P. Mathewson	50.00
Interest to June 26	82.61
H. W. Hixon	10.00
R. C. Canby	10.00
S. R. Guggenheim	100.00
Richard Tavis	5.00
Simon Guggenheim	100.00
J. V. Kelley	10.00
Algernon Del Mar	4.00
Sumner S. Smith	5.00
Will H. Coghill	10.00
Lincoln Crocker	10.00
C. E. Dewey	10.00
Plymouth Consolidated Gold Mines, Ltd.	100.00
United Eastern Mining Co.	50.00
W. A. Wilson	20.00
Oscar Lachmund (fifth contribution)	10.00
W. Rowland Cox	10.00
L. D. Huntoon	5.00
Alaska Mining and Engineering Society	50.00
W. R. Benedict	3.00
Etheredge Walker	25.00
Fritz Mella	10.00
Richard McCarthy	10.00
J. N. Houser	10.00
Weedon Mining Co.	50.00
Wm. H. Kinnon	30.00
A. P. O'Brien	10.00
Lester W. Strauss	10.00
Montana Society of Engineers	50.00
W. R. Atkeson	2.50
Charles Le Vasseur (third contribution)	5.00
Frank Carroll	10.00
Total	$16,024.61

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Owing to the large volume of work involved in administering the fund, contributions are acknowledged only by publication in the *Journal*.

Editorials

The Price for Copper

THE copper producers met the price-fixing committee of the War Industries Board last Wednesday and had a session that was entirely amicable. On the previous day there had been a conference with the "high-cost producers," at which the latter were informed that no discrimination in their favor would be made. At the general meeting on the following day, Mr. Brookings, the chairman, informed the producers that the Government had enough copper in sight, and therefore there was no reason why the price of 26c. should be advanced. If the opinion be correct, the reasoning is surely sound. With enough copper available at 26c., it would be absurd for the Government to offer any more.

The price-fixing committee is pretty cocky in its attitude, not only with regard to copper but also in the matter of lead, which, for the moment, is in an even more ominous situation. It recognizes that higher prices would bring out more copper and more lead, but its present logic appears to be that any additional production would come from high-cost producers, who would better not produce at all, for the reason that the men they would require ought rather to be occupied in some more profitable work. More copper and more lead may indeed be needed, but the answer is to discontinue non-essential work, so that not so much of the metals will be required. Indeed, with this view, a further curtailment of production may be regarded with complacency, and, in fact, the high-cost producers are told in substance that they would best give up the fight and shut down.

In our opinion, such an attitude is preposterous and dangerous. The fact that no producer of copper is willing to sell a pound of it for less than 26c. is in itself conclusive evidence that there is not copper enough. If there were copper enough, somebody would find that he had a little that he could not sell for 26c., he would offer it for less, and immediately the market price would be something below the restrictive maximum. The country has no reserve stock of copper, and yet we are told with smug complacence that there is copper enough. Mr. Brookings seems to us rather to be playing checkers with a gambler's spirit than to be considering that he is performing a part in fighting a life or death war.

The New Industrial Dispensation Must Be Made Labor Insurance

PASSAGE by Congress of the legislation demanded by the railroad brotherhoods, and embodied in the agreement of Mar. 19, 1917, marked the inauguration of a new and significant era in American industrial evolution. The recognition then tacitly accorded organized labor by the legislative branch of the Government has since been enlarged and extended by executive order, and the acute situation attributable to conditions created by the war has operated further to confirm the unionist movement in its insistence on full partnership in every field where it has won recognition.

Indeed, many leaders in the labor world, frankly subscribing to the obvious truth that labor, by no possible legerdemain, can take more out of an industry or business than the workers put into it, are nevertheless convinced that the large corporation or other business association or combination, no matter how erected or with what skill or acumen made to show return and render public or other service, is in essence merely a distributing agency for the product of labor, and this point of view is naturally most insistent in those industries wherein the work of men's hands and brawn and brain takes the tangible form necessarily assumed by those exceedingly tangible commodities through the instrumentality of which our country must expend such prodigious and sustained effort to "make the world safe for democracy."

It is patent that if development progress along the courses now indicated, and if further extensions of duality of control over industry are to continue and to be confirmed by general acceptation, the arrangement must be on a basis radically correcting past uncertainties, vexations and abuses. Since the United States took up the sword, there has been an epidemic of strikes and disturbances, and of threats of strikes, in essential industries—labor profiteering in no degree extenuated or rendered less patriotic by the sporadic individual or corporation grafting recorded daily in the press and apparently to be expected in every period of national peril by every nation in every age. And before the American people will accept organized labor at its own valuation, there must appear a reformation of the policy too often dominating its leaders.

The strike is a worn-out weapon, born of bitterness and a sense of outraged class distinction foreign to our genesis, and often, in truth, of the subconscious desire for leisure inherent in all animate creation. It is as antiquated, unjust and inequitable a method of adjudicating differences over wages or hours as is the fist fight or club fight in determining ownership of property —or wives. Executive decrees, counselling arbitration —ordering it when exigency indicates the need—in which, theoretically, the voice of the people speaks through their chief executive, point a course that must be followed if industrial peace, founded on justice, is to be a concomitant of that political and national peace for which the noblest blood of the race is now drenching the soil of France.

To some workers the words compulsory arbitration have an ugly sound. Why? Civilization is itself built on that foundation. The law of every civilized land compels the arbitration of every crime that discolors the human record. Were the existing labor status not a serious and present menace, the very suggestion that industrial disputes are in their nature not susceptible

of settlement by reasonable methods would be matter for derision and contempt.

It follows that if labor is to bargain and covenant collectively, its agreements must be something more than a German treaty—scraps of paper. Contracts must be honestly drawn, understood, confirmed and observed, in upright good faith, in spirit and in letter, if organized labor is to be accepted as competent to manage its affairs and disposed to do business as business ought to be done. Its agreements must constitute to society protection against strikes, an insurance against industrial disorders and a guaranty, likewise, of a fair day's work for the wage paid, assuring stability of industrial processes and freedom from mutual and community loss arising through childish pique over such trivial episodes as a change in shift boss, foreman or superintendent.

When those directing the destinies of organized labor in mine, shop and field can persuade the vast body of American workers that to live and work and prosper under the law, moral as well as statute, is more to be desired than to attempt to wax fat and prosperous outside and above the law, the people of America—and especially "Big Business"—may be expected, no doubt, willingly to adjust their industrial practice to the new industrial order.

The Comparative Efficiency Of Ball Mills

A CORRESPONDENT in this issue avers that the frequent expressions of opinion and the publication of much data as to the merits and weakness of different types of ball mills have led nowhere. From this view we respectfully beg to differ. Keen competition has led to the carrying out of exhaustive tests and the publication of useful and illuminating information. What our correspondent probably means is that the controversy, if such it may be called, remains at the *status quo ante bellum*, as far as any decisive general verdict is concerned. This reflects to the credit and ingenuity of those who have attacked the question from so many angles.

In such matters the personal equation is often overlooked, and this factor enters largely into the question of efficient operation of the equipment under discussion. The majority of operators who really believe in the mechanical or metallurgical efficiency of a machine will take abnormal pains to make it work satisfactorily. The inventor will make almost superhuman efforts to insure success; and, convinced of its infallibility from the beginning, will use every possible argument to see that the good features of design and construction are duly appreciated. Such arguments are made to appeal to the millman, especially if the machine is of a type that takes a feed and delivers a discharge without need for constant attention, causes little trouble, and, to use a popular phrase, "delivers the goods."

The ball mill has proved a welcome relief to operators whose experience has included the care of a stamp mill, or other even less popular crushing machine. To be in a condition to wager, with fair chances of success, that a mill will run for 24 hours without attention, is welcomed by the millman; it means a conservation of labor—a freedom to attend to minor details which, in the aggregate, help to maintain or improve the general efficiency of the plant. Many millmen make their preference for a type of ball mill at the outset, and remain loyal to the first machine of this class that they had any experience with, provided, of course, that it was not of defective design or construction. They remember the smooth-running operation, and the time that was left to adjust it to varying conditions, or to perfect normal results. When confronted with some modification in design in an alternative type of mill, they are loath to expend the same enthusiasm on its operation; they cannot see eye to eye with the inventor and similar enthusiasts; they already know, from actual experience, that the other mill did excellent work; and no student of human nature could expect them to transfer their allegiance from type to type, without strong reasons, and to modify their convictions accordingly.

A bias toward a particular class of mechanism is not to be deprecated—it is only natural. It breeds opposition or encouragement; it leads to criticism which often exhibits an unconscious bias of its own, but which, nevertheless, serves to encourage further research; and it engenders accuracy of statement. An engineer whose ideas are consistently neutral is inclined to present a flavorless view of any problem. Thanks to a healthy bias of opinion among millmen and metallurgists, there is an opportunity for frequent discussion of important points which often leads to the elucidation of problems and improvements in design and operation.

Conservation of Power Resources

ELIMINATION of waste must needs be the slogan of the day, and mine operators, in conjunction with other directors of industry, are placing their shoulders to the wheel in the supreme effort to convince the nation that conservation of every resource is a necessity. The present war situation has undoubtedly produced a speedier realization of this fact, but the trend of modern industrialism has for some time been in that direction. The two basic things necessary for the continuation of industry—power and labor—have been undergoing a period of education and experimentation, and the results of both have been to form a stronger working unit and one which has operated to the benefit of the nation.

In this issue we present two papers, one complementary to the other and each descriptive of a distinctly different operation, but both splendid examples of power conservation. In his article on "Hydro-Electric Development on Dead River," Mr. Wright describes the proposed utilization of water power which "for years has run to waste within a few miles of one of the world's most important iron districts." This is conservation of the right order—an efficient operation, carefully planned and one in which every opportunity was taken of the natural resources offered. In the generation of this power, which is used in mine operation, the complete elimination of the use of coal is effected.

In contrast to the hydro-electric development described, Mr. Collins, in his "Use of Pulverized Coal," suggests and expounds the complete and efficient utili-

zation of coal in the metallurgical field. The many advantages, i. e. fuel conservation, labor reduction, utilization of lower grades of coal, maintenance of constant temperature and ease of combustion acquired by fine-grinding, strongly commended this process wherever it may be applicable.

Both processes aim at and achieve fuel conservation, and both are laudable in their saving of power and labor.

The California All-Steel Dredge

THERE is a wide gulf between the D-handled shovel and the all-steel dredge illustrated in this issue. It represents a similar process of evolution to that of the American blast furnace, the steam shovel or the Hulett unloader, and it exemplifies how dependent the mechanical engineer is upon the peculiar requirements developed by operating conditions.

The first successful gold dredges were constructed in New Zealand and were used for dredging river beds. They were necessarily small, but were of good mechanical design.

The dredging of alluvial auriferous terraces on the sierran rivers of California was first done with small dredges, and the richer alluvial material was successfully worked. Operating engineers speedily discovered that large capacity, high operating efficiency, freedom from excessive wear and tear, greater range of work, both in depth and width of cut, were essential if low-grade deposits were to be worked. Larger and larger dredges were successively developed. Gravel from 12 to 15c. per cubic yard was profitably handled. The culmination of this development is seen in the massive dredge illustrated. It is an achievement in which mining and mechanical engineers should take special pride.

BY THE WAY

During the spring of '60 two mining companies were at war about their locations, and one company threatened the other with an injunction, wrote Dan De Quille in "The History of the Big Bonanza." There had been considerable talk among members of the threatened company about the impending injunction being put on their claim. Two green Irishmen, who heard of the matter, concluded that they would keep a bright lookout for the injunction, although they had no idea what it was like. This they did for several days, but saw nothing stuck up anywhere about their claim.

About this time, it happened that a party of surveyors, engaged in running out a road in that neighborhood, arrived at the disputed claim; and, leaving their theodolite standing on the line they were running, went into town to get dinner. Pat and Mike returned from their dinner before the surveyors got back; and, catching sight of the costly instrument, Mike cried:

"By the powers o' war, Pat, what divlish thing is that, standing there on its three legs?"

"It looks like some quare kind of patent invintion," said Pat, "wid all of its brass muzzles and stop-cocks. What would it be, anyhow?"

"Well, now," said Mike, "I wonder if it isn't the thaving injunction thim rascally divils over beyant have been swearin' they'd put upon the claim?"

"By the sivin churches, ye've said it!" yelled Pat. "Let's afther it!"

With this, one seized a pick, the other a crowbar; and, rushing upon the theodolite, they smashed it into a hundred pieces. Pat flung one leg of the instrument as far as he could send it, yelling: "To the divil wid all injunctions!" Mike sent another down the hill, shouting: "Bring out yer injunctions, we're the lads that can knock the stuffin' out of the best and biggest of thim!"

Just as the pair had succeeded in "busting up the injunction," the party of surveyors returned. The interview between them and the two Irishmen was short; but, as Pat afterward acknowledged; it was "mighty improvin'."

Government Needs Draftsmen

The United States Civil Service Commission announces vacancies in large numbers of drafting positions. The filling of these situations is urgently necessary, as they have a direct connection with the war organization. Applicants will not be required to report at any place for examination, the ratings being based upon the applicant's education, training, experience and general qualifications, as shown by the application and corroborative evidence.

Following is a list of the drafting positions now open in the civil service, and the entrance salaries paid:

Title	Sex	Usual Yearly or Daily Entrance Salary
WAR DEPARTMENT		
Construction Division:		
Architect	M	$2500–$3500
Structural designer	M	2400– 2700
Architectural designer	M	2100– 2700
Senior architectural draftsman	M	1800– 2100
Junior architectural draftsman	M	1200– 1800
Architectural tracer	M	1000– 1200
Quartermaster Corps and Ordnance Department:		
Automobile engineer	M	2400– 7200
Automobile engineer	M	1800– 3000
Automobile draftsman	M	1400– 2000
Automobile tracer	M	1000– 1400
Signal Service:		
Aëronautical mechanical draftsman	M	1200– 1400
Ordnance Department:		
Mechanical draftsman	M&F	800– 1800
Gage designer	M	2000– 3000
Automobile draftsman	M	800– 1800
Apprentice draftsman	M	480
NAVY DEPARTMENT		
Ship draftsman	M&F	4.00– 6.88
Architectural, mechanical and structural-steel draftsman (for shipwork)	M&F	4.00– 6.88
Topographic and subsurface draftsman	M	4.48– 5.04
Radio draftsman	M&F	3.52– 6.00
Copyist draftsman	M&F	2.00– 3.44
Bureau of Yards and Docks:		
Mechanical draftsman, armor and steel plant	M	4.00– 8.00
Engineering draftsman	M&F	3.04– 7.04
Bureau of Ordnance:		
Mechanical draftsman	M&F	4.00– 7.84
Bureau of Construction and Repair:		
Metal furniture draftsman	M	4.00– 6.00
Aëronautic draftsman	M	4.00– 5.04
Bureau of Steam Engineering:		
Electrical draftsman	M&F	4.00– 6.40
Marine engine and boiler draftsman	M&F	3.28– 7.04
INTERIOR DEPARTMENT		
Geological Survey:		
Copyist topographic draftsman	M&F	1100– 2000
DEPARTMENT OF COMMERCE		
Coast and Geodetic Survey:		
Hydrographic and topographic draftsman	M	1000– 1200
Apprentice draftsman	M	(a) $60

(a) Per month.

Full information and application blanks may be obtained by communicating with the U. S. Civil Service Commission, Washington, D. C., or with the secretary of the board of civil service examiners at Boston, New York, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, St. Louis, New Orleans, Seattle or San Francisco.

NEW PUBLICATIONS

Hydraulic and Placer Mining. By Eugene B. Wilson, pp. 425; 5 x 7¼; illus.; third edition, $3. John Wiley & Sons, New York.

A well-known book that has served the practical miner by bringing the more important practical details of placer mining to his attention.

Analyses of Mine and Car Samples of Coal Collected in the Fiscal Years 1913 to 1916. By Arno C. Fieldner, Howard I. Smith, J. W. Paul and Samuel Sanford. Pp. 478; Bull. 123, U. S. Bureau of Mines, Washington, D. C.

Mineral Enterprise in China. By William F. Collins. Pp. 308; 5¼ x 8½; maps; 21s. William Heinemann, London, England.

The author of this interesting contribution to the literature of the art deals at length with the vicissitudes which have attended all attempts to extend or improve mining in China. The chronology of the industry carries the reader back to 2852 B. C., when metals were probably first used for currency, through mediæval times when non-metallic media of exchange were adopted at intervals, to the Eighteenth Century, when mining was allowed "only when found not to interfere with the farms and graveyards of the people." The opposition to the systematic development of mineral wealth, inexplicable to the more practical ideas of other nationalities, is attributed by the author largely to the amazing hold on the Chinese mind of superstitious "sciences," the tenets of which seem capable of being twisted to suit every eccentric point of view.

A detailed history of the efforts made by the United States, Great Britain and France in recent times to promote trade and, incidentally, to foster and develop the mining industry, provides interesting sidelights on the efforts of Li Hung-chang, and the official Chinese attitude toward the "barbarians." Sandwiched in among other historical facts we read of H. C. Hoover's connection with Chinese mining from 1899 to 1901.

The author deals at length with Chinese mining legislation, and avers that it is diametrically opposed to the policies of progressive nations. Titles are said to be uncertain and liable to forfeiture for flimsy reasons. Taxation is dependent on quibbling interpretations of Chinese terms and the precise meaning of statutes, all of which are apparently liable to periodic modification. Government control of mines, as suggested in official Chinese quarters, is viewed as an economic impossibility.

Equivalent weights and measures of Chinese and other systems are given in the appendix. The volume is one which will prove invaluable as a reference book on Chinese mining history, from the earliest time to the present day; and it will provide interesting reading on the subject of the psychological viewpoint of the Chinese mind toward modern ideas and progress.

Mining Operations for Gold, Coal, etc., in the Province of British Columbia for the Year Ended Dec. 31, 1917. Pp. 485; illus. Minister of Mines, British Columbia, Canada.

An excellent review in detail of the mining industry of an important mining area. British Columbia is a metal- and coal-producing province. The gross value of its mineral production in 1917 was $37,010,392, and the gross value of the metallic minerals recovered in 1917 was $27,284,474. Statistical tables and charts, together with descriptions of mines and mining districts, are given in sufficient number thoroughly to cover the field. The descriptions of the Granby Smelting Works, at Anyox are interesting. A report by George S. Rice, chief engineer of the U. S. Bureau of Mines, on the "Bumps and Outbursts of Gas in the Mines of the Crowsnest Pass Coalfield," furnishes an insight into the problems of mining coal in certain districts of British Columbia.

Matachewan Gold Area. By A. G. Burrows, Ontario Bureau of Mines; Bull. No. 34. Pp. 30, with Geological Map. A. T. Wilgress, King's Printer, Toronto, Canada.

This publication, which will form a part of the 27th annual report of the Ontario Bureau of Mines, has been issued in separate form as an advance edition, so as to make the information contained available to prospectors and others interested as early as possible. The Matachewan gold area is so called from its proximity to the Hudson's Bay Company post of that name on the Montreal River. Gold was found in Powell Township in the autumn of 1916, and it has also been found in the adjoining townships of Cairo and Alma. Mr. Burrows' report is the result of a general examination embracing Powell, Cairo, Baden and Alma townships and the Matachewan Indian reserve, with some adjacent territory. The newest railway station is Elk Lake, the terminus of a branch line of the Temiskaming & Northern Ontario Ry., from which point where is a canoe route up the Montreal River, a distance of about 30 miles, to the Davidson landing. A gasoline boat has been utilized for a part of the route in high water. The trip by canoe is arduous, owing to the swift current. Three portages are necessary. A route via Long Point Lake, requiring wagon transportation for part of the way by the Gowganda wagon road, has also been used, and supplies for this season's operations went forward from Elk Lake by a winter road that roughly follows the Montreal River.

The country covered by the report is near the height of land separating the waters tributary to Hudson Bay from those flowing southward. The area is of the rocky lake type, but much of the rock is concealed by a thin covering of soil. Where not recently burned over, there is a heavy growth of medium-sized timber. The topography is rugged in parts, some hills reaching 200 ft. above the plain, and changes of elevation of 50 to 100 ft. are frequent. The oldest rocks are of the Keewatin age, and consist mostly of basic to intermediate volcanics, accompanied by chert (iron formation) and schistose sedimentary rocks like quartzite and conglomerate. These have been intruded by numerous diabase and porphyrytic dikes.

The gold deposits in Cairo and Alma townships consist of quartz veins in the syenite. Narrow quartz veins on the Brookbank and Cluef claims in Alma give low assays in gold and silver, and on the Brookbank the quartz carries some fluorite, barite, copper pyrites and galena. On the Craig claims there is a long north-and-south vein consisting mainly of quartz and brecciated syenite, in one place showing a width of over 150 ft. A shaft has been sunk, and visible gold was reported in material from the workings.

The gold deposits in Powell Township occur in rusty weathering gray schist, reddish orthoclase porphyry, and a wide quartz-schist vein on the Davidson. The orthoclase porphyry occurs as small stocks intersected by numerous veinlets of quartz, some of which carry gold associated with iron pyrites. The porphyry itself is impregnated with iron pyrites, which at the surface has been partly oxidized with the formation of iron oxide and a breaking down of the porphyry into irregular fragments at different points. The porphyry outcrops are in places from 300 to 600 ft. in width. Gold has been found on several claims of the Davidson and Otisse groups in the porphyry. A sample from the surface of the porphyry in a trench on one of the Davidson claims gave an assay of $10 per ton over a length of 15 ft. Another surface sample from a long trench gave on assay a value of $12.50 over a length of 10 ft. These figures are not given as representative of the actual value of the whole mass of the porphyry, but indicate its gold-bearing character. Gold also occurs in a quartz and schist vein that has been traced 225 ft. by trenching.

Veins containing barite in syenite occur in several parts of the area. They are generally small, but there are two deposits which would be of commercial value if nearer railway transportation. They are the Beiderman deposit, in Cairo Township, and one near Yarrow Lake, in Yarrow Township. Fluorite has been found in small quantities in Cairo and Alma townships, and hemalite occurs in lenses in quartz veins on the La Brosse claims in Yarrow Township, west of the east branch of the Montreal River.

Personals

Have you Contributed to the Association of the 27th Engineers?

Edson S. Pettis, of San Francisco, is in New York.

Algernon Del Mar is now manager of the Techatticup mines, El Dorado Canyon, Nevada.

P. W. Clark, manager of the Galena Farm Mine, Silverton, B. C., has returned to Spokane.

D. R. Thomas has accepted a position with the American Cyanamid Co., and will act in an advisory capacity.

Herbert C. Hoover has paid a visit to the American battlefront. Among the places he visited was Belleau Wood.

John C. Anderson, general manager of the Santa Cruz Silver-Lead Co., Tucson, Ariz. was recently in New York.

Bruce C. Yates, superintendent of the Homestake Mining Co. is spending his vacation at the Yellowstone National Park.

Milnor Roberts, dean of the college of mines, University of Washington, is making a trip to the mining districts of Idaho.

John W. Beard, formerly with the Philadelphia Exploration Co., is now with the Cia. Minera de Penoles, Mapimi, Dgo., Mexico.

W. A. Deichen, formerly chief engineer for the state mines at Hibbing, Minn., has accepted a position with the Dean Iron Co., Mr. Deichen is succeeded by Ray Moore.

H. C. George, who has been engaged in consulting work in the Wisconsin zinc district during the last year, has accepted the position of geologist to the Wisconsin Zinc Co.

A. C. Allen will be in charge of the Bureau of Mines Rescue Car, No. 5, which will be at Lead, S. D., from Aug. 4 to 17. Instruction will be given in First-Aid and mine-rescue work.

W. C. Thomas has severed his connection with the Wolf Arizona Copper Co. and is now engaged in consultation work. His present address is 167 Seymour Ave., Newark, New Jersey.

J. N. Mahoney, for 12 years a member of the engineering department, has tendered his resignation to the Westinghouse Electric and Manufacturing Co., and intends to open consulting offices in New York City.

Bruce A. Middlemiss, general manager for the Todd Stambaugh interests on the Mesabi range for several years, has accepted the post of superintendent of the Chile Copper Co.'s mines in South America.

Charles Lehmann has left Naltagua, Chile, and has returned to England. His address for the present will be care of the Institution of Mining and Metallurgy, 1 Finsbury Circus, London, E. C., England.

S. K. Dahl, mill superintendent for the Messina (Transvaal) Development Co., Ltd., Zoutpansberg, South Africa, until the closing down of the property, has severed his connection with the company and will return to the United States.

L. B. Pringle, formerly chief chemist and experimental engineer for the Bonne Terre division of the St. Joseph Lead Co., Bonne Terre, Mo., is now office manager of the varnish division of the Certain-Teed Products Corporation, St. Louis, Missouri.

J. O. Elton, superintendent of the Anaconda Copper Mining Co.'s electrolytic zinc plant at Great Falls, Mont., is now in charge of special work for the Bureau of Mines. During his absence **R. B. Caples** will have charge of the plant.

S. G. Blaylock, of Trail, B. C., assistant general manager of the Consolidated Mining and Smelting Co., of Canada, Ltd., is in the East and intends to return at an early date. Mr. Blaylock attended the mining convention held last month at Reyelstoke, British Columbia.

R. W. Brock, who has been in England for the last two years on military duty, has been chosen by the Imperial authorities as geologist with the British army in Palestine, and has been instructed to proceed to the Holy Land to take up his new duties there. Mr. Brock was until recently dean of the faculty of applied science at the University of British Columbia.

C. E. Addams has resigned from the position of general manager of the Arizona Hercules Copper Co., which he held for several years, and was succeeded, on Aug. 1, by **A. A. Wrenn,** formerly with the Ray Consolidated Copper Co., and the Nevada Consolidated Mining Company.

F. H. Brownell, president of the Federal Mining and Smelting Co. and the Tacoma Smelting Co., and one of the directors of the American Smelting and Refining Co., is now general counsel for the last-named corporation, vice John K. Steele. Mr. Brownell recently left New York for Seattle.

Industrial News

L. R. Boyer, formerly with the Bureau of Standards, has joined the organization of E. & T. Fairbanks & Co., scale manufacturers, St. Johnsbury, Vermont.

J. H. Fenton, of the Los Angeles office of the Westinghouse Electric and Manufacturing Co., has recently been appointed manager of the industrial division of that office, which includes jurisdiction over the Tucson and El Paso offices.

Allis-Chalmers Manufacturing Co. reports earnings for the first six months of the year of $3,279,993, as compared with $2,107,361 for the latter half of 1917. Unfulfilled orders on June 30 represented $28,962,095. Sufficient has been earned during the first six months to pay regular 7% dividends for the whole year on preferred stock to liquidate the 7% dividend at present unpaid, and leave nearly 4% for dividends on common stock.

W. R. Grace & Co., of New York City, have formed a corporation to be known as the International Mining Co., which will operate tin and wolfram mines in Bolivia, and will develop an extensive mineral area there. The control of operations in Bolivia will be vested in a board consisting of D. S. Ingelhart, J. Louis Schafer and J. E. Zalles, with J. M. Connal as managing director. The Bolivian office will be at La Paz.

Societies

The British Iron and Steel Institute will hold the Autumn meeting in London on September 12 and 13.

American Museum of Safety and Sanitation will hold an exposition at St. Louis, Mo., during the week of September 7 to 12.

American Gear Manufacturers' Association will hold its semi-anuual meeting at the Onondaga Hotel, Syracuse, N. Y., Sept. 19, 20 and 21. Announcement of the program will be given in a later issue.

American Chemical Society will hold its annual meeting at Cleveland, Ohio, from Sept. 10 to 13, inclusive, with headquarters at the Hotel Statler. The following local committees have been appointed: Executive—A. W. Smith, chairman, Case School of Applied Science, Cleveland, Ohio; Hippolyte Gruener, vice chairman, Adelbert College, Cleveland, Ohio. Finance—W. A. Harshaw, 720 Electric Bldg., Cleveland, Ohio. Entertainment—Hippolyte Gruener, Adelbert College, Cleveland, Ohio. Hotels—H. H. Gronemeyer, 1887 East 93rd St., Cleveland, Ohio. Entertainment of Ladies—Miss Josephine Grasselli. A tentative general program has been arranged as follows: Monday, Sept. 9, 4 p. m., council meeting at the University Club, Euclid Avenue and East 38th St. Dinner there for the council as guests of the Cleveland section. Tuesday, Sept. 10, 10 a. m., general meeting, reading of a paper on "The American Chemist's Place in Warfare," by Charles L. Parsons, chairman of the committee on war service for chemists. Other general papers to be announced. At 2 p. m. a general symposium on the chemistry of dyestuffs. R. Norris Shreve will act as chairman. Numerous interesting papers and addresses are being prepared. These will take up the whole of the afternoon of Tuesday and may continue on Wednesday morning in the industrial division. In the evening there will be a banquet at the Hotel Statler, followed by a smoker at the same place. Wednesday, Sept. 11, in the morning there will be divisional meetings at the Hotel Statler, and in the afternoon a choice of excursions. (a) Sanitary trip, including sewage-disposal experiments, water filtration, garbage disposal. (b) Steel industries, blast furnaces, byproduct coke, steel—bessemer and open-hearth. (c) Industrial tour of Cleveland, including manufacturing centers. (d) Trip to Oberlin. In the evening the president will deliver an address, followed by informal reception. Thursday, Sept. 12, divisional meetings all day. In the late afternoon there will be an outing to one of the country clubs, followed by reception at the Cleveland Museum of Art. Friday, Sept. 13, choice of excursions. (a) By special cars to Akron—Goodrich Rubber Co. (limited to 200), Knight Chemical Stoneware plant, and possibly pottery works. (b) Auto trip to Wadsworth, near Akron—Ohio Match Co., Ohio Salt Works, and Ohio Brass Co. (limited to 50). The usual meetings, including the annual election of officers, will be held by all the divisions, and by the rubber chemistry section, with the following special program: The division of biological chemistry is planning a symposium on plant chemistry. The division of industrial chemists and chemical engineers, besides continuing the symposium on the chemistry of dyestuffs, is planning a symposium on potash and a continuation of the very successful symposium on metallurgical subjects started at the Boston meeting.

Exposition of Chemical Industries. The program for the fourth national exposition, to be held in New York from Sept. 23 to 28, is in active preparation. Opening addresses are to be made by Dr. G. H. Herty and Dr. G. W. Thompson. Other addresses will be made by F. J. Tone, president of the American Electrochemical Society; Dr. W. H. Nichols, president of the American Chemical Society; and others. Joseph W. Richards, of the Naval Consulting Board, will speak on "Ferroalloys of Silicon, Tungsten, Uranium, Vanadium, Molybdenum and Titanium." Theodore Swann, president of the Southern Manganese Corporation, will speak on "Ferromanganese." The program will include a series of symposiums on the "Development of Chemical Industries in the United States, Notably Since July, 1914," one of which will be devoted to a consideration of potash development. C. A. Higgins, of the Hercules Powder Co., will speak of the operations of that company in recovering potash from kelp. Linn Bradley, of the Research Corporation, will discuss the recovery of potash from cement dust and other sources by electrical precipitation. Among the speakers at other symposiums are: A. Hough, "Chemical Engineering in Explosives, T N T, T N A, Picric Acid and Nitrobenzol"; E. J. Pranke, "Development of Nitric Acid Manufacture"; S. P. Sadtler, "Development of Industrial Organic Chemistry"; George H. Tomlinson, "Wood as a Source of Ethyl Alcohol"; C. A. Higgins, "Kelp as a Source of Organic Solvents"; and Alcan Hirsch, "Pyrophoric Alloys." The American Ceramic Society, which will hold its meeting at the exposition on the afternoon of Sept. 26, already has the following on its program: A. V. Bleininger, "Recent Developments in the Ceramic Industries;" L. E. Barringer, "Manufacture of Electrical Porcelain;" H. Ries, "American Clays;" and F. A. Whitaker, "Manufacture of Stoneware." Motion pictures will be shown depicting various phases of the many fields in which chemistry plays a part.

New Patents

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

Zinc Vapor, Apparatus and Method for Condensing—Charles H. Fulton, St. Louis, Mo., assignor, by mesne assignments, to Metallurgical Laboratories, Incorporated, Chicago, Ill., (U. S. No. 1,271,560; July 9, 1918.)

Electric Furnace—Carl A. Pfanstiehl, Highland Park, Ill., assignor to Pfanstiehl Company, Inc., North Chicago, Ill. (U. S. No. 1,271,760; July 9, 1918.)

Filter—William Henry Duryea, Tiffin, Ohio. (U. S. No. 1,271,681; July 9, 1918.)

Frog—Joseph P. Fleckenstein, Bethlehem, Penn., assignor, by mesne assignments, to Bethlehem Steel Co. (U. S. No. 1,271,556; July 9, 1918.)

Gold-Saving Apparatus—Adolph J. Jarmuth, Seattle, Wash., assignor to Erastus S. Bennett, New York, N. Y. (U. S. No. 1,271,714; July 9, 1918.)

Joint for Fixing Elastic Tubes Upon Metal Pipes—Maurice Alexandre Mazade, Paris, France. (U. S. No. 1,271,597; July 9, 1918.)

Melting-Furnace—Thaddeus F. Baily and Frank T. Cope, Alliance, Ohio, assignors to Electric Furnace Company, Alliance, Ohio. (U. S. No. 1,272,186; July 9, 1918.)

Sulphur Dioxide, Method of Recovering from Furnace Gases—Henry Howard, Brookline, and Frank G. Stantial, Melrose, Mass. (U. S. No. 1,271,899; July 9, 1918.)

Motor-Actuated Shovel—Michael J. Zabawa, Grand Rapids, Wis. (U. S. No 1,271,648; July 9, 1918.)

Editorial Correspondence

SAN FRANCISCO—Aug. 7

The Confidence That Oil Producers of the Pacific Coast and Rocky Mountain regions will avoid unnecessary and harmful competition, as expressed by Mark L. Requa, will no doubt be respected without the slightest hesitancy in California, where Mr. Requa is well known for intelligent and fair conduct of important matters. And there is no occasion for doubt that in other regions of petroleum production respect for the wisdom of Mr. Requa's recent remarks on the subject also obtains. The recommendations of the National Petroleum War Service Committee on distribution and price control do not apply to the Western regions. These recommendations include regulation of sales and time of selling, fixing of posted prices and of maximum premiums and elimination of competition. The committee stated that similar regulation may be applied to the Rocky Mountain and Pacific Coast regions later. But Mr. Requa, who is at the head of the Oil Administration, speaking on behalf of the petroleum producers, says he believes the oil industry of these regions can govern itself wisely and well; that it can better formulate its own rules and regulations voluntarily than through Government mandate. But the Government will be obliged to act in the matter if the oil industry does not do so voluntarily. And he adds: "I should be unwilling to be obliged to admit that the industry has failed in finding some solution to this question, some method of determining what is just and right, which will prevent unnecessary and harmful competition. I can conceive of nothing less to be desired than the necessity for the oil division of the Fuel Administration being compelled to initiate such procedure." That is straight talk and of the sort to be expected from the source, and, moreover, the kind of speech that will be respected and heeded.

The Survey of the Gold Situation in California undertaken by the State Mining Bureau has been completed in the Mother Lode region and is being extended into Nevada, Placer and Sierra counties. The survey has disclosed what is well known to all metal-mining men, that costs of mining gold in 1918 are approximately double the costs in normal times. In other words, the purchasing power of gold has been reduced about 40%, and production in the first half of 1918 is estimated at $8,500,000, as compared with about $11,000,000 in the same period of 1917. Also, the facts indicate that the decline in production is due largely to shortage of water for placer mining and quartz milling and power uses. Statistical data compiled in tabular form or narrated in the text of the report to be issued by the bureau will be of no direct, or even indirect, benefit to the gold-mining industry of California. It will not influence a reduction in the costs of labor, materials or supplies; nor increase the amount of available labor; nor cause the rains to fall on the just and leave the unjust to go dry. As a mere matter of history—that in 1918 the gold miners in California were hard hit by a combination of conditions over which they had not the slightest control, due primarily to the wickedness of the Kaiser and in a small degree, at least, to the neglect of Jupiter to shake his shield and send down the much-needed rain and snow—it may make easy reading for the idle curious after the war. But for the purpose announced by the state mineralogist—the relief of gold miners from the increased costs of mining—it will be as a missed hole in an extremely hard formation. Missed holes break no rock, but are a dangerous menace to be carefully guarded. Unwarranted expenditure of state money is a menace to the progressiveness of the department of the state which allows it, and should be more carefully scrutinized, even in the beginning of a political campaign.

La Grange Hydraulic Gravel Mine, in Trinity County, is being permanently closed down, owing to high costs and lack of material for continued operation. War conditions are demanding steel to the extent that steel rails for riffles cannot be supplied for hydraulic mining, and as the La Grange used 500 tons of steel rails annually, it was impossible to operate the property on a paying basis under existing conditions. It is the largest hydraulic mine in the world and has been in operation for about 40 years. Its operation has never been affected by the anti-debris laws, owing to the fact that the tailings in no way interrupted agriculture nor interfered with navigation or the purity of domestic water. Whether the owners, chiefly English stockholders, made any effort to induce the Government to aid them in the interests of gold mining as an essential industry to the success of the war has not been made public. It is probable that the life of the property might not have extended much longer and possible that the increased cost of steel would have rendered the complete working out of the mine unprofitable. But that there is still a large amount of gold in the holdings that cannot be profitably mined by other than expensive hydraulic process is not disputed. The production of the past has totalled several million dollars, and operating methods were being constantly improved during the working life of the property. The company has 23 miles of flume, ditches and pipe and large "giants" and other essentials were employed in the operation. Forty men, most of them having families, were employed, and an important camp was established, being supplied with electric lights and water system. The property is situated four miles from Weaverville, the county seat and chief town of the county. The final gold clean-up is about finished, and the company is said to be contracting with junking firms for dismantling the plant and disposing of the material.

The High Cost of Gold Mining has in the last year been more disastrous to the gold-mining industry in California than will ever be made public by the mine owners and operators. The survey of conditions undertaken by the State Mining Bureau will probably disclose that the cost has increased approximately 43% since 1914. The real condition is not being made known to the field assistants of the Bureau by any of the larger mines. There are many inside facts regarding the gold-mining situation that mine owners keep to themselves. It is safe to place the increase in costs, not since 1914, but within the last two years, at near 50% in every important gold-mining region in the state. And unless there is to be an appreciable reduction in costs, many of the mines will close down completely, instead of keeping the properties alive merely by development and preserving the physical conditions and maintaining the equipment in proper repair for future resumption of production. It can serve no good purpose to make public to the world of mining investors and disinterested people generally the details of the true condition of the gold-mining industry in the state. Such publication will not make the future any better but, rather, might drive away from the state many possible future investors in gold mines. The fact is that it is bad enough as it stands. But not so bad that a remedy may not be found if action is taken immediately. It does not require expensive and extensive travel over the state to learn the facts. A review of the information provided and opinion expressed by mine owners and operators of prominence and repute as gold miners will provide all the essential facts. As to the remedy, the same number of responsible owners and operators may be as reliably quoted, if they would permit. And there is not one of the entire fraternity of gold miners in the state that demands anything unreasonable or that has the disposition to be unpatriotic. The consensus of views as to the remedy for excessive costs is that the gold miner should be relieved of certain taxation and be given the advantage of priority, along with other mine owners and operators, in the obtaining of the necessary supplies and materials. The gold miners are ready and willing to forego even the ordinary or usual profits if they are allowed to keep their properties alive and in condition for future continuous operation without loss and damage to mines and equipment. They are all patriotic enough to trail along behind the copper and silver and lead and zinc miners and the miners of chrome, manganese, tungsten and other special minerals, who are making money or getting rich. And their patriotism, like the patriotism of all good Americans, is backed by the belief that the future will bring its reward and happiness not to themselves merely but to their fellow Americans and to the rest of the world who are opposed to Kaiserism. All the fuss and feathers and playing politics and making a great stir about the situation of the poor gold miner does not get anywhere. Let the proper representatives of the Government and the real representatives of the gold miners of the country get together, and eschew politics and eloquence and oratory, and they can settle the situation in a day. It will not require a great convention of delegates and a brass band and a waving of flags and shouts of patriotism. If the President would relieve Hoover from the job of Food Administrator and induce him to assume control of the gold-mining administration—with power to act—the whole question would be settled before the small fry had done talking about it, and the gold mines would be going along in the usual way and contributing their profits to the winning of the war. What Hennen Jennings is doing in his field and Mark Requa is doing in his field, Hoover or some other man of like caliber would speedily do in the gold-mining field.

SALT LAKE CITY—Aug. 9

An Increase in Coal Production by Utah and Wyoming of 7000 tons during the week ended July 20, over the week preceding, is evidence of the speeding up of the coal industry to meet war needs and is a hopeful augury for the coming winter, for which fears of a coal shortage have been entertained.

A New Process which will secure 100% copper concentrates, according to Prof. Elbert D. Thomas, secretary-registrar of the University of Utah, has been obtained through the work of the United States Bureau of Mines at the University of Utah. In accordance with the spirit of the times, this process will be secretly communicated to the Government for use in carrying on the war. The new process, if put into use, would add greatly to the amount of available copper.

Output of Park City Mines during July was 7710 tons of ore and concentrates, the largest shippers being Ontario Silver, Silver King Coalition and Judge Mining and Smelting. A further wage increase of 50c. a day has been granted by the above-mentioned mines, and by other companies operating in the camp. Mine rescue work is being done at various properties under direction of the United States Bureau of Mines, rescue car No. 1 having arrived in Park City on Aug. 5.

Possible Curtailment of Labor in non-productive mines until producing properties have been served has been talked of in connection with operations in American Fork Canyon. There is labor shortage at many properties, and the high cost of labor and material is automatically cutting off much prospecting. More or less of this work is necessary for the health of the industry, which cannot confine itself to the exploitation of known orebodies in proved ground.

An Immediate Increase in Sulphuric-Acid Output in this section is not to be expected. The plant of the Garfield Chemical Co., operating at Garfield and producing acid from smelter fumes, is maintaining an output of 150 tons daily, but further expansions is temporarily suspended, owing to the heavy cost of material and labor. The demand for the material, owing to transportation costs, is a local one. At present Utah Copper is taking the greater part of the output of the plant for use in leaching operations.

Increase in Coal Production in the state is shown for the first half of 1918 to be 500,000 tons over that of a corresponding period in 1917. It is expected that the increase for the year will be double this amount. There will, of course, be some shortage of cars in the autumn, when the heavy movement of crops begins. However, so great a shortage as that of the year preceding is not looked for, and it is hoped that it will be possible to keep the

coal moving. On the whole, it is not expected that the coal shortage of last winter will be repeated. The effort to speed up production during the period when coal mining is usually slack has met with success.

The Recent Increase in Freight Rates, as affecting Utah mine operators, is under consideration by those interested and a committee has been formed consisting of A. G. Mackenzie, Imer Pett, J. C. Dick, G. W. Lambourne, and F. G. Westcott, of the Utah Chapter of the American Mining Congress. The increased rates will be felt in two ways. The advance will rest directly on the producer, as changes in future smeltery contracts and increased charges are announced; and curtailment in the output of low-grade ores is sure to follow, which may make it difficult for the smelters to operate at full capacity, resulting in an increase in overhead expense. As has been pointed out, it seems logical to conclude that an increase in the price of metals would afford a solution of the problem of preventing a curtailment of production. In regard to the fixing of a basic wage scale by Government action, definite assurance has been extended to operators by the Department of Labor that no action will be taken without giving all concerned a full opportunity to be heard, and to present suggestions and criticism.

JEROME, ARIZ.—Aug. 6

Jerome Labor Trouble has been settled by acceptance of the award by mediator Hywell Davies of a 25c. wage raise, in addition to the 50c. that came after the increased copper price to 26c. In this connection, Mr. Davies explained that the copper companies would derive no benefit whatever from the raise of price from 23½c., the difference being wholly consumed in additional labor, transportation and refining charges. A demand for the $100 a year service bonus for old employees, lately made effective in Bisbee, was waived, in consideration of the 25c. addition. It was agreed, also, that local companies attend to the better housing of their employees at lower cost, the United Verde assenting to rental reductions of $8000 a year and to a program of building new quarters for its men. Lighting costs will be reduced from 15c. to 11c. per kw-hr. and the water rates go down 10 per cent. These changes all are effective July 1. Word has been received that on recommendation of mediator J. S. Myers, an additional 25c. has also been granted in the Globe-Miami section, effective Aug. 1. Here the demand of the workmen for a flat raise of $1.10 a day lost strength after receipt by the unions of a telegram from Secretary Wilson of the Department of Labor, asking coöperation with the mediator, that there be no cessation of the production of copper.

JOPLIN, MO.—Aug. 7

A Shortage of Electric Current for the district is threatened once more this summer as a result of comparatively dry weather. White River is low, and the generators of the Ozark Water and Power Co. there are unable to operate sufficiently to supply the Empire District Co. at Joplin with the necessary current. Spring River also is low, and Empire's plant at Lowell, Kan., is likely to have trouble soon. In line with the Government's fuel conservation ideas, it is hoped sufficient current may be produced without using too much coal. Numerous mills are operating on afternoon and night shift in order that the peak load may be divided up.

An Attempt to Concentrate Labor at mines of larger companies that are not likely to be forced down by low zinc ore prices may be made by producers in this field. The cut in ore prices again last week put a final quietus on the efforts to stimulate a boom out of the raise in price of a few dollars during the last month, and it is likely that companies forced to close now will remain closed for some time. The fact that there is a continued and growing scarcity of capable labor is causing operators to consider favorably an attempt to concentrate available labor at those mines that are almost certain to be kept in steady operation, regardless of prices. It is argued that such a plan would benefit both workers and employers and therefore would be for the good of the district and the Government. Some of the larger companies in the district that are expected to continue operations despite poor ore markets include the Commerce Mining and Royalty, Eagle-Picher, Admiralty Zinc, U. S. Smelting, Underwriters, Golden Rod, Bilharz, Acme, Huttig, Blue Mound, Skelton, and Bethel-Domado-Croesus.

DULUTH, MINN.—Aug. 8

Labor Shortage on Mesabi Range is proving serious. As all industries are working at capacity, there seems to be no source from which to draw additional labor. This shortage appears to be affecting the smaller underground mines more than any other type of property. At present the minimum wage for common labor is $4 a day. Few receive less than $100 a month, and the average wage ranges from $100 to $125 per month.

HOUGHTON, MICH.—Aug. 7

Training of Soldiers in mining methods is being conducted at the Michigan College of Mines. Two hundred men, selected from the last draft, are being trained as infantry and are specializing in mining. They are being taught how to operate and repair machine drills, the handling of dynamite, timbering and various other details of mining. Half of their time is spent underground, where they are employed by the Hancock, Franklin, Isle Royale and Quincy mines.

SPOKANE, WASH—Aug. 8

Relief of the Gold Stringency is to be discussed at a conference to be held in Spokane, during the week of Sept. 2, under the auspices of the Northwest Mining Association, which has appointed a committee consisting of F. A. Ross, A. W. Boyd, F. C. Bailey and S. Norman to arrange all details. The conference is one of many similar gatherings to be held all over the country at the request of Secretary McAdoo. At each of these meetings representatives of metal interests will discuss what is most needed in each section. An invitation to attend the Spokane conference will be extended to financiers from British Columbia and other Canadian states.

COBALT, ONT.—Aug. 6

Mining Companies in Northern Ontario having machinery which has become second-hand, or that has been replaced by more modern equipment, are finding a growing demand for their discarded material, owing to the great increase in price of new mining machinery of all kinds. Another feature which makes desirable the purchase of the material in the district is the fact that deliveries over the railroads have been a source of much worry and waiting. A number of mining concerns in the district are having their discarded machinery overhauled and placed in a marketable condition, and in many cases this equipment is bringing a higher price than that paid for it when new, several years ago.

VICTORIA, B. C.—Aug. 6

Natural Gas of Northern and Southern Alberta is to be tested as to its value as a source of gasoline. The work is to be carried out under the direction of D. B. Dowling, of the Canadian Geological Survey Branch, Mines Department, Ottawa. It is probable intial tests will be made at the Dingman well, south of Calgary City, and that these will be followed by similar tests in the Viking and Peace River fields.

MELBOURNE, AUSTRALIA—July 2

Mines in the Westonia Field, situated on the Fremantle-Kalgoorlie Ry., Western Australia, and 207 miles from Fremantle, include the Edna May, Edna May Central, Edna May Deep, Edna May Consolidated, Edna May Battler, the two first mentioned being the only two opened up and completely equipped. The Edna May mine has been developed by six levels to a depth of 480 ft. From January, 1913, to the end of the last half year, a total of 151,914 tons has been treated, which yielded 132,000 oz. gold, valued at £620,169. Output for the last six months was 11,850 tons. In addition, 9900 tons of sands were cyanided and 605 oz. of gold with a value of £2071 recovered, as well as 8983 tons of slimes, which produced 1324 oz., of a value of £8013. Working costs, including development, averaged £2 4s 4.67d. Heavy inflows of water, uncommon in Western Australia mines, have retarded development, but an additional plant installed during the last half year appears to have mastered the flow, and the mill should be kept running continuously. Six months ago the normal quantity of water to be pumped did not exceed 40,000 gal. per hr., but while stoping operations were being carried on above the 385 level, the water increased to a maximum of 60,000 gal. per hr., necessitating the closing of bulkheads to prevent flooding.

CARACAS, VENEZUELA—July 5

Lawsuits Against Foreign Corporations attempting to operate mines in Venezuela have not only been internationally notorious but such cases as the Imataca iron deposits, the Bermudez asphalt concessions and the Guanta coal fields have been subjects of more or less energetic exchanges between foreign powers and Venezuela. The honest efforts of the American Magnesite Mining and Manufacturing Co., and the Magnesite Products Corporation, both of New York, to work the extensive magnesite deposits of the Island of Margarita, Venzuela, have resulted in lawsuits of a malicious and blackmailing character, and in both cases the courts have supported the claims of those suing. The result has been that both companies have abandoned operations and 300 laborers have been thrown out of work. President J. V. Gomez recently sent a telegram to the governor of the state that bids fair to stop the pernicious practice, which has persisted for the last 25 years, of making war on mines operated by foreign capital that are outside of Federal influence. The telegram was to the effect that judges who placed a wrong interpretation upon the embargo were liable to removal from office. The attitude of the President is of great importance to foreign mining and other interests, as it shows a desire to protect foreign capital from the persecution of local authorities.

The Mining News

ARIZONA

Cochise County

PHELPS DODGE CORPORATION (Bisbee)—Uncle Sam shaft to be reopened and retimbered. C. and C. shaft has been sunk to 1500 level, and is to be equipped with headframe from Spray shaft.

CALUMET & ARIZONA (Warren)—Smeltery production during July amounted to 7,034,000 lb. of copper, of which 4,214,000 lb. was available for Calumet & Arizona.

Gila County

INSPIRATION CONSOLIDATED (Miami)—July production was 9,000,000 lb. of copper.

Maricopa County

SOUTH VERDE CONSOLIDATED (Mesa)—Driving tunnel to cut ore developed by shafts.

Mohave County

CACTUS QUEEN COPPER (Kingman)—New machinery to be installed and operations started soon.

FRISCO MINES (Kingman)—Work resumed. Surface ores to be milled with the ores from lower levels.

GOLD ROADS MINES (Kingman)—A 300-ton crushing plant to be placed in operation soon.

GOLD TRAILS (Kingman)—Hoist to be installed. Shaft down over 100 ft. and will be continued to greater depth. Contracts to be let for shaft sinking.

RECORD LODE (Kingman)—To install a mill in six months. Shaft down 400 ft. To be sunk to 500 level.

STANDARD MINERALS (Kingman)—Cutting station at 350 level and will crosscut to vein.

Pima County

NEW CORNELIA (Ajo)—July production was 3,900,000 lb. of copper.

Pinal County

GREAT RAY (Ray)—Churn drill operating property.

Santa Cruz County

HARDSHELL MINE (Patagonia)—Installing large Hartz jig. H. K. Welch is manager.

HARDSHELL NO. 2 (Patagonia)—Has installed cyanide plant, which is in operation.

TRENCH (Patagonia)—To sink 200 ft. deeper and cut orebody at lower level.

Yavapai County

ADAMANA OIL (Holbrook)—Machinery received and preparations for drilling under way.

HOLBROOK OIL (Holbrook) — Contracted for sinking of 2600-ft. well.

HACKBERRY (Jerome)—Installing a 200-ton flotation plant.

CALIFORNIA

Alameda County

WESTERN MAGNESITE (Livermore)—To install 150-ton mill. Other properties in this district under development.

NOBLE ELECTRIC (San Francisco)—To erect new hoist on property developing manganese in Tesla district.

Amador County

BUNKER HILL (Amador City)—Dropping 20 stamps on day shift. C. E. Bunker is superintendent.

KEYSTONE (Sutter Creek)—Report for six months ended June 30, shows 40-stamp mill lost only 17 hours. Crushed 43,694 tons, yielding $85,802 net, after deducting freight and smelter charges on concentrates, from ore averaging less than $2 a ton. Mining and milling charges, $83,000; corporation license, stock tax, $133; interest, $509; secretary's office, manager's salary, etc., $1970. Total, $85,612. The 900-ft. level produced only 34 tons; 1000-ft. level produced 17,788 tons. Development on these levels has been discontinued until cost conditions are improved. Development on 1800-ft. level shows larger amount of ore than in sight six months ago. Main stope on 1200-ft. level is 80 ft. above drift in 8 ft. width of milling ore. Prospects good for large tonnage. C. R. Downs is manager.

Butte County

INSKIP (Chico)—To be reopened. Development by 2000-ft. tunnel. Cut vein 200 ft. below surface.

SURCEASE (Oroville) — Temporarily closed down.

Calaveras County

DUTCH-SWEENEY-APP (Jamestown)—Receiving material for new mill construction and installation is in progress. W. J. Loring is manager.

Del Norte County

CALIFORNIA CHROME (Crescent City)—Unwatering old mine on Chrome hill has commenced.

Eldorado County

ROCKY BAR (Placerville) — Installing gasoline engine, hoist, pumps and other equipment. Development in progress. J. A. Prentiss is superintendent.

Humboldt County

MANGANESE DEPOSIT being developed at Blocksburg and ore hauled to railroad for shipment.

Imperial County

IMPERIAL REDUCTION (Pasadena) — Application for U. S. patent on American Girl, American Girl Extension, Western, Homestake, Black Rock, Annex. Also mining claims situated near Ogilby, in southeastern part of county, northwest of Yuma and known and operated as American Girl mine.

Inyo County

MINERAL PRODUCTION in 1917, according to U. S. Geological Survey, is valued at $2,959,504. Total tonnage of ore treated, 84,508 tons; gold yield, $121,313; silver, 648,791 oz.; copper, 744,582 lb.; lead, 19,671,732 lb.; zinc, 3,956,343 pounds.

Madera County

TEXAS FLAT (Coarsegold)—to increase operations. Large supply of water anticipated, and mill will resume in fall.

MINARETS MINING (Mammoth) — Ore carrying silver and zinc disclosed in new development tunnel.

Placer County

FARMERS' LIME (Auburn)—Installing crusher and kilns.

Plumas County

BUSHMAN PLACER (Quincy) — Steam hoist and pumps to handle gravel and water to be installed and contracted to S. R. Ede and Louis Smith by San Francisco owners.

Shasta County

MAMMOTH (Kennett)—Smeltery production during July was 1,330,000 lb. of copper.

MOUNTAIN COPPER (Keswick)—Iron Mountain and Hornet mines averaging 800 tons of ore a day. Shipments to Martinez smeltery normal, in spite of labor shortage, which chiefly affects development. Enlargement of concentrating plant at Minnesota station to 300-ton capacity to be completed by September.

BIG PINE CHROME (Redding) — New deposit in Shotgun district discovered by Antone Orsini.

REID (Redding)—Quartz mining in Old Diggings district resumed. Contract for 150 to 200 tons daily delivered at Mammoth smeltery, at Kennett, has been made.

BULLY HILL (Winthrop)—Copper production in first half of 1918 amounted to 1,623,591 lb.; silver, 2623 oz.; gold, 449 oz. Construction of flotation plant progressing. Expect first unit ready in September.

Sierra County

WISCONSIN (Downieville)—Driving drift in gravel channel and developing. Wagon hauling to supplant packing by mules.

Siskiyou County

CHROME DEPOSITS are reported near Eddy Mountain. The Caldwell mine has 20 tons on the dump running as high as 50%. Prospectors are working south of Shasta. Liberty Mining Co., in Little Humbug district, has 100 tons on the dump to be hauled by motor trucks to Yreka for rail shipment. Installation of concentrating mill contemplated. Scott River district is producing about 20 tons a day, which is hauled by team 32 miles and transferred to motor trucks for Yreka. Concentrating mill at Yreka, enlarged to 150 tons, is operating.

Sonoma County

MANGANESE DEPOSIT near Lytton to ship ore to Noble Electrolytic Steel Co., at Heroult.

Tuolumne County

SPRINGFIELD TUNNEL (Columbia)—New tunnel making good progress through soft ground, requiring timbering. Raise to be driven for air at 1200-ft. point. Depth of gravel to be determined by drilling, and tunnel will be advanced to provide for drainage and economical working.

EAGLE-SHAWMUT (Shawmut) — Impounding dam for tailings, under construction, made necessary by closing down of chlorination plant and changes in milling methods.

Yuba County

MACEY (Camptonville)—Development to be resumed by L. C. Trent. Ore carries gold, silver and copper.

COLORADO

San Juan County

GOLD KING EXTENSION (Silverton)—Company recently incorporated has taken over old Gold King mine, at Gladstone, and six other claims between it and Sunnyside mine. Development work in new ground from Gold King workings to be immediately started under management of W. Z. Kinney.

IDAHO

Bonner County

FALLS CREEK (Sandpoint)—Has completed installation of compressor, 50-ton mill and power plant.

Shoshone County

AJAX (Burke)—Crosscutting north from Oom Paul tunnel for vein.

IDAHO-CARBONATE (Mullan)—Has cut galena in shaft. W. E. Greenough is manager.

SUNSET (Sunset)—Fire, caused by lightning, recently destroyed engine and compressor house.

AMAZON-MANHATTAN (Wallace) — To resume operations at 400-ton mill.

NATIONAL (Wallace)—Completed alterations to mill and to resume operations soon. Mining ore on 800 level in addition to lower levels.

MICHIGAN

Copper District

ALLOUEZ (Allouez)—Mined 54,000 tons during July.

SENECA (Calumet)—Sunk vertical shaft 202 ft. during July.

FRANKLIN (Demmon)—Closed down mill, pending decision of Government regarding freight rate.

QUINCY (Hancock) — Framework for skip-run of new hoist being placed.

ISLE ROYALE (Houghton)—Mined 77,000 tons during July.

AHMEEK (Kearsarge)—Has reopened No. 3 shaft, but No. 4 shaft will remain closed. Operating three shafts.

OSCEOLA (Osceola)—July tonnage amounted to 103,000, as against 104,000 tons in June.

COPPER RANGE (Painesdale)—To drill four more holes on land below Globe.

MICHIGAN (Rockland)—Cut epidote vein at 180 ft. in north drift. July tonnage was 3414 tons.

MINNESOTA

Mesabi Range

SARGENT (Keewatin)—Winston Dear Co. preparing to strip property for the Wisconsin Steel Co., operators. New camps being built.

MISSOURI

Joplin District

ST. JOSEPH LEAD (Herculaneum)—Announced by National Labor Board that award has been rendered granting general increas in wages, establishing minimum wage and providing a system of collective bargaining between employer and employee. Award is made retroactive to April 21.

MONTANA

Silver Bow County

BUTTE COPPER AND ZINC (Butte)—Shipments for six months ended June 30 were 22,700 tons zinc ore and 28,900 tons manganese ore, which netted to the company $268,337.59.

NEVADA

Clark County

MOUNTAIN TOP (Goodsprings)—Vanadium ore opened some time ago by Kennedy and Wilkinson, operating under lease from Campbell estate. Shipments now being made.

Douglas County

KENNEDY COPPER (Buckskin)—Development work from shaft to be pushed.

Esmeralda County

ATLANTA (Goldfield) — Following a brief walkout of miners, work resumed. Crosscut to foot wall of vein on 1850 level again being driven. Incline winze from 1750 level opened stringers of high-grade ore, and foot wall will be thoroughly explored.

GOLDFIELD MINING AND ORE REDUCTION (Goldfield)—Shaft down 200 ft. Four-drill compressor to be installed and sinking pushed. Company owns seven claims on Divide vein.

SILVER PICK CONSOLIDATED (Goldfield)—Shaft nearing 1200 level, from which extensive lateral work will be done.

Lyon County

NEVADA-DOUGLAS (Ludwig)—Change of management and staff being made. Regular shipments being made to Thompson smeltery.

McCONNELL (Mason) — Shipping carbonate ore from surface workings.

Nye County

TONOPAH DISTRICT ore production for the week ended July 27 totaled 10,065 tons, of an estimated gross milling return of $171,105. Producers were: Tonopah Belmont, 1934 tons; Tonopah Mining, 3800; Tonopah Extension, 2259; Jim Butler, 351, West End, 1005; Halifax, 107; Montana, 294, and MacNamara, 315 tons. Production for the week ended Aug. 3 totaled 9722 tons, of an estimated gross milling return of $165,274. Producers were: Tonopah Belmont, 1985 tons; Tonopah Mining, 3700; Tonopah Extension, 2108; Jim Butler, 285; West End, 1049; Halifax, 48; Montana, 86; MacNamara, 315; Cash Boy, 39; Rescue, 68, and miscellaneous 39 tons.

MANHATTAN CONSOLIDATED (Manhattan)—Raise from the 300 level on the High Grade vein, when holed through, will improve ventilation and permit further development of High Grade and Mushett veins.

MANHATTAN DEXTER (Manhattan)—Making test run of ore from the Juhl Nelson lease at War Eagle mill.

UNION AMALGAMATED (Manhattan)—Crosscut from shaft on 700 level being turned toward orebody developed from the upper levels.

WHITE CAP (Manhattan) — Plans to sink working shaft another 150 ft. below fifth level on contract.

DIVIDE (Tonopah)—Shaft station being cut on 300 level and some ore of commercial grade opened.

GOLD ZONE (Tonopah)—West drift on 285 level being driven to connect with Tonopah Divide mine.

TONOPAH DIVIDE (Tonopah)—To install electric hoist and compressor, and advance development work as rapidly as possible. Crosscut on 350 level being driven to cut vein opened on level above, now in 60 ft. Electric power line to camp of Divide recently completed by Nevada-California Power Company.

NEW MEXICO

Grant County

MANGANESE CLAIMS are being worked 20 miles north of Lordsburg by Tuck Edwards and associates, of Duncan, Ariz. Trucks will be used to haul ore to Lordsburg.

ATWOOD (Lordsburg)—Sinking 200-ft. shaft started on Southern group. Old shaft has been re-collared, new compressor and Diesel engine installed. Old workings have been re-sampled.

BOUNDS AND RICE (Lordsburg)—Fluorspar properties 30 miles northeast to be worked under lease by H. M. Maple.

LAST CHANCE (Lordsburg) — Work started on 50-ton unit of mill. Viola, adjoining property, being unwatered for examination purposes, and if satisfactory will take mine over. Basil Prescott is general manager.

PHILLIPS (Steeple Rock)—Producing high-grade fluorspar and will ship from Duncan, Ariz. T. O. Phillips is superintendent.

Luna County

WATERLOO (Tres Hermanos)—Main shaft down 100 ft. to be sunk another 100 ft., and drift 300 ft. Vein carries lead-silver. This to be followed by concentrator.

OKLAHOMA

Joplin District

DORRIS (Miami)—Sinking shafts to deeper ore level, and will drain ground.

R. P. SHARPE (Miami)—Has taken over Scott-Eagle and Gander mines, west of Quapaw, and will operate. Scott-Eagle mill to be used for both mines.

DOROTHY BILL (Picher) — Started operation of new 1000-ton mill between Tar River and Picher. J. R. Cole, of Tulsa, Okla., is manager.

ALAMO (Quapaw)—To sink shaft. Joe T. Burgher, of Dallas, Tex., is president.

BIG TEN (Quapaw)—To sink shaft on lease near Lincolnville soon.

OREGON

Jackson County

RAY & HAFF GROUP (Gold Hill)—A second strike has been made on the main vein in new drift on 600 level. New hoist and machinery being erected and reduction plant being assembled. J. G. Davies and associates, of Sacramento, Calif., are lessees.

RED OAK (Gold Hill)—Has been sold to R. E. Doan, of Gold Hill. Mine closed for 20 years. New owners to reopen and equip at once.

Josephine County

GOLCONDA (Waldo)—Shipped 450 tons of chrome ore in May; 1035 tons in June; and 1500 tons in July. R. J. Rowan is engineer in charge.

SOUTH DAKOTA

Custer County

FOYE (Custer)—Work has been started. Expects to make regular shipments of mica.

OLD MIKE (Custer)—Making regular shipments of mica to Chicago.

SPOKANE LEAD AND SILVER (Custer)—Plant in operation and producing lead-silver concentrates. Motor trucks to be used to haul to railroad.

Lawrence County

ECHO (Deadwood)—Pumps being installed. Shaft to be sunk deeper to develop lead-silver ores.

TITANIC (Deadwood)—To resume work and drive 1200-ft. tunnel under contract. Work to start this month.

BISMARK (Lead)—Tungsten being recovered, in addition to gold-silver ore.

TINTON (Tinton)—Concentrating tin ores. One shipment of concentrates made to Eastern market.

Pennington County

GOLD KING (Rochford)—Machinery has been installed and sinking of three-compartment shaft started.

TENNESSEE

Carter County

PATTON (Breamer)—Manganese properties have been taken over by L. D. Gasteiger and O. W. Richarson, who will install a two-log washer, with a second soon to follow.

WILLIAMS (Elizabethton)—Option taken by local interests and manganese has been found in promising amounts. Shaft to be sunk 100 ft. to prove depth of the ore, and, if satisfactory, a washer will be built.

H. V. MAXWELL (Hampton)—Shipped four cars high manganese ore during July.

UTAH

Juab County

TINTIC DISTRICT SHIPMENTS for the week ended Aug. 2 were: Dragon Consolidated, 52 cars; Chief Consolidated, 31; Tintic Standard, 18; Iron Blossom, 15; Centennial-Eureka, 15; Eagle and Blue Bell, 11; Colorado, 8; Gemini, 7; Gold Chain, 6; Grand Central, 5; Godiva, 2; Ridge and Valley, 2; Victoria, 2; Shoewers, 2; Scranton, 2; Sunbeam, 1; Gold Key, 1; Swansea, 1; Yankee, 1; Eureka Hill, 1. Total, 184 cars.

TINTIC SHIPMENTS during July amounted to 620 cars, as compared with 686 cars in June, 29 properties shipping.

APEX-STANDARD (Eureka)—Work to start immediately in hope of finding extension of Tintic Standard vein.

EUREKA LILY (Eureka)—Developing on 1400 level.

EUREKA METALLURGICAL (Eureka)—Small experimental plant using flotation making good recoveries from Tintic ores.

NORTH BECK (Eureka)—Shaft now down 1150 ft. to be sunk to 1200 level and drifting started.

DRAGON CONSOLIDATED (Silver City)—Shipping fluxing ores and silver-lead-gold ore from north end of property.

TINTIC MILLING (Silver City)—Treating 150 to 200 tons of ore daily, and making profit.

Salt Lake County

COLUMBUS-REXALL (Alta)—New ore opened in drift has widened out and is thought to be part of the old producing orebody.

SOUTH HECLA (Alta) — Ore being shipped from four different stopes. Mining in eastern zone is in sulphides, and carbonates in western.

MONTANA-BINGHAM (Bingham) — Marketed three cars of ore in the last three weeks.

OHIO COPPER (Bingham)—Third unit of new flotation plant treating 500 tons daily. Fourth unit expected to start before end of August and fifth about October 1.

Summit County

PARK CITY SHIPMENTS for week ended Aug. 3 amounted to 3,564,920 lb. the largest shippers being Ontario Silver, Silver King Coalition, Judge Mining and Smelting and Silver King Consolidated.

NAILDRIVER (Park City)—New strike reported promising. Operated under lease.

ONTARIO SILVER (Park City)—Owing to caving of one of principal stopes, July production was materially decreased. Another stope being opened on 1700 level.

SILVER KING CONSOLIDATED (Park City)—Progress being made in alterations to mill which will permit production of zinc concentrates.

Utah County

LIVE YANKEE (American Fork)—Body of ore exposed by wash-out in mountain by recent cloud-burst.

WASHINGTON

Okanogan County

GRANT (Chesaw)—Resuming operations and plan extension of tunnel.

NEUTRAL (Chesaw)—Have resumed hauling of iron ore for use of Northwest Magnesite Co. as flux.

Stevens County

ELECTRIC POINT (Northport)—Station cut at 800 level and crosscutting for ore. Difficulty in receiving material has delayed completion of tramway.

CANADA

British Columbia

GRANBY CONSOLIDATED (Anyox)—Strike has been settled and men have returned to work.

STEWART-CALVERT (Cascade)—Operating chromite claims and have made shipments.

MANGANESE SHIPMENTS are being made from property near Kaslo operated by B. F. Millard, of Seattle. Drying plant is being installed.

LADYSMITH SMELTING (Ladysmith)—Has purchased Double Header property at Nespelem and will develop on large scale.

Ontario

ANKERITE (Porcupine)—Opening up 350 level. Douglas Mutch is in charge.

OPHIR (Cobalt)—Sinking winze to develop veins at contact.

ADANAC (Coleman)—Continuing drift on mineralized vein to cut high-grade ore.

KEELEY (South Lorrain)—To enlarge operations. Property has been idle some time.

COBALT-ALADDIN (Kirkland Lake)—Crosscut at south workings being continued. North shaft has been sunk 300 feet.

KIRKLAND LAKE GOLD (Kirkland Lake)—Main shaft has been sunk 230 feet.

MINAKER-KIRKLAND (Kirkland Lake)—Shaft sunk 70 feet. Work being done by company.

MEXICO

Sonora

GREENE CANANEA (Cananea)—Production in July was: Copper, 5,000,000 lb.; silver, 146,000 oz., and gold, 1185 ounces.

The Market Report

SILVER AND STERLING EXCHANGE

Aug.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Aug.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
8	4.7530	99⅛	48 11/16	12	4.7600	99⅛	48 11/16
9	4.7530	99⅛	48 11/16	13	4.7600	99⅛	48 11/16
10	4.7550	99⅛	48 11/16	14	4.7600	99⅛	48 11/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
8	*26	†	8.05	7.75	@8.07½ @8.12½
9	*26	†	8.05	7.75	@8⅛ 8¼
10	*26	†	8.05	7.75	@8⅛ 8¼
12	*26	†	8.05	7.75	@8⅛ 8⅛
13	*26	†	8.05	7.75	@8⅛ 8⅛
14	*26	†	8.05	7.75	@8⅛

*Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917, and July 2, 1918.

† No market.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

Aug.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
8	122	122	137	387½	387½	29½	28½	54
9	122	122	137	387½	387½	29½	28½	54
10	...	...	...	...	...	...	...	...
12	122	122	137	387½	387½	29½	29½	54
13	122	122	137	387½	387½	29½	28½	54
14	122	122	137	385½	385½	29½	28½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. 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, reckoning exchange at $4.7515: £29½ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK, Aug. 14, 1918

The chief features of interest in the markets this week were the sharp advance in the price for spelter, and the temporary easing in the domestic situation in tin.

Copper—The meeting between the producers and the price-fixing committee last Wednesday, at which the 26c. price was continued until Nov. 1, passed without subsequent comment or gossip. The price having been thus arranged for 75 days to come, domestic manufacturers placed orders more freely. The Government's requirements continue to be large.

President Wilson approved on Aug. 9 the continuence to Nov. 1 of the existing maximum price of 26c. per lb. for copper.

Copper Sheets—Situation unchanged; prices not quoted. Copper wire is quoted at 29 to 30c. per lb. f.o.b. mill, carload lots, subject to any change in the price of copper.

Tin—The large arrivals of Banka and Chinese tin in July and August have made the domestic situation very much easier, temporarily at least.

Banka tin is quoted at 92@93c., but sales as low as 90c. have been reported. However, these are for small lots. Much of this tin that has recently arrived was purchased many months ago, and the owners of it, being apparently fearful of a drastic downward regulation of price, are anxious to dispose of it quickly. Producers and merchants in the East take a different view, and we have therefore the situation of metal being obtainable in this market at 92@93c., while it is not to be had for prompt shipment from Batavia at less than $1.01@1.05.

Straits tin was quoted in Singapore at £388, c.i.f., London, on Aug. 8 and 9; at £383½ on Aug. 13; and £381½ on Aug. 14.

Lead—This metal is very scarce, there being nowhere near enough available to supply the demand. The lead producers' committee is handling the situation with the utmost fairness and with excellent judgment. All of the producers have practically pooled their supplies, and the committee is allotting among manufacturers according to their needs. To all intents and purposes lead is being rationed, like coal, sugar, etc. Manufacturers, especially the larger ones, understand the situation and are doing everything they can to make things easier. The market is therefore quite free from any frantic demands, and both looks and is quiet and orderly, but the mortifying fact remains that our lead supply is short.

Zinc—Producers on Aug. 8 made tenders to the Government on its inquiry for 3000 tons of common spelter, for acceptance Aug. 9. The order did not go to any one concern, the Government selecting the lowest parts of scale bids. The entire quantity was therefore obtained at a low price. However, the consummation of this business stirred up the market and caused a sharp advance in price, but producers did not succeed in doing much business, the upward movement being apparently due largely to the bidding of speculators.

Zinc Sheets—Unchanged at $15 per 100 lb., less usual trade discounts and extras as per list of Feb. 4.

Other Metals

Aluminum—Price fixed at 33c. per lb. for lots of 50 tons or more, ingot, 98-99% grade. Sheets are 42c. per lb. for 18 gage and heavier. Price established June 1 and continues to Sept. 1. Unchanged.

Antimony—This metal became decidedly strong on increased inquiry by consumers, which resulted in considerable business. The situation is such that even a moderate demand is bound to put up the price, for Chinese producers do not want to sell even at present prices, saying that the market is still below their cost of production. There were also reports this week that Japan had been buying antimony in China, which is not improbable, in view of the recent Japanese demand for other metals. In this market business in antimony was done at advancing prices, and at the close we quote spot at 14c., and very strong. We quote futures at 13c., c.i.f., in bond.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—This metal is quoted $1.50@1.75 per pound.

Nickel—Market quotation: Ingot 40c.; shot 43c.; electrolytic 45c. per lb.

Quicksilver—Unchanged at $125. San Francisco reports, by telegraph, $117.50, strong.

Gold, Silver and Platinum

Gold—The withdrawal by the United States of the offer made last October permitting the exportation to Peru of $6,000,000 in gold annually, and the transfer within three months after peace was signed of the Peruvian gold deposited with the Federal Reserve Bank in New York, according to the "Tribune," has caused the complete collapse of the Peruvian currency law. The Government will send to Congress a new project designed to meet the serious financial situation.

The general stock of money in the United States on Aug. 1, totaled $6,896,089,799; of this $3,080,767,801 was in gold coin and bullion, $473,197,959 in standard silver dollars and $232,222,651 in subsidiary silver. The money in circulation on Aug. 1 was $5,559,396,561, or $52.44. per capita. On Aug. 1, 1917, the per capita circulation was $46.53.

Silver—Silver quotations unchanged. China demand continues urgent, and there is a good profit in exchange by buying silver over $1 per oz. and shipping to China. It seems probable that our Government will take steps to prevent such shipments, otherwise the U. S. Government and her Allies will be unable to buy silver on the Government basis of $1 per oz. for war needs.

Mexican dollars at New York: Aug. 8, 77; Aug. 9, 77; Aug. 10, 77; Aug. 12, 77; Aug. 13, 77; Aug. 14, 77.

Platinum, Palladium and Iridium—Prices fixed at $105, $135 and 175, respectively.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 10—Blende, per ton, high, $76.90; basis 60% zinc, premium, $75; Class B $65@60; Prime Western $47.50@45; calamine, basis 40% zinc, $37.50@30. Average selling prices: blende, $54.86; calamine, $35.81; all ores, $54.16.

Lead, high, $102.96; basis 80% Pb, $100; average selling price, all grades of ore, $100.75 per ton.

Shipments the week: Blende, 10,606; calamine, 399, lead 1092 tons. Value, all ores the week, $706,110.

The blende market strengthened materially today, with all buyers going out of the market short of purchasing the amounts ordered.

Though the lead basis is still quoted $100, active buying crowds up some settlements to a point that indicates a higher basis. Two of the buyers are finding it hard to compete and secure any ore.

No matter how light the buying next week, sellers will probably hold firm for stronger prices in line with the stronger spelter market.

Platteville, Wis., August 10.—Blende, basis 60% zinc, highest settlement price reported was $70 per ton; premium grade, base $75 per ton; high-lead blende, base $50 per ton.

Lead ore, basis 80% lead, $93 per ton base. Shipments reported for the week were 2510 tons blende, 146 tons galena, and 869 tons sulphur ore. For the year to date the totals are 79,667 tons blende, 4506 tons lead, and 31,219 tons sulphur ore. During the week 2906 tons blende were shipped to separating plants.

Other Ores

Chrome Ore—Considerable business was again done at $1.70 per unit for 50% material.

Manganese Ore—Unchanged.

Molybdenum Ore—Unchanged.

Tungsten—The market is very active in high-grade ores. Price of high-grade wolframite is $23-24.50; highest-grade scheel-

ite is quoted at $24.50 to $25. Impure ores are much neglected, but are quoted at $18 to $20 per unit, according to amount of impurity.

Other Minerals

Pyrites—Spanish lump is quotable to those who possess a license from the Government at 17c. per unit on the basis of 9s. ocean freight, buyer to pay war risk, less 2% and excess freight. Tonnage is extremely difficult to obtain. Domestic pyrites is selling at a price of 25c. per unit, f.o.b. mine, according to delivery basis. Some mines in the South are reporting prices as 34c. per unit for lump and 32c. per unit for fines f.o.b. mines. Unchanged.

Iron Trade Review

PITTSBURGH—Aug. 13

The report of steel-ingot production in July shows an annual rate of about 42,250,000 gross tons, or 3% less than the rate in June. July was the first month since January to show a decreased rate, but, considering the sharp decrease that has always occurred in July, the output is regarded as satisfactory. August, during which the weather has been still hotter than last month thus far, is likely to show a further decrease, but heavy outputs are expected in September and October.

Distribution of steel products to jobbers this month will be fairly adequate in the case of pipe and wire products, but bar, sheet and plate distribution will be extremely light. The regulations as to shipments to jobbers do not include tine and terne plate. The former is going entirely for food products, whereas the latter is now hardly made at all.

No additional information is forthcoming as to the project to build additional blast furnaces and openhearth furnaces to provide more steel for war purposes, but a favorable decision may be reached, the new construction to be more or less under Government auspices. Meanwhile, it is understood that the Jones & Laughlin Steel Co. has just decided to build an additional blast furnace on its own account.

The shortage of raw steel for the finishing departments that are not filled with Government orders continues acute. The sheet mills receive less than 60% of their full supply, this amount doing little more than take care of war orders, and merchant mills are not faring much better.

Pig Iron

Pig Iron—There is less selling of pig iron for delivery in the first half of 1919, as it has been made fairly plain that the War Industries Board does not favor such business as a rule. Sales for early deliveries are confined almost entirely to business caused by allocations. The furnaces in this general district are operating fairly well, with an adequate supply of coke, except in occasional instances. The market remains quotable at the set limits: Bessemer, $35.20; basic, $32; foundry, $33; malleable, $33.50; forge, $32, f.o.b. furnace, freight from Valleys to Pittsburgh being $1.40 and from six detached furnaces somewhat less.

Steel

Steel—Only small and occasional lots of discard steel are coming into the market, and there is no soft steel at all in billet or sheet bar form, except what is shipped on contract or comes out by allocations. The market remains quotable at the set limits: Billets, $47.50; sheet bars and small billets, $51; slabs, $50; rods, $57.

Ferroalloys

Ferromanganese—The market is quiet, with demand limited and consumers apparently well supplied. Ferromanganese is quoted at $250, delivered, for 70%, with $4 a unit for higher manganese content and 16% spiegeleisen at $75, f.o.b. furnace.

Coke

Coke—There are fairly large offerings of foundry coke in the market, and some foundries are believed to be stocking up. Furnace coke rarely reaches the open market, as the Fuel Administration has been watching the situation closely, and surplus coke is promptly discovered and allocated where it will do the most good. Most of the furnaces would be glad to stock some coke, but they rarely have an opportunity to do so. Connellsville coke remains at $6 for furnace, $7 for foundry, 72-hour selected, and $7.30 for crushed, over ¾-in., these being the set limits. Coke screenings from old dumps when clean and over ¾-in. bring $6.50 as an open market price, the limit being $7.30.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36.682	44.356
Feb.	56.755	77.585	85.716	26.975	37.742	42.792
Mar.	57.935	73.861	88.082	27.597	36.410	43.620
April	64.415	73.875	95.346	30.662	36.963	47.215
May	74.269	74.745	99.505	35.477	37.940	48.980
June	65.024	76.971	99.500	31.060	39.065	48.875
July	62.940	79.010	99.625	30.000	40.110	48.813
Aug.	66.083	85.407	.....	31.498	43.418	.....
Sept.	68.515	100.740	.....	32.584	50.920	.....
Oct.	67.855	87.332	.....	32.361	44.324	.....
Nov.	71.604	85.891	.....	34.192	43.584	.....
Dec.	75.765	85.960	.....	36.410	43.052	.....
Year	65.661	81.417	.....	31.315	40.851	.....

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

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28.673	23.500	131.921	110.000	142.895	125.000
Feb.	31.750	23.500	137.895	110.000	148.100	125.000
Mar.	31.481	23.500	136.750	110.000	151.000	125.000
April	27.935	23.500	133.842	110.000	147.158	125.000
May	28.788	23.500	130.000	110.000	142.000	125.000
June	29.962	23.500	130.000	110.000	142.000	125.000
July	26.620	25.904	128.409	119.913	140.409	134.913
Aug.	25.380	.....	122.391	.....	137.000	.....
Sept.	25.073	.....	117.500	.....	135.250	.....
Oct.	23.500	.....	110.000	.....	125.000	.....
Nov.	23.500	.....	110.000	.....	125.000	.....
Dec.	23.500	.....	110.000	.....	125.000	.....
Year	27.180	.....	124.892	.....	138.401	.....

Tin	New York		London	
	1917	1918	1917	1918
January	44.175	85.500	185.813	293.227
February	51.420	92.000	198.974	311.525
March	54.388	(a)	207.443	318.875
April	55.910	(a)	220.171	329.905
May	63.173	(a)	245.114	364.217
June	62.053	(a)	242.083	331.925
July	62.570	(a)	242.181	360.347
August	62.681	.....	243.978	.....
September	61.542	.....	244.038	.....
October	61.851	.....	247.467	.....
November	74.740	.....	274.943	.....
December	87.120	.....	298.556	.....
Av. year	61.802	.....	237.563	.....

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6.782	7.530	6.684	30.500	29.50
February	8.636	6.973	8.595	6.899	30.500	29.50
March	9.199	7.201	9.120	7.091	30.500	29.50
April	9.288	6.772	9.158	6.701	30.500	29.50
May	10.207	6.818	10.202	6.704	30.500	29.50
June	11.171	7.611	11.123	7.511	30.500	29.50
July	10.710	8.033	10.644	7.750	30.500	29.50
August	10.594	.....	10.518	.....	30.500	.....
September	8.680	.....	8.611	.....	30.500	.....
October	6.710	.....	6.650	.....	30.500	.....
November	6.249	.....	6.187	.....	30.500	.....
December	6.375	.....	6.312	.....	30.500	.....
Year	8.787	.....	8.721	.....	30.500	.....

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9.619	7.836	9.449	7.661	48.329	54.000
February	10.045	7.814	9.875	7.639	47.000	54.000
March	10.300	7.461	10.130	7.286	47.000	54.000
April	9.459	6.890	9.289	6.715	54.632	54.000
May	9.362	7.314	9.192	7.114	54.000	54.000
June	9.371	8.021	9.201	7.791	54.000	54.000
July	8.643	8.373	8.473	8.338	54.000	54.000
August	8.360	.....	8.190	.....	54.000	.....
September	8 136	.....	7.966	.....	54.000	.....
October	7.983	.....	7.813	.....	54.000	.....
November	7.847	.....	7.672	.....	54.000	.....
December	7.685	.....	7.510	.....	54.000	.....
Year	8.901	.....	8.813	.....	52.413	.....

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

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35.95	$37.25	$30.95	$33.95	$30.95	$33.95
February	36.37	37.25	30.95	33.95	30.95	33.95
March	37.37	37.25	33.49	33.95	35.91	33.95
April	42.23	36.15	38.90	32.95	40.06	33.95
May	46.94	36.20	42.84	33.00	43.60	34.00
June	54.22	36.36	50.05	33.16	50.14	34.16
July	57.45	36.60	53.80	33.40	53.95	34.40
August	54.17	.....	50.37	.....	53.95	.....
September	46.40	.....	42.24	.....	48.58	.....
October	37.25	.....	33.95	.....	33.95	.....
November	37.25	.....	33.95	.....	33.95	.....
December	37.25	.....	33.95	.....	33.95	.....
Year	$43.57	.....	$39.62	.....	$40.83	.....

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.† Aug. 13	
Alaska Gold M.	3⅛
Alaska Juneau	2
Am.Sm.& Ref.,com.	78⅜
Am. Sm. & Ref., pf.	105
Am. Sm. Sec., pf., A	89½
Am. Zinc	18
Am. Zinc, pf.	49½
Anaconda	66⅛
Batopilas Min	1½
Bethlehem Steel	84½
Bethlehem Steel, pf.	‡88½
Butte & Superior	25⅛
Butte Cop. & Zinc	11⅛
Cerro de Pasco	34½
Chile Cop.	16
Chino	39
Colo. Fuel & Iron	47½
Crucible Steel	66⅛
Crucible Steel, pf.	90½
Dome Mines	8½
Federal M. & S.	10½
Federal M. & S., pf.	33
Great Nor., ore ctf.	32½
Greene Cananea	43⅞
Gulf States Steel	83½
Homestake	75
Inspiration Con.	52½
InternationalNickel	30⅜
Kennecott	34
Lackawanna Steel	84½
Mexican Petrol	101
Miami Copper	28½
Nat'l Lead, com.	58½
National Lead, pf.	103
Nev. Consol.	20
Ontario Min	9⅞
Ray Con	24
Republic I.&S.,com.	92½
Republic I. & S., pf.	101
Sloss-Sheffield	62
Tennessee C. & C.	19½
U. S. Steel, com.	112
U. S. Steel, pf.	110½
Utah Copper	82
Va. Iron C. & C.	72½

BOSTON CURB* Aug. 13	
Alaska Mines Corp.	.12
Boston Ely	.65
Boston & Mont.	.51
Butte & Lon'n Dev.	.14
Calaveras	.50
Calumet-Corbin	‡.01
Chief Con.	2½
Cortes	.08
Crown Reserve	.17
Crystal Cop.	.37
Eagle & Blue Bell	2½
Gila Copper	‡17
Houghton Copper	.50
Intermountain	‡.05
Iron Cap	19½
Mexican Metals	.45
Mines of America	1
Mojave Tungsten	.09
Nat. Zinc & Lead	.15
Nevada-Douglas	.51
New Baltic	.90
New Cornelia	18½
Oneco	.20
Pacific Mines	‡.35
Rex Cons.	.07
Yukon Gold	1

SAN FRAN.* Aug. 12	
Alta	.03
Andes	.05
Best & Belcher	.03
Caledonia	‡.03
Challenge Con.	.03
Confidence	.06
Con. Virginia	.21
Gould & Curry	.01
Hale & Norcross	‡.01
Jacket-Cr. Pt.	.07
Mexican	.18
Occidental	‡.51
Ophir	.06
Overman	.02
Savage	.03
Sierra Nevada	.03
Union Con.	.38
Utah Con.	.01
Belmont	2.75
Jim Butler	.58
MacNamara	.32
Midway	.04
Mont.-Tonopah	.09
North Star	.07
Rescue Eula	.09
West End Con.	1.05
Atlanta	.03
Booth	.04
Comb. Frac.	‡.02
Florence	.11
Jumbo Extension	.09
Kewanas	.03
Nevada Hills	.01
Nevada Packard	.27
Round Mountain	.18
Silver Pick	.03
White Caps	.26
Big Jim	‡.75
United Eastern	3.50

COLO. SPRINGS* Aug. 12	
Cresson Con.	4.75
Doctor Jack Pot	.03
Elkton Con.	.04½
El Paso	.10
Gold Sovereign	‡.02
Golden Cycle	1.66
Granite	.18½
Isabella	.04½
Mary McKinney	.07½
Portland	.81
United Gold M.	.14
Vindicator	.40

BOSTON EXCH.* Aug. 13	
Adventure	‡.60
Ahmeek	75½
Algomah	‡.15
Alloues	50
Ariz. Com., ctfs.	15½
Arnold	‡.20
Bingham Mines	19½
Bonanza	‡.15
Butte-Balaklava	‡.25
Calumet & Ariz.	67½
Calumet & Hecla	460
Centennial	‡12½
Copper Range	48½
Daly West	12½
Davis-Daly	5½
East Butte	9½
Franklin	‡4½
Granby	‡79½
Hancock	16
Hedley	‡12
Helvetia	‡.15
Indiana	.50
Isle Royale	26
Keweenaw	1½
Lake	‡5½
La Salle	‡2½
Mason Valley	‡3½
Mass	‡5
Mayflower	‡2½
Michigan	2½
Mohawk	57
New Arcadian	1½
New Idria	‡14
North Butte	14½
North Lake	‡.60
Ojibway	‡.50
Old Dominion	‡42
Osceola	50
Quincy	68½
St. Mary's M. L.	‡50
Santa Fe	.60
Seneca	1½
Shannon	‡3½
Shattuck-Ariz.	‡16
So. Lake	‡1
So. Utah	‡.13
Superior	‡5
Superior & Bost.	1½
Trinity	‡3
Tuolumne	1½
U. S. Smelting	42½
U. S. Smelt'g, pf.	‡43½
Utah Apex	‡1⅛
Utah Con.	‡10
Utah Metal	‡2
Victoria	‡2½
Winona	1½
Wolverine	‡26½
Wyandot	‡.50

N. Y. CURB† Aug. 13	
Big Ledge	1⅛
Butte & N. Y.	‡.75
Butte Detroit	1.11
Caledonia	.48
Calumet & Jerome	1⅛
Can. Cop. Corpn.	1⅛
Carlisle	‡2
Cashboy	.05
Con. Ariz. Sm.	1½
Con. Coppermines	4½
Con. Nev.-Utah	‡⅛
Emma Con.	‡.10
First Nat. Cop.	‡2
Goldfield Con.	‡.24
Goldfield Merger	‡.03
Greenmonster	⅛
Hecla Min	4½
Howe Sound	‡4½
Jerome Verde	.50
Kerr Lake	5½
Louisiana	‡⅛
Magma	‡32
Majestic	‡.18
Marsh	.04
McKinley-Dar-Sa.	.40
Milford	‡.75
Mohican	‡.06
Mother Lode	.36
N. Y. & Hond.	‡12½
Nipissing Mines	8.65
Nixon Nevada	.50
Ohio Cop.	‡1⅛
Rawley	‡2½
Ray Hercules	4½
Richmond	‡.56
Rochester Mines	.37
St. Joseph Lead	14½
Standard S. L.	⅛
Stewart	‡.13
Success	‡.12
Tonopah	‡2½
Tonopah Ex.	1½
Tribullion	‡⅛
Troy Arizona	.12
United Cop.	‡⅛
United Verde Ext.	37½
United Zinc	11½
Utica Mines	‡.08

TORONTO* Aug. 13	
Adanac	.06
Bailey	.03
Beaver Con.	.23
Chambers Ferland	.12
Coniagas	2.50
Hargraves	.04
La Rose	.35
Peterson Lake	.09
Temiskaming	.30
Wettlaufer-Lor.	.04
Davidson	.25
Dome Exten.	.11
Dome Lake	.13
Hollinger	4.57
McIntyre	1.40
Newray	.15
Porcu. Crown	.12
Teck-Hughes	.13
Vipond	.12
West Dome	.09

* Bid prices. † Closing prices. ‡ Last Quotations.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York—Current	New York—One Yr. Ago
No. 10	4.25	5.52	5.52	6.50	5.495	9.50
No. 12	4.30	5.57	5.57	6.55	5.545	9.55
No. 14	4.35	5.62	5.62	6.60	5.595	9.60
Black						
Nos. 18 and 20	4.80	6.32	6.32	7.40	6.295	9.80
Nos. 22 and 24	4.85	6.37	6.37	7.45	6.345	9.85
No. 26	4.90	6.42	6.43	7.50	6.395	9.90
No. 28	5.00	6.52	6.52	7.60	6.595	10.00
Galvanized:						
No. 10	5.25	6.97	6.97	....	6.845	.....
No. 12	5.35	6.97	6.97	7.95	6.795	.....
No. 14	5.35	6.97	6.97	8.10	6.945	11.65
Nos. 18 and 20	5.65	7.17	7.17	8.25	7.245	11.85
Nos. 22 and 24	5.80	7.32	7.32	8.40	7.295	12.55
No. 26	5.95	7.47	7.47	8.55	7.445	12.70
No. 28	6.25	7.77	7.77	8.85	7.745	13.00

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails	$55.00	$38.00	$65.00	$38.00
Standard openhearth rails	57.00	40.00	67.00	40.00
Light rails, 8 to 10 lb	3.13½*	83.00	3.13½*	68.00
Light rails, 12 to 14 lb	3.09*	82.00	3.09*	67.00
Light rails, 25 to 45 lb	3.00*	75.00	3.00*	65.00

* Government price per 100 lb.

TRACK SUPPLIES—The following prices are base per 100 lb. f. o. b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, ⅝-in. and larger	$3.90	$5.00	$4.50	$5.30	$6.70
Track bolts	4.90	6.25	5.50	Premium	8.00
Standard section angle bars	....	3.65	4.45	Premium	5.15

STRUCTURAL MATERIAL—The following are the base prices f. o. b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill, Pittsburgh	New York—Current	New York—1 Yr. Ago	St. Louis	Chicago	San Francisco	Dallas
Beams, 3 to 15 in.	$3.00	$4.245	$5.25	$4.27	$4.27	$5.25	$5.50
Channels, 3 to 15 in.	3.00	4.245	5.25	4.27	4.27	5.25	5.50
Angles, 3 to 6 in. ¼ in. thick	3.00	4.245	5.25	4.27	4.27	5.25	5.50
Tees, 3 in. and larger	3.00	4.245	5.30	4.27	4.27	2.55	5.50
Plates	3.25	4.495	9.00	4.52	4.52	5.50	6.50

STEEL SHEET PILING—The following price is base per 100 lb. f. o. b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$4–5	$4–5	$3.10

RIVETS—The following quotations are per 100 lb.:

	Mill Pittsburgh	New York—Current	New York—One Year Ago	Chicago	St. Louis	San Francisco	Dallas
STRUCTURAL Warehouse							
½-in. and larger	$4.65	$5.65	$7.00	$5.57	$5.55	$7.15	$8.00
CONE HEAD BOILER							
½ in. and larger	4.75	5.75	7.10	5.67	5.65	7.25	8.00
⅝ and ¾	4.90	5.90	7.25	5.82	5.80	7.40	8.15
⅞ and 1	5.25	6.25	7.60	6.17	6.05	7.75	8.50

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Galvanized iron rigging	List + 20%
Galvanized cast steel rigging	Net List
Bright plow steel	30%
Bright cast steel	17½%
Bright iron and iron tiller	5%

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight	$5.75	$7.00	$6.50	$6.25	$8.00	$7.50
Assorted	5.90	7.00	6.50-7	6.40	8.25	7.75

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh

Iron bars 3.5c. Steel bars 2.90c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0.16½	$0.18	$0.19	$0.17	$0.16½

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham
Solid	15c.	14c.	15c.
Hollow	24c.	25c.	...

PIPE—The following discounts are for carload lots f. o. b. Pittsburgh, basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

Butt Weld

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
⅛, ¼ and ⅜	44%	17%	⅛ to 1¼	33%	17%
½	48%	33½%			
¾ to 3	51%	37½%			

Lap Weld

2	44%	31½%	2	26%	12%
2½ to 6	47%	34½%	2½ to 4	28%	15%
			4½ to 6	28%	15%

Butt Weld. Extra Strong Plain Ends

⅛, ¼ and ⅜	40%	22½%	⅛ to 1¼	33%	18%
½	45%	32½%			
¾ to 1½	49%	36½%			

Lap Weld. Extra Strong Plain Heads

2	42%	30½%	2	27%	14%
2½ to 4	45%	33½%	2½ to 4	29%	17%
4½ to 6	44%	32½%	4½ to 6	28%	16%

Note—National Tube Co. quotes on basing card dated Apr. 1.

From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Cleveland	Black Chicago
⅛ to 3 in. butt welded	33%	43%	41.9%
3½ to 6 in. lap welded	15%	39%	37.9%

	Galvanized New York	Galvanized Cleveland	Galvanized Chicago
⅛ to 3 in. butt welded	16%	28%	26.9%
3½ to 6 in. lap welded	3%	25%	23.9%

Malleable fittings, Class B and C, from New York stock sell at list price. Cast iron, standard sizes, 5 and 5%.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York—Current	New York—One Year Ago	Cleveland—Current	Cleveland—One Year Ago	Chicago—Current	Chicago—One Year Ago
Hot pressed square	$2.50*	List	$1.40	$1.65	$1.05	$3.00
Hot pressed hexagon	2.50*	List	1.20	1.50	.85	3.00
Cold punched square	2.50*	List	.75	1.40	1.00	1.75
Cold punched hexagon	2.50*	List	.75	1.40	1.00	2.25

* List plus.

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50%
Chicago	50%	50%
Cleveland	60%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	30—5%	46%	45%
Larger and longer up to 1 in. by 30 in.	15%	40%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York $2.50 Cleveland $3.00 Chicago $2.50

For cast-iron washers the base price per 100 lb. is as follows:
New York $5.00 Cleveland $4.00 Chicago $3.50

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f. o. b. New York or Chicago:

	Carload Lots	Less Than Carload Lots
Tarfelt (14 lb. per square of 100 sq. ft.)	$64	$65
Tar pitch (in 400-lb. bbl.)	21	22
Asphalt pitch (in barrels)	37	42
Asphalt felt	72.50	77.20

PREPARED ROOFINGS—Standard grade rubbered surface complete with nails and cement costs per square as follows in New York and Chicago:

	1-Ply c.l.	1-Ply l.c.l.	2-Ply c.l.	2-Ply l.c.l.	3-Ply c.l.	3-Ply l.c.l.
No. 1 grade	$1.30	$1.55	$1.60	$1.75	$1.90	$2.50
No. 2 grade	1.15	1.30	1.45	1.60	1.75	1.90

Asbestos asphalt-saturated felt (14 lb. per square) costs $5.35 per 100 lb. Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $1.95 per roll in carload lots and $2.20 for smaller quantities.

Shingles, red and green slate finish, cost $5.25 per square in carloads, $5.50 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4 x 12 x 12	8 x 12 x 12	12 x 12 x 12
St. Paul	.056	.11	.162
Kansas City	.0786	.15	.205
Seattle	.09	.175	.30
Los Angeles	.0633	.1071	.1966
Cincinnati	.07275	.1361	.1834
Boston	.11	.15	.24

LUMBER—Price per M in carload lots:

	8 x 8-In. x 20 Ft. and Under			12 x 12-In. 20 Ft. and Under	
	Y. P.	Fir	Hemlock	Spruce	Y.P.	Fir
Boston	Government only					
Cincinnati	$39.00	.....	$38.00	.....	$43.00	$42.00
Kansas City	38.00	45.50	40.50	$38.50	43.00	42.50
Seattle	24.50	24.50	24.50	24.50	24.50	24.50
St. Paul	.....	52.00	48.00	48.00	.....	60.00
Denver	43.00	36.50	.....	.....	.....	40.00

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and G. 10 In. x 16 Ft.	
	Y.P.	Fir	Hemlock	Y.P.	Fir
Boston	Government only				
Cincinnati	$45.00	.....	$41.00	$44.00	$40.00
Kansas City	45.50	$24.75	54.75	52.25	60.00
Seattle	24.50	24.50	24.50	24.50	24.50
St. Paul	62.50	45.00	43.00	47.50	47.50
Denver	43.00	34.00	34.00	.....	32.50

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	$3.50	$4.50	$4.75	$4.32	$5.05
Cut	4.00	5.40	....	4.47	6.40

PORTLAND CEMENT—These prices are for barrels in carload lots, including bags:

	Current	One Month Ago	One Year Ago
New York	$2.85	$2.85	$2.22
Jersey City	2.84	2.84	2.16
Boston	2.90	2.81	2.77
Chicago	2.45	2.36	2.31
Pittsburgh	2.15	2.45	2.31
Cleveland	2.32	2.68	2.44
Denver	3.02	2.99	2.39

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 300-Lb. Barrel	
	Finished	Common	Finished	Common
New York	$16.50	$13.50	$2.35	$2.10
Kansas City	22.00	20.00	2.20*	2.10*
Chicago	18.00	17.50	1.80*	1.10*
St. Louis	14.00	.....	.....	1.50
Boston	21.50	16.50	3.55	3.05
Dallas	16.50	.....	.....	.....
San Francisco	19.50	.....	.....	1.90
St. Paul	20.00	14.00	1.40	1.30
Cincinnati	14.20	13.20	.....	11.95(ton)
Denver	.....	26.25	.....	2.40*
Seattle	23.00	23.00	.....	2.50†

* 200-lb. barrels. † Per 180-lb. barrel.
Note—Refund of 10c. per bag, amounting to $2 per ton.

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw per barrel	$1.86	$1.16	$2.10	$1.20	$2.05	$1.17
5-gal. cans	1.96	1.26	2.25	1.35	2.25	1.27

WHITE AND RED LEADS in 500-lb. lots sell as follows in cents per pound:

	Red				White			
	Current		1 Year Ago		Current		1 Yr. Ago	
	Dry	In Oil	Dry	In Oil	Dry and In Oil	In Oil	Dry and In Oil	In Oil
100-lb. keg	14.00	14.50	13.25	13.50	14.00		13.00	
25- and 50-lb. kegs	14.25	14.75	13.50	13.75	14.25		13.25	
12½-lb. keg	14.50	15.00	13.75	14.00	14.50		13.50	
5-lb. cans	.....	.....	15.25	15.50	16.00		15.50	
1-lb. cans	.....	.....	.....	.....	17.00		.....	

MINING AND MILLING SUPPLIES

HOSE—

Fire	50-Ft. Lengths
Underwriters' 2½-in	75c. per ft.
Common, 2½-in	40½%

Air	First Grade	Second Grade	Third Grade
¾-in. per ft	$0.60	$0.35	$0.30

Steam—Discounts from List

First grade..... 25% Second grade.....30% Third grade.....40%

LEATHER BELTING—Present discounts from list in the following cities are as follows:

	Medium Grade	Heavy Grade
New York	40%	35%
St. Louis	40+5%	35%
Chicago	45%	40+5%
Birmingham	35%	35%
Denver	40%	30%
Cincinnati	40—10%	40%

RAWHIDE LACING—40—5% off list.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ½-in., 8 ft., ¾-in., 6; ⅞-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ½-in. and larger, in 1200-ft. coils:

Boston	$0.34½	Denver	$0.35½
New York	.36	Kansas City	.34
Cincinnati	.33½	San Francisco	.32
Chicago	.33	Seattle	.34
St. Paul	.34	St. Louis	.34

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0.99
Asbestos for high-pressure steam	1.76
Duck and rubber for piston packing	1.10
Flax, regular	.99
Flax, waterproofed	1.21
Compressed asbestos sheet	1.10
Wire insertion asbestos sheet	1.30
Rubber sheet	.66
Rubber sheet, wire insertion	.99
Rubber sheet, duck insertion	.55
Rubber sheet, cloth insertion	.25
Asbestos packing, twisted or braided and graphited, for valve stems and stuffing boxes	1.21
Asbestos wick, ½- and 1-lb. balls	.75

REFRACTORIES—Following prices are f.o.b. works, Pittsburgh:

Chrome brick	net ton	$175.00
Chrome cement	net ton	75.00
Clay brick, 1st quality fireclay	per 1000	50.00—$55.00
Clay brick, 2nd quality	per 1000	35.00— 40.00
Magnesite, raw	ton	30.00— 35.00
Magnesite, calcined	ton	32.00— 35.00
Magnesite, dead burned	net ton	32.00— 35.00
Magnesite brick, 9 x 4½ x 2½ in	net ton	110.00—125.00
Silica brick	per 1000	50.00— 60.00

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.
St. Louis—High grade, $55; St. Louis grade, $40.
Birmingham—Fire clay, $55–60; silica, $55–60.
Chicago—Second quality, $25 per ton.
Denver—Silica, $35 per 1000.

RAILWAY TIES—For fair size orders, the following prices per tie hold:

	Material	7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
St. Louis	No. 1 White Oak	$1.45	$1.25
Chicago	Plain	1.40	1.25
San Francisco	Douglas Fir—Green	1.35	.96
San Francisco	Douglas Fir—Creosoted	2.70	1.92

GREASES—Prices are as follows in the following cities in cents per pound for barrel lots:

	Cincinnati	Chicago	St. Louis	Birmingham	Denver
Cup	7	5½	13	8½	12½
Fiber or sponge	8	6	13	8½	20
Transmission	7	6	13	9	20
Axle	4½	4	4.1	3½	5½
Gear	4½	4½	7.0	8	9
Car journal	22 (gal.)	3½	4.3	5½	8½

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels:

			Denver	
	New York	Chicago	In Bbl. Lots	In Carload Lots
Pure steam-distilled pine oil, sp. gr. 0.925-0.94	$0.58	$0.65	$0.30	$0.27
Pure destructively distilled pine oil	.58	.52	.30	.....
Pine tar oil	.35	.34	.24½	.19
Crude turpentine	.45	.....	.44	.38
*Hardwood creosote, sp. gr. 0.96-0.99	.23	.....	.34½	.31

* F.o.b. Cadillac, Mich.

COTTON WASTE—The following prices are in cents per pound:

	New York		Cleveland	Chicago
	Current	One Year Ago		
White	11.00 to 13.00	13.00	16.50	12.00 to 16.50
Colored mixed	8.50 to 12.00	10.00	13.00	11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½ x 13½	13½ x 20½
Cleveland	$52.00	$58.00
Chicago	48.00	50.00

EXPLOSIVES—Price per pound of dynamite in small lots and price per 25 lb. keg for black powder:

	Low Freezing	Gelatin			Black
	20%	40%	60%	80%	Powder*
New York	.....	$0.27½	$0.34½	.....	$2.40
Boston	$0.24½	.27½	.34½	.41½	2.40
Kansas City	.20	.26½	.33½	.43½	2.45
Seattle	.17½	.23½	.31¼	.41½	2.35
Chicago	.18½	.22½	.33	.43	2.35
St. Paul	.19	.23	.28	.43½	2.75
St. Louis	.19	.26½	.33½	.43½	2.35
Denver	.18	.25½	.32½	.42½	2.45
Dallas	.23	.30½	.37½	.47½	.....
Los Angeles	.22	.28	.36	.....	.....
San Francisco	.19½†	.26½†	.33½†	.43½†	2.35

* Per keg. † In carload lots.

CHEMICALS

SODIUM CYANIDE—New York price is 39c. per lb.; Denver, 44c.; Chicago, .38.5; St. Louis, 45c.

SODIUM SULPHIDE—In New York the price per pound is 4c. to 4½c. for concentrated, 2½c. to 2½c. for crystals. The Denver price for 60% is 6 to 10c.; the St. Louis price, 5c. for concentrated; the Chicago price is 6½c. Concentrated comes in 500-lb. drums, the crystals in 440-lb. bbl.

ZINC DUST—For 350 mesh the New York price is 16c. per lb.; Chicago, 18½c.; Denver, 13c. f.o.b. Pueblo; St. Louis, 35c.

ALUMINUM DUST—Chicago price is $1.65 per lb.

MINERS' LAMP CARBIDE—Prices net f.o.b. cars at warehouse points.

	Union 100-Lb. Drums Per Ton	Cameo 100-Lb. Drums Per Ton	Union 25-Lb. Drums Per Drum
East of the Mississippi, North of Chattanooga	$106.00	$101.00	$1.52
Southeastern portion U. S. A.	115.50	110.50	1.63
Texas (except El Paso)	124.00	119.00	1.74
El Paso, Texas	126.00	121.00	1.77
Denver, Colo.	124.00	119.00	1.74
West Coast	129.00	124.00	1.81