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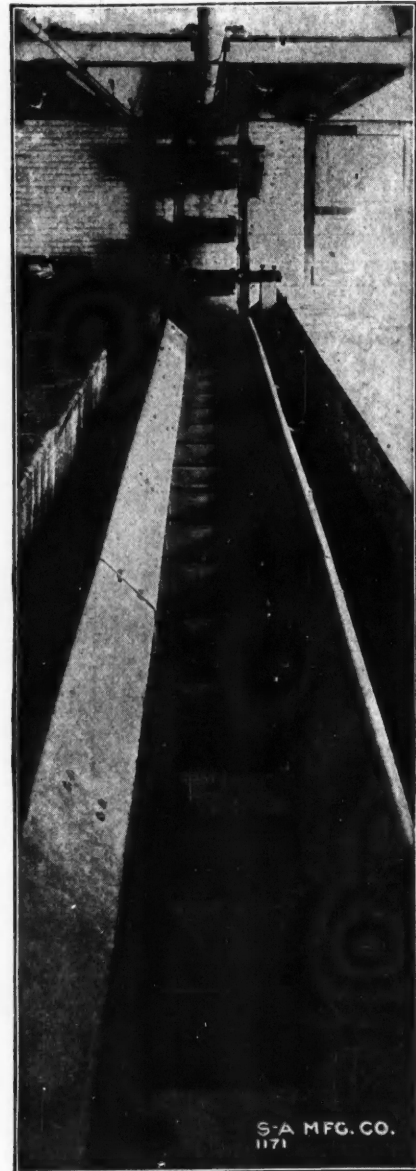
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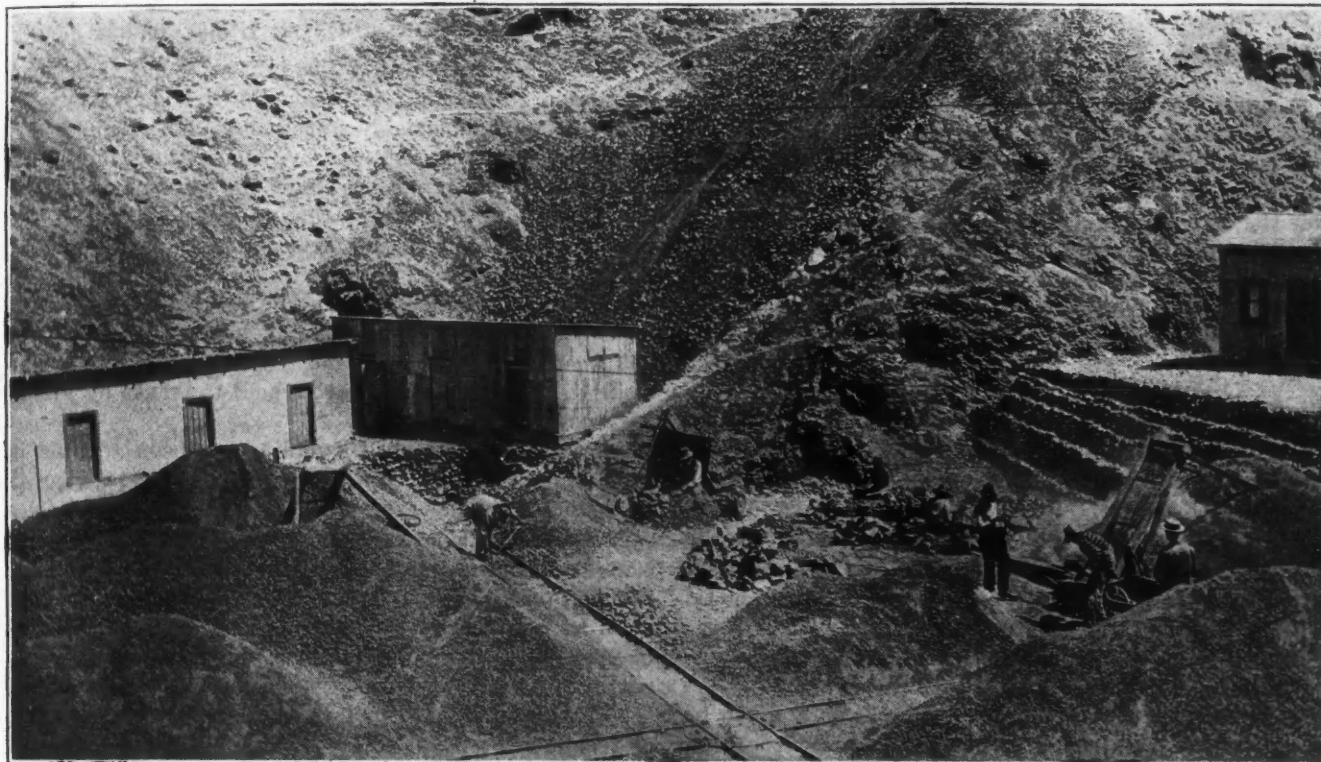
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PREPARATION OF COPPER ORE AT PUQUIOS, CHILE

The Importance of Particle-Size Reduction Before Sampling for Assay

BY A. W. ALLEN

Efficient sampling of broken rock is impossible without previous consideration of two important factors—fineness and homogeneity. The superiority of a sample of an ore which has been ground to a comparatively fine mesh is obvious, especially when it is realized that the process of grinding almost invariably effects a more even distribution of the valuable metals throughout the mass. Assays of samples are used to calculate the metallic contents of ores and the result of metallurgical operations, and it is important to know which class of samples can be relied on to

give more consistent and truthful results, and to represent, as nearly as possible, the average of the whole mass from which they are taken. A study of the question will indicate that uniform fineness has much to do with efficient work, and it is therefore reasonable to place more reliance on the sampling of ore that has been ground and mixed than on determinations made on that which is in an unhomogeneous condition and contains a proportion of material of large size and uncertain, though obviously variable, metal content. Residue samples usually give reliable results.

WHEN a sample of ore is to be prepared for assay or chemical analysis, one of the most important precautions to be observed is that it be ground sufficiently fine to insure homogeneity. One or more weighed portions are taken for the test, and it is necessary that the results from duplicate or tripli-

cate estimations should be in close agreement. By grinding the sample no appreciable alteration is made in the total metal or mineral content. The constituents are more evenly distributed than when found in nature, and this is effected by a general division and subdivision of the whole sample, accompanied, as it invariably

is, by a commingling action which disseminates the valuable material more evenly through the mass.

The weighing of an assay ton or of a number of grams for estimation purposes is merely an elaboration of simple sampling. The charge resulting is representative of the larger sample, just as the latter is supposed to be representative of the tonnage of ore under consideration. Assaying would be merely a waste of time if regrinding were neglected and the charge for assay weighed without further reduction of the ore beyond the point needed to insure accurate weighing to an exact amount. With an unground sample, and other than under circumstances so exceptional that they are too rare to be taken into account, the selection of a representative charge would be impracticable. The fault would not be with the method of sampling, for, however the assayer wiggled the spatula, he could never be sure of obtaining an impartially representative proportion. The fault would be entirely with the manner of preparation of the ore—with a system which absolutely precluded efficient sampling.

FINE GRINDING ESSENTIAL IN ASSAYING

Fine grinding is essential in assaying, and, if it be not practiced, there are inconsistencies in results that, by a process of elimination, could be proved to arise from no other cause. These inconsistencies are due to the fact that it is usually impossible to weigh two or more separate charges from unground and unmixed ore, of average physical characteristics and average metal content, that will give concordant results.

The facts stated are obvious and of considerable importance in metallurgical work. If the principle is applied to ordinary sampling, radical changes must be made in many installations before anything approaching satisfactory results can be obtained. Sampling of ore feed is often carried out on material so coarse that, unless the metal is evenly disseminated, no two samples, taken over the same period, will agree. If the procedure is to be at all logical, the material should be uniformly reduced to form a homogenous mixture; and the test of the representativeness of a sample would be to copy assay practice and see if two or more independent samples, taken over the same period of time, agree as to metal content. If there is an appreciable difference, not explicable by other reasons, the sampling should be postponed until the ore is further reduced in size, and mixed, and until agreement of assay results is obtained.

BULLION-PLUS-RESIDUE METHOD

Reasons for the adherence of so many engineers to the bullion-plus-residue method of calculating recovery percentage are often sought. No other phrase of metallurgical operations is more clearly definable; but, to judge from the entire lack of a uniform system in the presentation of metallurgical results in company reports, it is obvious that it is little understood. Assuming an acceptance of the logical differentiation between the primary extraction of a product from an ore and final recovery in metallic form, it is easy to understand that an assay extraction refers to a figure calculated from assay differences only; whereas a recovery must necessarily be based on an actual known weight of metal.

It is impossible to compute, by a positive method such as direct weighing, the original metal content in a certain tonnage of ore. A calculation is, however, needed to furnish the complementary figure required in any metal-recovery estimation, and it may be effected by using either the assay of the head or tail sample. If the former is taken, then the entire calculation is often based on an error owing to the fact that it is impossible to obtain a representative sample by available means.

HEAD SAMPLING OFTEN UNRELIABLE

In a large number of mills I have found that head samples of unground ore, taken by a wide variety of methods, were invariably unreliable. I confirmed this conclusion in many instances by placing the sampling in the hands of different men during the same period. The results were so discordant that it was doubtful if the cost of assaying was justified. The fault did not lie with the samplers, or with the mechanical apparatus in use, but rested entirely with the system. The ore in these instances contained metal in variable quantity and unevenly distributed, and too little effort had been made to disseminate this throughout the mass by grinding and mixing.

An elaborate system of sampling has been adopted in some mills, but it has failed to merit general approval. In custom mills, however, where it is imperatively necessary to obtain as correct an estimate of the original content of the ore as possible, the expense of an amp's installation may be justified. The head sample, if taken from an unground feed, is in most cases unreliable. It may average within fairly close limits if taken over a period, but, on the whole, it is not suitable as a basis for the estimation of the metallurgical result of a scheme of treatment.

I do not wish to imply that, because sampling of unground ore usually results only in an approximate estimation of metal content, no effort at improvement should be made. The daily assay result of samples of feed to a mill is an essential requirement, to serve as a guide in computing averages, if for no other purpose. The theoretical or assay extraction may be calculated from the amounts of metal found, by assay, to exist in head and tail samples; and the result is of value for comparison with the actual recovery of product. The one forms a check on the other, and inequalities between the two should lead to an investigation.

RESIDUE SAMPLE USUALLY RELIABLE

The residue sample is the most reliable that can be secured. Reasons for this are obvious, but they will bear assembling and repetition. The material has been finely ground and intimately mixed during the mechanical process of reduction and conveyance. The final product to be discharged from a metallurgical plant is usually of homogeneous composition, so that a sample taken by ordinary methods is truly representative of the whole bulk. If there be any question about the correctness of a tailing or residue sample, the material can usually be resampled without trouble. Residues are often dumped, so that the checking and rechecking of metal contained is feasible. Indeed, the sampling of the face of a residue dump is so simple that it should be periodically carried out to verify the results from ordinary sampling.

The occurrence of coarse particles of metal in an ore, such as may be found in the head samples of many mills, introduces a source of error, and is almost certain to lead to the taking of an unrepresentative sample and the recording of erratic results. Here again the sampling is not to blame, because it is usually not feasible to secure a good sample under such conditions. Even if obtainable by extraordinary means, a further source of error is introduced by the fact that assaying is complicated by the presence of coarse metal, and sundry precautions and additional estimations are necessary. These sources of error are not in evidence if the residue sample is taken for assay, as, if such an estimation is incorrect, the trouble is remediable, and the cause easy to determine. The result of a determination for metal in residue may therefore be relied upon in most cases.

When the product is recovered in a pure or almost pure state, a second figure is available that gives a true record of the actual recovery. Bullion is, or should be, in homogeneous form, and so is easily sampled. Hence the reliability of the final result. The actual weight of fine or pure metal is calculated by positive methods, and there can be little opposition to the view that this represents the final recovery or gain by the process.

Placer Mining in the Yukon

A paper by W. E. Cockfield, containing the result of explorations in the Yukon, is included in Part B of the Summary Report of the Canadian Geological Survey for 1917. The area covered comprises over 1000 square miles in the Sixty-mile and Ladue River valleys. Placer gold has been mined on some of the tributaries of Sixty-mile River since 1893, Miller and Glacier creeks being the most important of the producers, and, as little geological work had been done in that area, it was deemed advisable to map the Klondike rocks along their strike. Furthermore, the finding of tungsten having been reported in the gravels of Sixty-mile River, it was considered important, in view of the war demand for that metal, to determine the nature of its occurrence.

The Sixty-mile and Ladue River valleys lie well within the physiographic province known as the Yukon plateau, which extends from northern British Columbia, through Yukon and Alaska to Bering Sea. Its topography consists of a series of long branching ridges occupying the space between intersecting streams. The inter-stream areas well back from the valley walls are prevailingly flat-topped and stand at an average elevation of 4000 to 4800 ft. The main topographic feature of the region studied by Mr. Cockfield is the divide between the Ladue and the Sixty-mile drainage, which swings in the form of a semicircle from near White River around the head of the north fork, a distance of over 100 miles measured along the divide. From the main divide ridges extend along the tributary streams to both master valleys, becoming progressively lower as these are approached.

The geological formations include sedimentary, igneous, and metamorphic rocks, of which the latter are most widespread, forming a series to which the name Yukon group has been applied. These are probably all pre-Cambrian in age. In point of areal distribution, the next most important series of rocks comprises volcanics and sediments, ranging from Tertiary to Recent in age.

Volcanics, which are referred to the Mesozoic, and small stocks of granite rocks, also of Mesozoic age, comprise the rest of the consolidated rocks of the district. Overlying the consolidated rock formations is a mantle of accumulations which includes gravels, sand, silt, clay, soil, muck, volcanic ash, and ground-ice. These cover the floors of the valleys to varying depths and extend over portions of the valley walls and upland.

Placer gold is the only mineral of economic value produced in the Sixty-mile district. Its distribution in the gravels of the Sixty-mile River and its tributaries is widespread, but thus far only a few creeks have been found rich enough to work. R. G. McConnell gives the total production up to 1901 as only \$500,000. After the discovery of the Klondike gold fields the district was deserted for a time, but in 1900 prospectors and miners began to return. At the time of the investigation about 45 men were engaged in mining operations in the district. The only portion of Sixty-mile River on which active work was being carried on was a stretch from the mouth of Miller Creek to a point a short distance below the mouth of Big Gold Creek. In the past the main workings have been confined to the bench gravels, but at present the creek gravels are receiving more attention.

Large portions of the bench gravels remain and the creek gravels are comparatively untouched. There are many points at which it is known that these can be worked at a profit. On the Little Gold Creek three men were working on a pay streak 100 ft. or more wide, the gold content running between 5 and 9c. per square ft. At the Discovery claim on the upper portion of Matson Creek bench gravels were being worked with a return ranging from 18c. to \$1 per ft. On the bench lying between Glacier and Big Gold creeks \$500 was recovered from a patch of ground comprising 80 sq. ft. Much ground which is known to contain gold remains to be worked on the creeks, and a small but steady production is expected for some years. In view of the geological conditions, there is no reason why the gold belt should be confined to the creeks where discoveries have been made, and the rest of the valleys of the area be barren.

The widespread distribution of the metamorphic rocks of the Yukon group, and the fact that they are cut at many places by later granitic, andesitic, and other intrusions, should indicate favorable conditions for the occurrence of placer gold. Float gold is known at several points in Ladue valley, and although no deposits of economic importance have been discovered, it must be borne in mind that very little prospecting has been done there. The ground in the master valleys is deep and therefore discouraging to the prospector, but equally good pay may be obtained by working the tributary streams, where results are more easily obtained. There is reason to believe that the producing field will be much enlarged in the future. No deposits of tungsten were found in any of the gravels examined.

A Chinese Company has been formed of which part of the capital will be subscribed by the Chinese government, for working the iron mines near Hsuanwafu, between Peking and Kalgan, and building blast furnaces. It is reported that the Japanese will lend 20,000,000 yen to finance the enterprise.

Standardization of Mining Methods VII—Prospecting and Development*

BY CHARLES A. MITKE†

In this paper, the seventh of the series, the author emphasizes the value of coöperation and foresight. The relation of footage to costs is explained. Practical notes on drilling and shoveling are followed by an account of time studies of the various operations, and the value of such checks on the subsequent standardization of methods and improvement in general efficiency.

ONE of the most important branches of mining, and one which, on account of its magnitude, the variety of its operations and amount of money involved, offers a large field for the introduction of standard methods, is that of "prospecting and development work." "Prospecting" and "exploration" are terms applied to all work directed toward the finding of ore, whereas the various headings driven through an orebody, preparatory to mining, are usually characterized as "development work."

There are two distinct classes of mines: those whose ore reserves are defined by churn drilling before production begins, and those which prospect and develop their reserves in the usual course of mining. To the first belong the large porphyries; the second takes in practically all the higher-grade mines. These so-called porphyries have the advantage of having their ore blocked out for many years ahead, so that an accurate estimate of the tonnage can be made and the size of their reserves determined in advance, whereas the higher-grade mines have a much smaller ore reserve. In this latter division are mines with monthly productions ranging from 2,000,000 to 7,000,000 lb. of copper, which have been steady producers for many years, but have rarely reserves of ore for more than a few years at any one time. During 1916, approximately 70% of all the copper produced in the United States came from mines of this character, the remaining 30% being shipped from properties which had proved orebodies, previously explored by means of churn drilling.

One of the principal reasons why the higher-grade mines cannot follow the methods pursued by the porphyries, and prospect and develop large ore reserves at the outset, is that the nature of the ground is such that it will not stay open for any length of time without an excessive cost for repairs. Therefore, to keep pace with the continual depletion, and to maintain normal ore reserves, it is essential that their prospecting and exploration work be carried on simultaneously with the stoping.

The life of mines is a subject of vital importance to everyone connected with mining, and an interesting question arises as to what is the correct amount of prospecting that should be done. If the work is carried

on too extensively it entails an excessive cost for repairs. On the other hand, if these operations are long postponed, the life of the mine is materially shortened. A precedent established by a number of companies is "to do sufficient prospecting to find one ton of ore for every ton extracted." To follow out this plan, prospecting and exploration work must be prosecuted continuously. Intensive prospecting should be carried on in the neighborhood of known orebodies, in order to make these ore-bearing areas as productive as possible. Favorable indications, faults, and small veins leading into the country rock should also be explored by means of intermediate drifts at the time of discovery, instead of postponing the work until some future date, when the records may have been lost, the incidents forgotten, and the cost of the work greatly increased, because of the necessity of reopening old workings.

In every case a golden mean should be sought, and a fixed ratio established between the amount of ore extracted and the amount of prospecting to be done. This fixed ratio should allow, in all instances, for sufficient ore to be developed in stopes to do selective mining, keep up the normal production, and maintain the required ore reserve. It should also provide for enough openings, carried just ahead of the average workings, to benefit the ventilation materially.

The exceptional conditions existing since 1914, attributable in the first instance to the outbreak of the war, secondly to labor difficulties, and finally to a decided shortage of labor, have caused operators to postpone, in a large measure, necessary prospecting work in a praiseworthy endeavor to maintain maximum production, and as a consequence, in many cases, ore reserves have become seriously depleted and a hazardous investment, both for the mine owner and the prospector. Though an occasional heading may penetrate an orebody, exposing enough ore to yield enormous returns on a comparatively small investment, thousands of feet of prospecting are done annually with practically negative results. One of the problems at present confronting the mining industry is how to make up for the large amount of prospecting which has necessarily had to be postponed during the last four years, so that normal ore reserves may be maintained in the future. To prosecute this work at a minimum cost it will be necessary to standardize all operations connected with it. At present, working forces are constantly being changed, vacancies generally being filled by men who require a considerable amount of training, as well as frequent supervision, before a fair day's work can be expected.

The employment of competent instructors to train the new men in the standard methods approved by the operating company will do much to alleviate the conditions created by this large labor turnover. Men who are best adapted for certain classes of work should be selected, complete equipment provided, and all unnecessary loss of time eliminated. This will make possible a larger amount of prospecting for the same expenditure,

*The seventh of the series of articles which began in the Nov. 9 issue of the *Journal*. Copyright, 1918, McGraw-Hill Co., Inc.

†Mining engineer, Bisbee, Arizona.

lower-grade material will then become of commercial value, and thus add to the reserves of the mine, and, ultimately, the cost per pound of copper will be lowered.

The previous articles in this series describe the standardized methods which comprise the elements of prospecting and development work. Examples have been given of what may be gained by the use of instruction in training inexperienced men how to mine. The following illustrations will show what may be done by taking a number of trained and skilled miners and giving them further instructions as to the best methods of doing certain work, thereby increasing their value to the company.

CONCRETING A FIVE-COMPARTMENT MINE SHAFT

In preparing the work of concreting a shaft the plans for clearing the old timbers, for moving forms and pouring the concrete were carefully made beforehand. The crew, working under the direction of a man thoroughly familiar with standard methods, was taught what was expected, and soon reduced the work to regular routine. Twelve men were employed, including the pipeman and foreman—two men to a compartment. They held the places originally assigned to them throughout the entire operations, and by constant application to the same task day after day became expert.

The estimated time for pouring five feet of concrete was ten hours. This was reduced to eight in a short time, and finally the work was done so expeditiously that it became a question of how to utilize the remainder of the shift. Before long it became possible frequently to concrete two sections in eight hours, and on one occasion three sections were put in within that time. Accurate records were kept, and it was found that the average time required to complete the work of putting in a 5-ft. section of concrete was 6 hr. 14 min., which represented a reduction in the total working time (eight hours) of 22.1%. During one month a record was made of 4 hr. 31 min., or 50.6% of an eight-hour shift.

These remarkable results were achieved by coöperation on the part of the men, and because they were trained in the beginning to plan ahead for their work and take all necessary tools and supplies with them when going on shift. Illustrations of this kind demonstrate the practicability of introducing standardized methods in other classes of mining, and indicate the great advantages to be gained thereby.

COST OF PROSPECTING AND DEVELOPMENT WORK

Prospecting and development work consists principally in sinking, drifting, and raising. Sinking is the most expensive and is therefore avoided wherever possible, deep shafts being put through in many cases by means of raises instead of by the more expensive process of sinking. Drifts are driven for horizontal prospecting, haulage, ventilation, and similar operations; raises, although used for like purposes, are vertical or inclined.

The amount of drifting and raising, or "prospecting and development work," as it is generally called, varies according to the stage of development the property has reached. In some instances as much as 30% of the total cost of mining is expended in prospect and development work, though in others it may be as low as 10%. In prospects which have not reached a producing stage,

¹Sacramento shaft at the Copper Queen mine.

practically the whole expenditure goes into this class of work, and in the average producing mine it amounts to about 25% of the total mining cost. In extensive veins, where little prospecting is required, nearly all the headings are driven in ore, but in the majority of cases they are in waste, which is usually harder and therefore more expensive than mining in ore.

Some of the most important items in the cost of prospecting and development work are labor, timber, and explosives. Tables I and II, showing the amount of footage made during one month, give the proportionate expenditure for these items at one of the representative mines in Arizona.

TABLE I. DETAILED COSTS OF SEVEN DRIFTS, UNDER VARYING CONDITIONS

Example	Cost per Foot			Total	Ft. per Shift (a)
	Labor	Timber	Powder		
1	\$4.47	\$0.31	\$1.81	\$6.59	1.35
2	5.84	.50	1.45	7.79	1.03
3	4.89	.33	1.84	7.06	1.21
4	4.43	.28	2.50	7.21	1.38
5	5.80	.75	2.04	8.59	1.02
6	5.43	.54	1.96	7.93	1.08
7	4.14	.11	2.00	6.25	1.47
Average.	\$5.00	\$0.40	\$1.94	\$7.34	1.22

Of the total expenditures, the labor cost was 68.12% of the total, timber amounted to 5.45, and powder to 26.43 per cent.

TABLE II. DETAILED COSTS OF SEVEN RAISES UNDER VARYING CONDITIONS

Example	Cost per Foot			Total	Ft. per Shift (a)
	Labor	Timber	Powder		
1	\$5.23	\$1.02	\$1.66	\$7.91	1.12
2	5.96	3.20	.68	9.84	1.02
3	5.10	1.88	1.49	8.47	1.16
4	7.25	2.46	1.37	11.08	.82
5	8.24	1.96	1.79	11.99	.72
6	6.90	2.07	1.66	10.63	.80
7	4.18	1.55	.98	6.71	1.42
Average.	\$6.12	\$2.02	\$1.37	\$9.51	0.99

(a) The footage per man shift denotes the entire work which has been done at the face, such as drilling, mucking, laying track, and other labor of the sort.

The standard custom in many mining districts dictates that the drilling of one round per shift (regardless of the amount of rock broken per round) shall constitute a day's work, even though it were possible for the miner to drill and blast two rounds in adjacent faces. Demands have frequently been made for two men on a machine, which if acceded to, would further increase the already high costs. When a machine weighing 150 lb. or more is used it is often considered best to put two men on it, but this would appear ridiculous with small machines, averaging 40 to 50 lb. In the majority of cases these small machines do the work equally well.

NECESSITY OF INCREASING FOOTAGE TO LOWER COSTS

To reduce the cost of prospecting and development it is necessary to increase the footage per man shift, just as in stoping the tonnage per man shift must be increased if the cost per ton is to be lowered. In other words, this means the drilling of deeper rounds, and the blasting and shoveling of more rock, in the same time and with practically the same number of men as were needed for the shorter round. To accomplish this it is absolutely necessary to have a complete equipment on hand for the driller, a regular program for the handling of the work, a type of round that will prove most effective, and a clean place to set up, which has been previously cleared by the mucker. In addition to these essential requisites, many other factors contribute to

standardization underground, such as transportation, explosives, compressed air, and ventilation. These should all be given careful attention.

One of the most important considerations is the type of round to be drilled. The great problem is to "pull" as much ground as possible, consistent with the size and shape of the working face. The blasting of deeper rounds and the doing of more efficient work do not involve greater effort on the part of the miner than his usual day's work, in which a large part of his time is spent seeking tools and supplies, and only a small part in drilling and blasting. It does mean, however, the elimination of waste effort and the concentration of his energy along the most productive lines.

STAGES IN DRILLING A ROUND OF HOLES AND SHOVELING

In general, the stages in drilling a round of holes, as practiced in many mines, are as follows: The foreman or shift boss comes into the face of a drift, raise or winze, and, after taking in the situation hastily, usually remarks to the miner: "Set up and drill a round of holes." He rarely tells him where to find the complete equipment. He may mention the place where a machine may be had, but never gives all the information necessary to drill the round. Consequently, the miner gets to work, and after finding the machine and column, brings both and makes the "set-up." Then he begins to search for the remainder of the equipment which was used by the preceding shift. He finds most of it in a reasonable time, but some things are generally missing—a few necessary wedges, a hose, wrench, wooden block, or some other minor part of the outfit.

The steel must next be obtained. In some mines racks are placed conveniently, but in others it is necessary to go a long distance to the shaft stations to get the steel. In a mine where a number of different kinds of machines are used, the miner often makes a mistake and brings the wrong size, which necessitates his returning for steel which will fit his machine. He then connects the hose and water lines and is ready to start drilling after one-quarter to one-third of the shift has been expended in preparations. After drilling for a few minutes, he finds it necessary to get oil for the machine. As no special oil cans are available, a bottle or ordinary tin can is used. Often the miner mixes car oil with machine oil so that the machine will not require frequent oiling. He next pours the oil, with the grit and dirt which has dropped into it, into the hose. Apart from the injury arising from the black oil and dirt entering the machine, the oil soon attacks the rubber in the hose, and small pieces break off from time to time and clog the air passages at the valve. This soon results in machine trouble.

NORMAL PROCEDURE NEEDS STANDARDIZATION

The type of round is of next importance. In approximately 90% of the rounds drilled in metal mines, the cut is put in the bottom of the drift. With the exception of the lower corners, this is the most difficult place in which the cut can possibly be put. The powder has no opportunity to break a deep round, on account of the unfavorable placing of the cut.

When the round is drilled the miner fills some paper bags with gritty material, or gets some clay to be used

as stemming. He is now ready to go for his powder and load the holes. By this time the shift is so far gone that he usually finds only five or ten minutes left before tally. He hurries to get the powder into the holes, in almost any fashion, cramps and doubles the fuse, hastily forces in some stemming, spits the fuse, calls "Fire," and leaves the face. He then counts the shots and chalks up the number of missed holes.

The entire shift, normally for the purpose of placing and loading the holes in such a manner that the maximum amount of ground will be broken, may be rendered ineffective by hasty loading and firing; and this most particular stage of the operations is nearly always the most carelessly attended to and frequently results in missed holes and a short round, which means higher costs, to say nothing of increased danger to the men.

Drilling is usually done on one shift and shoveling on the next. After the drift has progressed far enough, track is laid, the ditch cut, and, if necessary, the drift is timbered. As a preparatory to shoveling, the turn sheets are frequently forgotten, and the rock is blasted direct on the ground. This makes it difficult to shovel from the rough bottom, causes delays, and, as a consequence, generally means that the entire round is not all removed by the end of the shift, leaving some near the face. When the machine men arrive, they will be delayed, and it will be necessary for them to shovel back from the face on account of their not having a clean set-up. If the turn sheets have been forgotten, the mucker may not have the proper kind of shovel, and so be handicapped in his work.

THE VALUE OF TIME STUDIES

The following time studies are examples from a number made to obtain an accurate record of the distribution of the miners' time and to ascertain the proportion of the shift spent in actual drilling.

TIME STUDY—DRILLING HOLES 5 FT. DEEP IN HARD PORPHYRY

Distribution of Driller's Time	Minutes	Per Cent.
Walking to working place	5	1.0
Hunting blocks and putting up bar	50	10.3
Putting up clamp and machine	11	2.3
Building staging	3	0.6
Connecting hose	9	1.8
Adjusting clamp and arm of machine	17	3.5
Machine out of order, changing, and procuring new machine	118	24.3
Drilling	103½	21.3
Changing steel	36½	7.5
Oiling	7	1.4
Picking ground	1	0.2
Cleaning plugged steel	2	0.4
Talking	4	0.8
Lunch	35	7.2
Drawing out steel	2½	0.5
Moving machine for new holes	56½	11.6
Looking for tools	1	0.2
Tearing down machine and column	3	0.6
Cleaning out drift	2	0.4
Blowing out holes	4	0.8
Loading	11	2.3
Cutting fuses and spitting	3	0.6
Total	485	99.6

TIME STUDIES ON DIFFERENT GROUND

	A		B		C		D	
	Min.	Per Cent.	Min.	Per Cent.	Min.	Per Cent.	Min.	Per Cent.
Drilling	102.8	21.4	88.3	18.4	99.3	20.7	64.5	13.4
Loading	7.9	1.6	20.5	4.0	11.4	2.3	17.8	3.7
Cutting fuse and spitting	6.4	1.3	2.5	0.5	4.2	0.9	8.1	1.7
Setting up, oiling, hunting tools, changing position, lunch, etc.	362.9	75.7	368.7	77.1	365.1	76.1	389.6	81.2
Total	480.0	100.0	480.0	100.0	480.0	100.0	480.0	100.0

Note—A was drilled in very hard ground, consisting mostly of silica and pyrite; B in medium hard ground, principally limestone; C in oxidized limestone, and D in hard silicified limestone.

After averaging the figures recorded, it was found that only about 20% of the miner's time was spent in

actual drilling, 3% in blasting, and the remaining 77% in searching for tools and supplies, or, in other words, "preparing and quitting."

STANDARDIZATION OF OPERATIONS

The studies show that by far the larger part of the miner's time is not spent in productive labor, even though his efforts are equivalent to the energy expended in a good day's work. The aim of standardization of drilling operations is to eliminate waste efforts so far as possible, and to make a large proportion of this 77% of the miner's time as productive as that spent in actual drilling.

When a drift is to be driven, the shift boss should look over and carefully examine the face during the preceding day. He should then instruct his tool "nipper" to assemble the entire equipment on the car designed for that purpose and take it to the working place before the miner comes on shift. He should also see that turn sheets are laid at the face. Then, when the miner arrives he finds everything ready. All that is necessary is to set up his machine, make air and water connections, and begin drilling.

By this time the shift boss makes his visit and inquires regarding the number of holes and type of round to be drilled. If the miner has previously received instruction in drilling other drifts in this particular mine, he will be able to satisfy the boss as to the kind of round he is preparing to drill; but if he is not familiar with the type which has become standard, the shift boss sends the drill instructor to him, who helps him in drilling a standard round. This should be the same under all circumstances, with the exception that in soft ground some of the holes around the edges of the drift are omitted, whereas in hard ground the number is increased. If a ditch is necessary, one of the lifters should be kept down. Great care should be exercised in having the drift kept on lines, and a uniform grade should be maintained wherever possible. It is also important that the air pressure be kept up, in order that the machines may do effective work.

If, in the course of drilling, the machine should get out of order, or the supply of steel run low, the miner may obtain a new machine and a fresh supply of steel from the tool house on the same level, where a surplus should always be on hand, so that he may not be delayed longer than is absolutely necessary. The old machine should be taken back to the tool house and checked in before the new machine is taken out. This provides for a perpetual inventory of all such equipment. The man in charge of the tool house, who is also the powder man, sends the machine to the repair shop, either on surface or underground, as the case may be.

All machines require oiling from time to time during the shift, and a can filled with proper machine oil should be included in the equipment on the tool car. The injurious effects of constant oiling through the air hose should be explained to the miner, and he should be instructed to pour the oil into the receptacles designed for that purpose.

Having drilled the round, the miner disconnects the air and water lines, tears down the machine, loads the outfit on the tool car and pushes it back into a siding, where it should remain if he is to drill in the same face the next day. On the following shift, the con-

tents of the car should be checked over by the tool "nipper," who exchanges dull steel for sharp, refills the oil can, looks over the equipment and sees that everything is complete. The ventilating pipe near the face should next be removed, and the miner should see that sufficient turn sheets have been properly laid.

THE USE OF EXPLOSIVES

The miner then clears the holes with his blow pipe, takes his powder and fuse sacks, and goes to the powder magazine, where he is supplied with the number of sticks of powder and capped fuses for which the order he has previously obtained from the shift boss calls. The powder man also gives him a supply of stemming to be used in tamping the holes. He places all these things in the sacks provided for the purpose, and then returns to the face and starts loading, being careful to use a wooden tamping stick, and to slit the paper covers on the sticks of powder (except in the case of wet holes), so that in forcing it in he will eliminate all air spaces. Having placed the powder and primer in the holes, he fills the remainder of the space with stemming to within about 6 in. of the collar, and thoroughly tamps it, taking care, however, not to damage the fuse. When ready to spit the fuse, he calls another miner to his assistance and lights the fuses, igniting them *in the order in which they should be fired*, which is usually the cuts first, then the side holes, back holes, and, finally, the lifters. Having done this, he leaves the face and waits at a safe distance to count the shots, seeing that no one enters the working place. The number of missed holes is then chalked on the blackboards placed for that purpose for the information of the next shift.

It usually takes the miner the entire shift to drill, load, and fire a 6- or 7-ft. round in a drift 5½ ft. wide by 8 ft. high, in average ground. With the use of the standard round, described in a previous article, this depth of ground has been blasted consistently for periods of 15 consecutive days. In smaller drifts, such as 4 x 6 ft., it is not practicable to use as deep rounds as in the large drifts, and consequently it will not take the miner a full shift to drill a small round under average conditions. Consequently, wherever possible, two working faces, near each other, should be chosen. The miner in this case, having drilled a round in one face, can tear down and set up in another; and it would be entirely possible for him to drill, if not two whole rounds, at least a round and a half. In this event he would, of course, leave the loading and firing of the first round until near the end of the shift.

CLEARING THE FACE AND TIMBERING

The mucker, when coming on shift, should get his complete equipment from the tool house on the level where he is to work. After completing his shift, if he is to continue working in this particular place, this equipment should be left in the drift until he comes on shift again. When the tool "nipper" makes his rounds, he should look over the mucker's outfit at the time he inspects the miner's tool car, and replace the dull picks with sharp ones and make other necessary adjustments. It is the mucker's duty before going off shift to see that the turn sheets are laid near the face. His work should be planned beforehand by the shift boss, who arranges for cars, the transportation and destination of

the waste, and does everything possible to facilitate the work, so that when the driller comes on shift the next morning he has a clean place in which to set up and drill.

Mine cars should be light and easily handled, and the track carried as near the face as possible in order to avoid unnecessary shoveling. Tracks, ties and rails should be standardized as far as practicable.

If the drift requires timbering, it should not be arched; but, generally, three back holes are needed to square it up so that timbers can be put in without extra plugging. The timber man as a rule is not put in the drift until the face has progressed 30 or 40 ft., but sometimes it is necessary that the timber be kept up close to the face. In general, the timber man should get his timbers at the timber station on the level and take them to the drift in question. He usually has a helper to assist him in setting them up; and, as they are all of standard size for this character of drift, they require no cutting underground.

DETAILS OF RAISE DRILLING

The operations connected with the drilling of raises may be standardized along lines similar to those described in driving drifts. The miner should find his equipment waiting for him; and, soon after taking the machine and necessary parts up the raise, should be ready to begin work. The shift boss should outline the work and see that the driller is prepared to put in the standard round for raises. If necessary, the drill instructor should be sent to his assistance. When rounds have been drilled, loaded, and fired, and the rock has been drawn down the raise far enough to be out of the way, the back of the raise being about 12 ft. above the floor, it is necessary to put in a set of timbers. In timbering, the principle of putting in standard sets should be followed, carrying up a standard raise with chute, manway, and timber compartment as far as practicable.

These standardized operations apply equally well to stoping, inasmuch as stoping operations are usually, in the broad sense of the word, a combination of both drifting and raising, followed by timbering, with or without waste filling.

Provision should be made for good ventilation in all drifts, raises and stopes; and, where necessary, blowers with ventilating pipe should be installed to keep a supply of fresh air at the working face.

The night-shift bosses should come early enough to consult with those on the day shift, so that they may plan the work intelligently before the men arrive; and when going off shift should leave a complete record of what has been done during the night, in order that the day bosses, when they come on shift, may continue the work without delay.

THE IMPORTANCE OF COÖPERATIVE EFFORT

A continuous repetition of the above operations forms the basis of prospect and development work; but, that it may proceed smoothly and without serious interruption, many other matters should receive consideration. The personal equation is one which should not be overlooked. The attitude of the shift bosses and foremen should be such that they can maintain discipline, but at the same time have the full coöperation of the men.

It is impossible to produce the best results unless harmonious relations exist.

The shift boss should make a study of each man to learn the particular class of work for which he is best adapted. One man may be especially fitted for raising; another may do better at drifting, timbering, or some other detail in mining. It is sometimes necessary to change a new man around until he has been finally placed in the right job; but frequently mistakes are committed by bosses who make a practice of changing men around constantly, thereby preventing their making the showing possible were they permitted to become thoroughly familiar with one particular working place.

THE LABOR TURNOVER PROBLEM

One of the economic wastes in mining is in hiring and discharging men—a problem which has not, as yet, been satisfactorily solved. An endeavor is being made at several camps to eliminate this expense by having a central employment office. In case a man does not make good in the division in which he is first placed, he is sent back to the employment office, where he obtains a transfer and is tried out under another foreman. This practice is continued until he either finds the work for which he is suited or is discharged as incompetent to hold a job. In the majority of camps, however, though the hiring is done by the central employment office, the discharging is left entirely to the individual judgment of the bosses. With this system the bosses should, and in many cases do, receive specific instructions to discharge a man only for absolute inefficiency or for conduct contrary to company rules.

Experiments in various forms have been tried out in order to provide an incentive for additional footage over and above that made on day's pay by the average miner. One plan was the contract system, whereby a man was paid so much per foot, regardless of the total footage. Another was the bonus, which guaranteed a day's pay to every man, and at the same time compensated him for any additional footage made over and above the average.

TIME STUDIES LEAD TO MUTUALLY ADVANTAGEOUS RESULTS

To arrive at something which might be considered a basis for an equitable bonus system, time studies were made in drilling the standard round, to determine what would constitute a fair day's work. By this is meant not the maximum amount of work produced by the exceptional driller, but that which can be produced by the average man using standard methods.

The purpose of time studies is to furnish the necessary information upon which a day's work may be planned and an efficient system built up, and it is not intended to speed up the men or to induce them to work any harder. As may be seen from the few time studies given in this paper, the miner who puts in a round of holes by drilling 20% of the time, and spends the remainder in obtaining tools and supplies, would not work any harder if he should put in 40% of the time drilling, complete two rounds, and have all equipment and accessories brought to him.

In the minds of the men, unfortunately, the idea of time studies is so closely associated with "speeding up the work" that they are inclined to look upon them with suspicion, and much good which might be attained is

therefore lost. This prejudice on the part of the miners to stop-watches and time studies has some foundation, because many of those who have made time studies have been novices at the work themselves, and the bosses, not understanding the principle underlying these studies, proceeded to order the men around and speed them up. This has greatly retarded the work which might have been accomplished by these methods.

One of the principles adopted by the National Industrial Conference Board for the period of the war was that "maximum production should be maintained, and anything which interferes with it or tends artificially to increase the cost of production is discouraged."

This is well stated. Only by the use of time studies and cost sheets is it possible to arrive at the various weaknesses in underground mining systems. Until these weaknesses have been discovered and eliminated, it is impossible to operate with the highest degree of efficiency, which means maximum production; and until definite figures for a fair day's work have been ascertained, no satisfactory bonus system can be evolved.

After the deficiencies in the different underground systems have been fully brought to light, and a definite program has been outlined for the miner, it will be far better for him personally, as well as for the company, to make a good showing; for in this way the cost of mining will be lowered, more low-grade ore will be made commercial, and the life of the mines thereby increased. The company will be in a position to pay a substantial bonus to the man who has gone through a course to make his average day's work an achievement in which every move has been made to count.

Burma Corporation, Ltd.

The annual meeting of the Burma Corporation, Ltd., controlling Burma Mines, Ltd., through the ownership of 721,813 shares out of 724,577 issued, was held on Nov. 18, 1918, and at it the report for the year ended Dec. 31, 1917, was presented. Profits of the Mines for the year were £144,108, against £58,155 for the previous year. The entire amount was then advanced to Burma Mines, Ltd., to meet capital expenditures. The Corporation had other income from interest and transfer fees of £37,314 and general expenses of £22,898, carrying forward a profit of £181,423 for the year. The Corporation therefore shows on its balance sheet "shares and interests in and advances to subsidiary and connected companies" (at cost) amounting to £1,277,339 and current assets of £118,092. On the other side are current liabilities of £226,683; 6% debentures, £14,410; 963,749 shares (907,514 full paid at £1), £953,439; premium on shares, £3,108, and a profit-and-loss balance of £197,791.

No such summary, however, sufficiently indicates the wide activities of Burma Mines, Ltd. The most interesting point, possibly, is the decision to erect a zinc-distilling and sulphuric-acid plant in India, with the aid of the Indian government. The terms under which that government will advance £200,000 at 5½% are roughly as follows: A new mining lease will be given running for 30 years and providing royalties of from 2½ to 30% of the value of the ore at the shaft-collar. The interest is to run during construction, and the loan is to be on a first mortgage on the new plant, secured by collateral by the Burma Corporation, Ltd., to be re-

paid after 10 years in five annual instalments. The company is to enter into no arrangement tending to any monopoly in the products of its new works, and, while any of the loan is outstanding, the Indian government may purchase its own requirements at prices as low as those given to any purchaser.

Shipments from the mine amounted to 78,750 tons of ore in 1917, against 47,588 in 1916, and 2819 tons of washed slag and 210 tons of barytes were sent to the smelting plant in 1917, against 18,492 tons of slag in 1916. Refined lead production increased from 11,088 tons in 1916 to 16,957 in 1917, and silver from 105,603 oz. in 1916 to 1,525,844 oz. in 1917. (For the first half of the current year production was 10,387 tons of lead and 1,128,310 oz. of fine silver, showing a further increase in production.) At the close of 1917, ore reserves were estimated at 4,138,000 tons, assaying 24.6 oz. Ag, 27.2% Pb, and 18.9% Zn, against 3,644,000 tons of practically the same tenor at the end of 1916. (As of June 30, 1918, ore reserves were estimated at 4,299,888 tons.)

In the Bawdwin mines 6735 ft. of development work was completed in 1917, as compared with 8216 ft. in 1916. Geological studies point to the Shan lode and the Chinaman orebody as being the same, separated by the Yunnan fault. The ore is classified as follows: Lead-zinc ore, 4,033,000 tons, 24.7 oz. Ag, 27.4% Pb, 19.1% Zn, 0.4% Cu; copper ore, 105,000 tons, 21.0 oz. Ag, 19.9% Pb, 8.8% Zn, 8.9% Cu. In computing ore reserves a minimum figure of 20% lead plus zinc is assumed, although experiments indicate that much ore below these limits may prove profitable. Rill stoping is now practiced where feasible; elsewhere the square-set method is used.

Laurence Addicks has been retained as consulting metallurgical engineer, and the milling process has been fully reported on by him.

Registering Engineers in Service

The professional division of the U. S. Employment Service is endeavoring to assist experienced technical men of the Army and Navy to find places in reconstruction work. Officers and men released from active service are being registered with the division, and placed in touch with those employers who can best make use of their services. The record of each man is carefully investigated before registration is permitted. Communications should be addressed: Professional Division, U. S. Employment Service, 16 East 42d St., New York, N. Y.

Barnes-King Development Co.

The quarterly report of the Barnes-King Development Co., covering the months of July, August and September, 1918, shows that 5580 tons of ore from the North Moccasin property was milled, 3449 tons from the Piegan-Gloster property, and 5924 tons from the Shannon property. Grade of ore treated and metallurgical recoveries are not given. Favorable developments are reported as continuing in the Shannon mine. The total earnings for the period amounted to \$73,556.86, indicating a net profit of \$55,703.77. Dividends amounted to \$40,000.

Australian Transport Facilities

By ROBERT SLESSOR

In the Commonwealth of Australia the question of efficient transportation is of national importance. Unfortunately, interstate jealousies and other inexplicably petty hindrances have retarded progress in this direction. Insular policies in railway engineering resulted in the adoption of no less than three distinct gages on the different state railway systems. Our contributor discusses sea and land transportation and its effect on the Australian mining industry; forecasts the greater size of future cargo ships, and points out that increased port facilities will be necessary. Now that Australia has entered the ranks of the steel-producing countries of the world, an additional incentive for development is at hand.

PRODUCTION and realization costs of Australian base metals are greatly influenced by domestic transport conditions. The long Australian coast-line provides facilities for numerous ports, whence, with proper handling and railway equipment, goods could be cheaply shipped. A glance at a complete Australian railway map shows that only in Queensland has any systematic attempt been made to develop coastal ports and the country behind them. Considering the coast line from Cooktown, in North Queensland, to Geraldton, in West Australia—along about 5000 miles of the most inhabited parts of the commonwealth—there are only about 25 ports with railway connections, apart from the five state capitals. Of these, Queensland has 15. The sixth state, Tasmania, being a small island, is well served with numerous ports, each connected with railways.

RAILWAY GAGE DIFFERENCES COMPLICATE TRANSPORTATION PROBLEMS

Intercolonial communication is cheaper by sea than by land, even with the present abnormal sea freights; and this is attributable to the break of rail gages. The only long navigable waterways are the River Murray and its tributaries. These waterways, not being locked, are navigable only for small boats during flood time.

The subject of the breaks of gage in Australian railways has been written threadbare. Owing to state jealousies before federation, a mixture of broad (5 ft. 3 in.), standard (4 ft. 8½ in.) and narrow (3 ft. 6 in.) lines has resulted, that renders intercolonial transport slow and expensive. Whether a system of privately owned railways, instead of all state lines, would have resulted in better communications is now too late to discuss. The commonwealth railway policy is to gradually obtain lines of standard gage from east to west and north to south. The recently completed line from Port Augusta to Kalgoorlie is of standard gage and the idea is to eventually connect Brisbane with Perth by a standard line.

The Brisbane-Wallangarra-Werris Creek-Dubbo-Condobolin - Broken Hill - Port Augusta - Kalgoorlie - Perth route is incomplete, so far as construction is concerned,

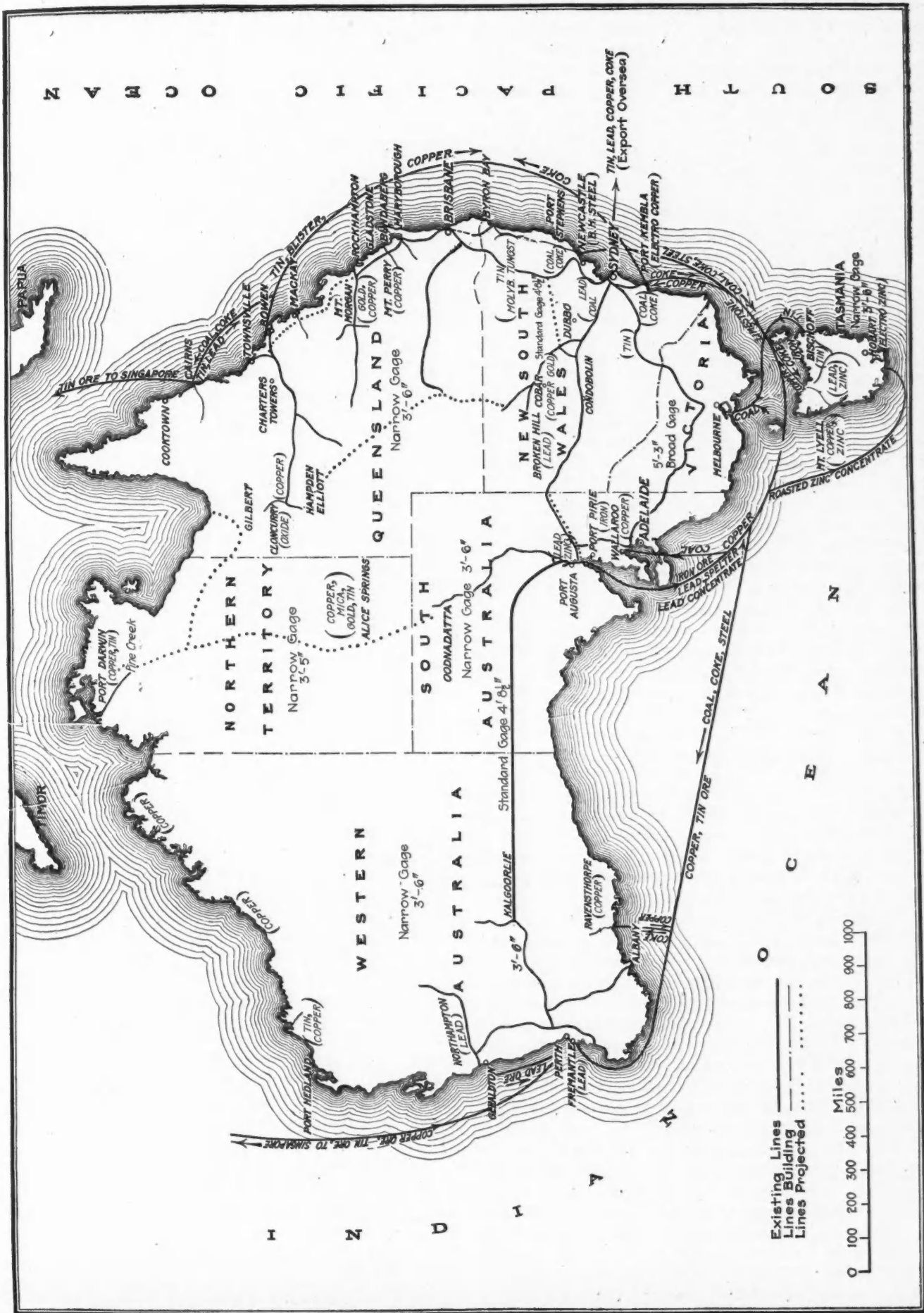
by 1000 miles. Of this, however, a distance of about 650 miles is traversed by narrow-gage lines which only need alteration to conform them to the standard. Meanwhile, a route is proposed from Brisbane, via Richmond Gap, to join with the New South Wales north-coast line, and so via Condobolin, to Broken Hill and Port Augusta. This would necessitate only about 200 miles of narrow-gage alteration between Broken Hill and Port Augusta and the building of about 200 miles of standard-gage track. The line from Condobolin to Broken Hill is constructed for 120 miles, and this connection must be made in order that goods may be sent from Sydney to Broken Hill by rail.

BROKEN HILL SUPPLY FREQUENTLY TRANSSHIPPED

The present route for the necessary coal supplies to Broken Hill is by sea from New South Wales to Port Pirie, and thence by narrow-gage rail to the Hill. Trouble with the coal lumpers at Pirie has resulted in partial suspension of operations at the Broken Hill mines. The completion of the Condobolin-Broken Hill line would make it possible to send coal from Lithgow or Newcastle to the Hill, and to bring back lead and zinc concentrates. The pre-war cost of shipping these to Sydney and Newcastle via Pirie was about 20s. per ton and, with the probable shortage of ships after the war, it may be cheaper and quicker to send these ores by rail. The chief mineral products to be transported annually are: Coal, 8,500,000 tons; coke, 450,000 tons; lead concentrate, 200,000 tons; zinc concentrate, 450,000 tons; iron ores, 250,000 tons; copper ores and blister, 60,000 tons; tin, molybdenite, tungsten and other minerals, somewhat less than 5000 tons. Besides these, timber, machinery, fluxes and other materials are required by the base-metal mines and works. Of a total of about 10,000,000 tons to be moved in connection with the mineral industries, approximately 4,000,000 goes by sea, and the remainder by rail. With a post-war continuance of shortage of ships, the outlook for cheaper transport is not bright. More ports should be opened by building interior railways, and these must be constructed on a broader and more scientific plan, and selfish interests must be disregarded.

STANDARDIZATION OF RAILWAYS IMPERATIVE

The railway problem, of course, is of greater importance in Australia for the pastoral and agricultural industries than for the mineral industries. The question has been ably discussed in papers on the commonwealth railway policy, published by the Victorian Institute of Civil Engineers. The internal transport problem is also bound up with that of overseas imports and exports. During the next decade it is likely that overseas ships will be exceptionally large and of very deep draft. They will probably stop at only one or two suitable ports, and transship to a number of smaller boats running to the other ports. Only a few ports in Australia can take vessels of exceptionally deep draft. These are Gladstone, Port Stephens, Hobart, and Albany. None possess facilities for quick handling of cargo such as are found in European and American ports.



MAP ILLUSTRATING MAIN LINES OF MINERAL TRANSPORT IN AUSTRALIA

Operations at the base-metal mines are restricted by high transport costs on imports of coke and coal, and on exports of lead and copper. Cloncurry, North Queensland, being the most remote region from present coke-making centers, may be taken as an example. This district is today the largest copper region in the country, and the one that gives the most promise of future development. Coke costs about £5 per ton there, yielding, on burning, from 12 to 18% ash, and the average price at the ovens, in 1917, was 25s. It therefore costs 75s. to carry one ton of coke from Bulli, New South Wales, to Cloncurry, North Queensland, about 2000 miles by rail and sea; and this cost is in addition to the loss arising from high wastage due to several handlings. Coke in 1913 averaged 14s. per ton at the ovens, whereas coal was 6s. 8d. per ton, in 1913, and 16s. per ton, in 1917, at pit (1917 report of the New South Wales Mines Department).

The future of the Cloncurry mines would seem to be bound up largely with the successful use of wet mills, and leaching in large central plants, together with production of fire-refined copper at suitable places, such as at Bowen. The selection of improved methods can well be left in the hands of those now at the head of the base-metal mines. At Lyell, Mount Morgan, and Wallaroo, increased attention is being given to milling, flotation, and leaching at the plants already at work, in anticipation of utilizing the low-grade ores, whereas Broken Hill and Port Pirie still lead in milling and smelting the lead ores.

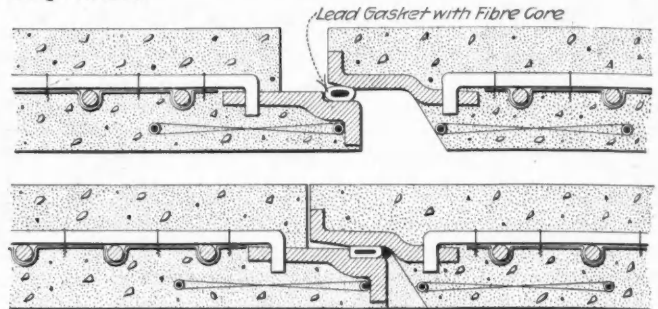
Now that Australian steel works can provide excellent material, the state and federal government can cheapen land and sea transport by building more railways and ships. The cheapening of coke and coal, and the improvement of labor efficiency, are the harder problems.

Joint for Concrete Pressure Pipe*

The need of steel and iron for war operations has attracted attention to the varied uses of concrete. Reinforced-concrete pipe is now used for water lines in which it is necessary to provide for considerable pressure. Variations in temperature demand proper provision for contraction and expansion.

The Lock Joint Pipe Co., of East Orange, N. J., has developed a joint for reinforced-concrete pressure pipe, details of which are shown in the accompanying illustrations. The bell and spigot ends of the pipe have cast-iron annular rings, previously faced to a true circle on those parts which come in contact with a lead gasket used to seal the joint. This gasket consists of a thin round lead pipe into which has been drawn a fiber core compressed by the act of drawing. The pipe gasket is then flattened by passing through suitable rolls, turned into a circle, and soldered to the exact diameter required. The gasket is placed in the bell end of the pipe just previous to the insertion of the spigot end of the adjoining pipe, as shown in the upper of the sketches. As this spigot is pressed home, it compresses the gasket until the latter occupies the shape and position shown in the lower sketch. In this way, one side of the gasket is forced against the square shoulder and into a partly dovetailed space, thereby producing a

greater thickness of gasket at this point than at the other edge nearest the outside joint. This extra thickness prevents the gasket from being withdrawn from its seat when the pipe contracts as a result of a drop in temperature.



JOINT FOR REINFORCED-CONCRETE PRESSURE PIPE

This system has been tested to 110 lb. hydraulic pressure per sq.in., the pipe joint opened as would be the case if the pipe contracted, the pipe deflected as much as 7°—all changes while under pressure—without developing leakage.

Negligence Imputable to Employer

BY A. L. H. STREET*

In the process of rewinding the cable of a mining hoist on the drum, a hoistman loosed the clutch band which acted as a brake. After the cable was rewound, the clutch band was not tightened by him, nor by the hoistman who came on duty with the succeeding crew. Plaintiff's husband was a member of the second crew, and when the second hoistman undertook to lower him and other miners in a bucket, the cable unwound so rapidly that the men were placed in peril, owing to improper adjustment of the clutch band. Realizing the imminence of peril, plaintiff's husband grasped a beam in the shaft, from which he fell to the bottom, and was killed. The other men were saved through a stopping of the cable before the bucket reached bottom.

Plaintiff sued the employing mining company for damages, and recovered judgment before the United States District Court for the District of Idaho. Affirming this judgment the United States Circuit Court of Appeals, Ninth Circuit, holds that the jury was warranted in finding that decedent was not guilty of contributory negligence in attempting to escape from the peril to which he was exposed, and that negligent failure of the hoistmen to have the clutch band in proper condition before the men were lowered in the bucket must be attributed to the employer, who rested under a non-delegable legal duty to provide reasonable safe appliances where the safety of his employees was involved (*Witkouski vs. Consolidated Interstate-Callahan Mining Co.*, 249 *Federal Reporter*, 833).

The Enormous Strength of Ferro-Concrete has been frequently demonstrated during the war. Steel cupolas have often been blown to pieces by means of high explosive shells, whereas ferro-concrete has escaped serious damage. In one part of Northern France a reservoir 80 ft. long by 40 ft. wide and 12 ft. deep and supported on slender pillars was subjected to gunfire. The columns were blown away and the reservoir fell to the ground, escaping injury except for a few holes and cracks.

*Excerpt from "Concrete in Architecture and Engineering."

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

Taxation of Land and Underlying Deposits

BY CHESLA C. SHERLOCK*

LAND is the most common basis for taxation, and it has long been recognized that the ordinary taxation of the surface carried with it the taxation of the entire property, extending to a vague point somewhere near the center of the earth.

Modern mining practices have injected complications into this theory. It is not infrequently found that the owner of the surface is one person and the owner of the mineral deposits under the surface another. The owner of the surface may be a farmer and have no interest in the deposits of mineral that lie beneath the surface. He may have conveyed all this interest to another person.

Naturally, in such a situation, the contention would be raised by the owner of the surface that it was unfair for him to have to pay taxes on the mineral interests owned by another. Furthermore, the mineral interest might greatly increase the assessable value of the tract. Was it fair to allow the owner of the mineral to escape payment of taxes, and to require the owner of the surface to be assessed in proportion to the value of the material under the surface which did not belong to him?

The courts readily realized that the old theoretical division of land, by vertical planes, was unjust in such cases. In many instances it worked a substantial loss on the taxing power, because of the inability of the taxing authority to assess and tax the mineral matter separately and independently.

The courts had previously held that two persons might, at the same time, be the owners of real property in the same division of land, in conformity with the governmental description; that it was possible for the owner of the surface to sell, grant, and convey the mineral deposits under the surface to another, and that such a conveyance would vest an estate in the purchaser of such mineral deposits.

Having reached this conclusion, it was not illogical for the courts to hold that it was possible to divide land horizontally as well as vertically—that one person might own the surface and another the minerals under the ground; and that each estate was subject to taxation (*Northern P. R. Co. vs. Mjeld* (1913), 48 *Mont.* 287, 137 *Pac.* 386).

It is a well-settled rule of law that the fee in the mineral may be severed from the fee in the surface, by properly executed instrument, and that when this has been accomplished the separated interests may be assessed and taxed to each owner as real property.

In this connection the following cases may be referred to as authority: *Re Major*, 134 *Ill.* 19, 24 *N. E.* 973; *Sholl Bros. vs. People*, 194 *Ill.* 24, 61 *N. E.* 1122; *Stuart vs. Com.*, 94 *Ky.* 595, 23 *S. W.* 367; *Smith vs. N. Y.*, 68 *N. Y.* 552; *Logan vs. Washington Co.*, 29 *Penn.* 373; *Sanderson vs. Scranton*, 105 *Penn.* 469; *Waterman vs. Davis*, 66 *Vt.* 83, 28 *Atl.* 664; *Low vs. County Court*, 27 *W. Va.* 785.

The real difficulty does not seem to be present in a clear-cut case where the mineral in the estate has been absolutely granted to another, but arises in determin-

ing whether a separate estate has been created in the mineral, or only a lease made, and the absolute estate in the mineral retained by the owner of the surface.

Where the instrument conveying the right to the minerals in the land is construed as a mere lease, which does not dissever the fee in the mineral from the fee in the soil or surface, it may, by reason of local statute, be taxed as personal property, but it cannot be taxed as real property. Such was the decision in a case where the instrument was construed to be a mere lease and not a conveyance of the mineral *in situ* (*Jones vs. Wood*, 9 *Ohio C. C.* 560; also 54 *Ohio St.* 627, 47 *N. E.* 1119).

In a Vermont case, an instrument giving a person the right to enter upon land, and open and test slate rocks, and, if suitable material were found, to manufacture roofing slate therefrom until the rock was exhausted—such party agreeing to pay a specified rent, and the owner of the land reserving all that is not needed for working the quarry—was held to be a lease creating no interest in land which is taxable to the lessee as such (*Hughes vs. Vail*, 57 *Vt.* 41).

In a Federal case it was held that the conveyance of a fractional undivided interest of oil, gas, and other minerals under a tract does not sever the ownership of the minerals *in situ* from the title to the soil, and is, therefore, not subject to separate assessment as real estate (*Barnes vs. Bee*, 138 *Fed.* 476).

The manner in which the severance of the fee in the mineral from the fee in the surface is accomplished is immaterial. It may be either by deed or by lease. This view was not always entertained by the courts, however, and it was formerly thought necessary to have the severance by deed only.

In a Kentucky case, the court said: "It is contended, however, that the oil *in situ*, being a part of the realty, cannot be severed therefrom except by deed. It is admitted that the leases held by the appellees are of the usual kind. They give to appellees the right to drill and operate for oil and gas for a definite term of years; and in case oil or gas is found in paying quantities, to continue said operations so long as same is found in quantities that pay. . . . Why, then, say that a deed is necessary to sever the oil from the realty, when the lease accomplishes the same result? During the continuance of the lease the ownership of the oil or gas is vested in the lessee; and, as the lease continues so long as oil or gas may be found in paying quantities, does not the lessor part with his title to the oil *in situ* for all practical purposes? We therefore conclude that the form of contract is immaterial, and that it makes no difference whether the oil or gas privileges be conveyed by deed or lease, so long as the effect of the instrument is to vest in the lessee all property rights to the oil or gas that may be found in paying quantities on the leased premises" (*Wolfe County vs. Beckett*, 105 *S. W.* 447).

There is no question that interests of this nature are taxable, but the dispute arises as to whether they are taxable as land or as personal property. Said one court:

*Box 84, University Place Station, Des Moines, Iowa.

"The owner may convey any part of real estate. He may convey some particular deposit or stratum, and retain the surface; or he may convey a part or all of the mineral strata or deposits, and retain the surface. Such strata or deposits are land." It follows that, if they are land, they are taxable as land.

Where the right to the minerals is granted for a fixed term, there seems to be no issue so long as the interest granted is land, whether the grant be by deed or lease. Said one court: "The minerals and the surface interests may, by separate conveyance, become separate pieces of real estate, and held by different persons; each estate may be separately seized and sold by execution; and each may be defeated by the statute of limitations as any other real estate. The mineral estate when severed by conveyance, being separate real estate, may be taxed as other real estate" (*Kincaid vs. McGowan*, 88 Ky. 91, 13 L. R. A. 289).

In a Minnesota case, the question arose as to what land was included in the description used in the tax proceedings. Said Justice Vanderburgh: "The title of each party being of record, it will not be presumed that the separate property of the different parties is embraced under one general description in tax proceedings, if the same may be applied and limited to the land of one, and not to that of the other. The description, when applied to the subject matter . . . is susceptible of the construction claimed for it by the defendant. An opposite construction would be misleading . . . and ought not therefore to be upheld."

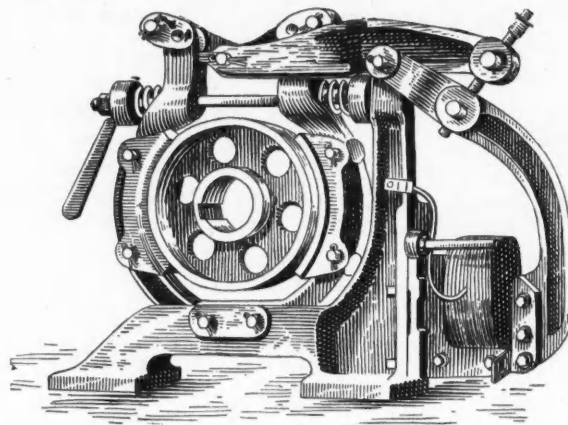
The effect of this is not to include the mineral rights; and a judgment against the surface owner, under a tax proceedings, cannot be held to have included therein the land of the owner of the fee in the mineral. As one court said: "It is nevertheless true that the land of one person should not pay the taxes that ought properly to be paid by the land of another. The judgment in the tax proceedings does not affect the mineral estate of plaintiff, because that estate was not described in the proceedings" (*Washburn vs. Gregory Co.*, 125 Minn. 491, 147 N. W. 706, 1914).

New Design of Magnetic Brakes

The principle of the type of magnet which has been successfully incorporated in the design of magnetic controllers by the Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Penn., has been employed by the company in a new design of magnetic brakes, just developed for use with mill, crane, and hoist motors. The use of a clapper-type magnet eliminates all movable parts within the coil, and the consequent wear, sticking, or damage to insulation.

The new brake is markedly quick in operation. It responds by an almost instantaneous release when the power is applied. This is attributable to the design of the operating magnet, which gives high initial pull and a small distance of travel ($\frac{1}{4}$ to 1 in.). When voltage is impressed on the motor, the magnet is energized and the armature lever overcomes the pressure of the compression springs through a toggle, and releases the brake-shoe grip on the brake wheel. While the magnet remains energized the brake wheel is allowed to rotate freely. As soon as the current is shut off from the motor, the brake magnet releases, and the compression

springs force the shoes against the brake wheel and bring the motor quickly and smoothly to rest without shock or jar. The compression exerted by the springs can be easily adjusted so that any holding or retarding



WESTINGHOUSE MAGNETIC BRAKE

torque, up to the full capacity of the brake, can be obtained for equal braking effort for both directions of rotation. Simple means for making adjustment for shoe wear are provided.

In case adjustments for shoe wear should be neglected, a safety feature has been introduced which assures that the magnet will not release the grip on the brake wheel. This insures proper brake operation and the elimination of accidents due to the slippage of the brake wheel. The simplicity and accessibility of the few parts of the brake are shown in the illustration.

British Iron and Steel Prices Regulated

The Minister of Munitions in Great Britain is fixing export prices of pig iron applicable to all exports while existing maximum prices for home delivery remain in force, Consul General Skinner cabled from London on Dec. 3. New maximum prices are also being fixed for steel for delivery in the United Kingdom from Feb. 1. The ministry stated that though the government was practically sole purchaser of iron and steel products, prices were stabilized by paying direct to makers a subsidy representing increased costs due to war conditions. As the government no longer is sole purchaser, it is desirable to place the industry on an economic basis, but because the immediate withdrawal of all subsidies would seriously prejudice the resumption of ordinary commercial work, the government has decided to remove them in two stages. Subsidies applicable to steel making will be removed Jan. 31; those applicable to pig iron will continue to Apr. 30. It is not intended that government subsidies should be used to enable exports to be made at less than full cost, and therefore the government will levy as drawback on exported iron and steel the difference between home and export prices.

Flake graphite was produced almost exclusively in Ceylon up till 1913, and the output averaged from 30,000 to 40,000 tons annually. Madagascar started in competition in 1907 with a production of 8 tons, which was increased by 1911 to 1246 tons, by 1913 to 6313 tons, and by 1916 to 25,489 tons. The Madagascar deposit is found distributed throughout an extensive crystalline schist formation covering an immense area, and the graphite reserves are said to be enormous.

The Elimination of Gelatinous Silica in the Hydrometallurgy of Zinc*

It is well known that in the hydrometallurgical treatment of zinc ores the presence of gelatinous silica, at certain stages of the process, interferes seriously with the efficiency of operations. Such troubles have been experienced at a number of metallurgical plants; and the following description of a new modification in treatment, invented by F. Laist, the manager of the Washoe reduction works of the Anaconda Copper Mining Co., outlines an interesting method of improving results by the elimination of this undesirable product. The last word, however, has not been said in this connection, and it is understood that further improvements in the process have been made since the filing of the patent applications.

A DESCRIPTION of procedure embodying the new Laist modified method of zinc recovery, whereby difficulties in treatment, arising from the presence of gelatinous silica, are overcome, and an increased yield of metal is obtained, follows:

Concentrates containing, for example, about 33% zinc, 8% lead, 20% iron and 6% insoluble matter, the last comprising about 4.5% silica and 1.5% alumina, are roasted in multiple hearth furnaces to oxidize the sulphides into oxides and sulphates. The roasted product, or calcine, is then leached with a solution containing 8 to 9% of sulphuric acid, this solution in a repetition of the process being the depleted electrolyte from the cells in which the zinc is electrolytically precipitated.

Usually, approximately five tons of leaching solution is used per ton of calcine. The resulting solution is then neutralized or nearly neutralized with calcine, and thereafter a small proportion of limestone is customarily added. The effect of this limestone addition is to establish a slightly alkaline condition in the liquor, and thereby to precipitate in gelatinous form any silica which has been dissolved during the acid treatment. Practically, it is necessary to effect complete precipitation of the silica at this point, as it will otherwise separate during later operating stages and occasion much trouble. The precipitation of silica may be rendered even more complete by adding to the pulp, after the limestone addition, a small amount of zinc dust. This reagent, either in the presence or the absence of copper salts, is effective for precipitating residual traces of dissolved silica. In the presence of copper salts the cement copper is, of course, the active reagent.

The above-described operations of neutralizing the liquid and precipitating the silica are conveniently performed in Pachuca tanks with thorough stirring. At this point the solution should carry at least 80% of the zinc content of the original calcine. The contents of the Pachuca tanks are now discharged into Dorr thickeners, and the thickened product, with the precipitated

matter, passes to the filters. The filtrate, together with the overflow from the Dorr thickeners, is a zinc solution usually containing small amounts of copper and cadmium. These metals are precipitated by zinc in dust or other suitable form, and the solution is clarified by settling or filtration and passed to the electrolytic cells. The entering electrolyte is a neutral solution containing about 8% of zinc in the form of sulphate; the depleted electrolyte flowing from the electrolytic cells contains about 2% of zinc as sulphate, with about 8 to 9% of sulphuric acid, and is returned to the leaching tanks, as mentioned above. Lead anodes may be used, and the current conditions are preferably those which have become standard in this operation.

In the practice of the above-outlined process a filter cake is obtained which comprises the insoluble matter from the ore and the precipitated gelatinous silica. This is in the form of a wet cake, ordinarily containing 42 to 45% of moisture, which is, of course, a rich zinc-sulphate solution. It is impossible to wash the cake free from zinc with an amount of water within practicable limits, and the losses at this point may attain 15% of the zinc content of the ore.

Efforts have been made to reduce this loss by removing the leach liquor from the residue before neutralizing and while still containing about 0.5% of acid. The acid pulp was passed through thickeners and filters, and yielded a dry, sandy cake, containing only about 20% of moisture, and readily washed. However, the subsequent treatment of the acid solution with calcine, limestone, and zinc dust yielded an unworkable precipitate of gelatinous silica, this precipitate being slimy, slow-settling, and producing a cake containing up to 80% of moisture. The necessity of precipitating the gelatinous silica in presence of the sandy ore residue was therefore established.

According to the present invention, the mechanical difficulties due to the precipitation of gelatinous silica, as well as the excessive losses of zinc occasioned thereby, are avoided by proceeding substantially as follows:

The silica is precipitated in presence of the ore pulp, preferably in the manner first described above, that is, by successive additions of calcine, limestone, and zinc dust, if required, the latter either with or without copper salts. The subsequent operations of thickening and filtration are easily carried out in apparatus of standard type, but yield, as above stated, a filter cake of high moisture content.

This filter cake, which may be termed the "primary filter cake," and which need not be washed, is discharged from the press and dried or gently calcined at a temperature sufficiently high to effect dehydration of the silica, as well as the hydroxides of aluminum and iron, a temperature of about 150° C. being suitable. These compounds are thereby rendered insoluble in water or dilute acids, and are also converted into a granular condition which lends itself readily to filtration, the zinc remaining soluble. The dried residue is now leached with a sufficient quantity of acidified solution, so that,

*Abstracted from specifications of Letters Patent Nos. 1,281,031 and 1,281,032, U. S. Patent Office.

after the leaching is completed, a small excess of acid may remain. An 8% solution of sulphuric acid is suitable for this purpose.

The pulp is now settled or thickened and washed. The washing is readily accomplished in the filter, and the residue, termed the "secondary filter cake" is sandy or granular. The filtrate from the secondary filters, with the overflow from the secondary settling tanks, is acid, and is returned to the primary leaching tanks, being introduced, preferably, just before the final neutraliza-

electrolytic cells contains about 2% of zinc as sulphate, together with about 8 to 9% of sulphuric acid, and is returned to the leaching tanks as mentioned above. Lead anodes may be used, and the current conditions are preferably those which have now become standard in this operation.

The above-described process also produces a filter cake, which comprises the insoluble matter from the ore and the precipitated gelatinous silica, the preferred method for the recovery of the zinc comprising purification by treatment with zinc in dust or other suitable form, clarification by settling or filtration, or both, and electrolysis with insoluble anodes, as, for example, lead. It has been found practicable, even with this dilute solution, to recover economically 75% or upward of the zinc content by electrolytic precipitation. The spent electrolyte may either be discarded or worked up by any appropriate method for its residual zinc content.

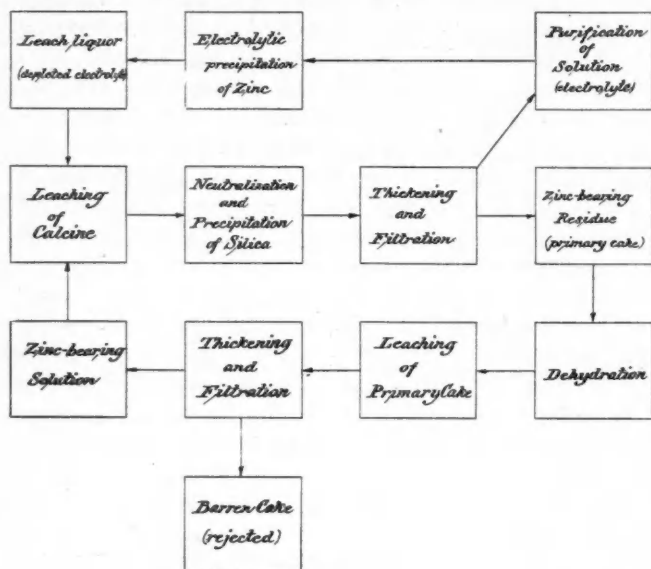


Fig. 1

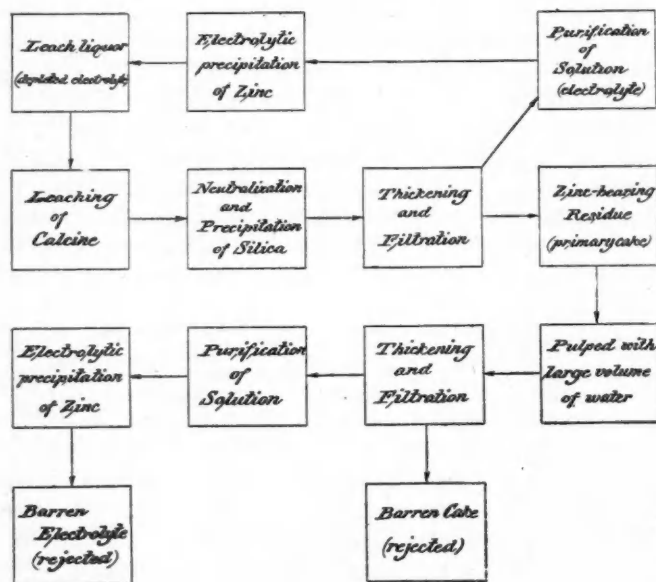


Fig. 2

THE LAIST MODIFICATION OF ZINC-ORE TREATMENT

tion with calcine or limestone. This modification is illustrated diagrammatically in Fig. 1, shown herewith.

In an alternative method, as shown in Fig. 2, the solution from the filter, with the overflow from the Dorr thickeners, is a zinc solution usually containing small amounts of copper and cadmium. These metals are precipitated by zinc in dust or other suitable form, the solution clarified by settling or filtration and passed to the electrolytic cells. The entering electrolyte is a neutral solution containing about 8% of zinc in the form of sulphate. The depleted electrolyte flowing from the

Concrete Road Construction*

Successful concrete road construction requires, first, proper preparation of a foundation of sub-grade. This usually calls for compacting the soil where the concrete is to be laid, and draining the roadbed so that water will not remain under the concrete slab. Concrete is placed on the foundation in one layer or, sometimes, two layers or courses. A one-course concrete road consists of a relatively rich concrete mixture throughout. A two-course concrete road consists of a somewhat leaner mixture for a base, with a richer top or wearing course, applied before the concrete in the base has begun to harden.

Sometimes reinforcement in the form of wire fabric or steel rods is imbedded in the concrete. This assists to prevent slabs from cracking and aids in keeping cracks which do form from opening to any appreciable extent. High-wearing quality of the concrete results from using properly graded, clean, hard sand and crushed rock or pebbles. These must be combined with portland cement in definite proportions, mixed in a power-operated batch mixer with an amount of water to produce a stiff, plastic consistence, then placed on the sub-grade and struck off with a templet or strikeboard, so shaped that the surface of the pavement will have the desired crown. After rolling with a light metal roller, to compress and remove excess water used in mixing, the concrete is finished by seesawing a belt to and fro and along the pavement, leaving a true, even, gritty, dense surface. When hardened sufficiently to prevent pitting or marking, the surface is sprinkled with water, then covered with two inches or more of moist sand or earth, which is kept wet by sprinkling for from ten days to two weeks to prevent the concrete from drying out too rapidly. Under no circumstances should a concrete road be put in use until it is 14 days old, and in cool weather a longer time must be allowed.

Serbian Copper Mines.—The copper mines of Maidan-Pek, in Serbia, which belong to a French company, have recently been exploited by the Austrians, who about mid-summer were contemplating an increase in the scale of operations. Recent events in Serbia may have caused a modification of those plans.

*Abstracted from a bulletin published by the Portland Cement Association.

Central Station Power for Mines*

BY A. TANCIG†

It may surprise many to know that 30% of the fuel burned in the ordinary mine boiler plant is wasted absolutely. Not only is there a waste of fuel, but there is also considerable other expense incidental to a mine steam plant that can and should be eliminated. In making comparisons between the mine power plant and that of a central station power plant, one fundamental should not be lost sight of, and that is to remember that it is the miner's business to mine ore, whereas the business of the central station power plant is to generate and sell power. Obviously the economical way to conduct both propositions is for each one to follow its own particular line. There is no secret or mystery as to why a central station can sell power for less than it can be generated at the mine. It is merely the natural result of a small trained organization, operating an efficient plant which carries the greatest possible average load.

In a general way, conditions about the average mine boiler plant are as follows: Two or more horizontal return tubular boilers, the kind our grand-dads used, are set in a brick setting that leaks more or less air, usually more. The probability is that the grates are stationary in a hand-fired furnace, and that the breaching dampers have not been used for ages. One look at the feed pumps indicates, by the groaning and kicking, that at least 15% of the plant steam is being used there. The prevailing idea seems to be to let any old contraption feed the boilers, pumping against a 300-ft. head for every hour in the day, and every day in the year. Off in a dark corner is the plant goat, which we are pleased to call the feed-water heater. It gets no attention, but is supposed to perform wonders. Let a recording thermometer diagnose its case for 24 hours, and one will wonder where the heater got its name. The sizzling sound that has been going on all this time is from a few leaks that we intend to fix on Sunday.

The real plant losses, however, are due to the low average load. If it were possible to hoist continuously, all of the day's production would be on surface in about three hours. The tramming would take a little longer, and the rest of the time the plant would be just burning coal. Of course, if there is a pumping load the plant is doing some good, but not enough to warrant its operation, if it be a large one.

While on the subject of wastes and losses it is important to mention the ever-present "chain gang"—a sort of foreign legion, composed of a few good men, ball players, bandmen, and boomers who perform some good work and are more or less necessary around a mine steam pump. Just the same, I should hate to be around when the efficiency expert makes his report on the false moves, starts, and time losses of the "chain gang." The so-called mine-heating systems come in for their share of the blame for wasted fuel. To justify their maintenance they are called exhaust steam heating systems, but it is an exhaust steam that makes it necessary to carry from 3 to 7 lb. back pressure on the rest of the plant, to say nothing about the vacuum pump which

uses its share of live steam. In this Minnesota climate, a heating system is a necessity, but, as such, it should be given the same thought and care, both in planning and operation, that would be given to any other important part of the plant. Too often, in order to please the boss, or for some other reason, a makeshift affair is installed, and is a constant source of trouble. A whole volume could be written on that economic crime of the Mesabi Range entitled "A Mine-Heating System." The main objection to the mine steam plant is that the conditions are not favorable to the plant because the load it carries is too light for the expense involved.

The following are some of the advantages obtained by the use of the central station plant: The individual mine does not need a boiler plant, and this means from \$10,000 to \$20,000 saved on initial installations; the labor problem is simplified, as no firemen, coal wheelers, engineers, or pipemen are required; the power bill will be much smaller than the coal bill would have been; considerable is saved in waste, oils, packings and other items too numerous to mention, but the saving of which nevertheless helps to make the cost sheet more or less attractive; and the appearance of the surface layout will be improved.

Why are not the central stations selling more power to the mines? There are several reasons. Demand for power precedes the supply. But the most important reason is that the boss is from Missouri and he has to be shown. When you talk power to him, talk to him in dollars and cents, because he is paid to make a decent return on invested capital, and every fraction of a cent that can be saved will look good to him. Once prove to him that his \$20,000 boiler plant is a liability, and he will be the first one to say, "Sell it for junk."

Sooner or later the fact must be recognized that mining is not altogether the capitalist's necessity, but that it is our opportunity to show that we see in mining a competitive business, a business that must be made to pay from A to Z. The profit in mining is not all made from the ore in the mine; the ton of iron ore carries quite a burden as it is without laying the blame for wasted fuel, labor, and investment on its shoulders.

John Scott Legacy Medal Awarded

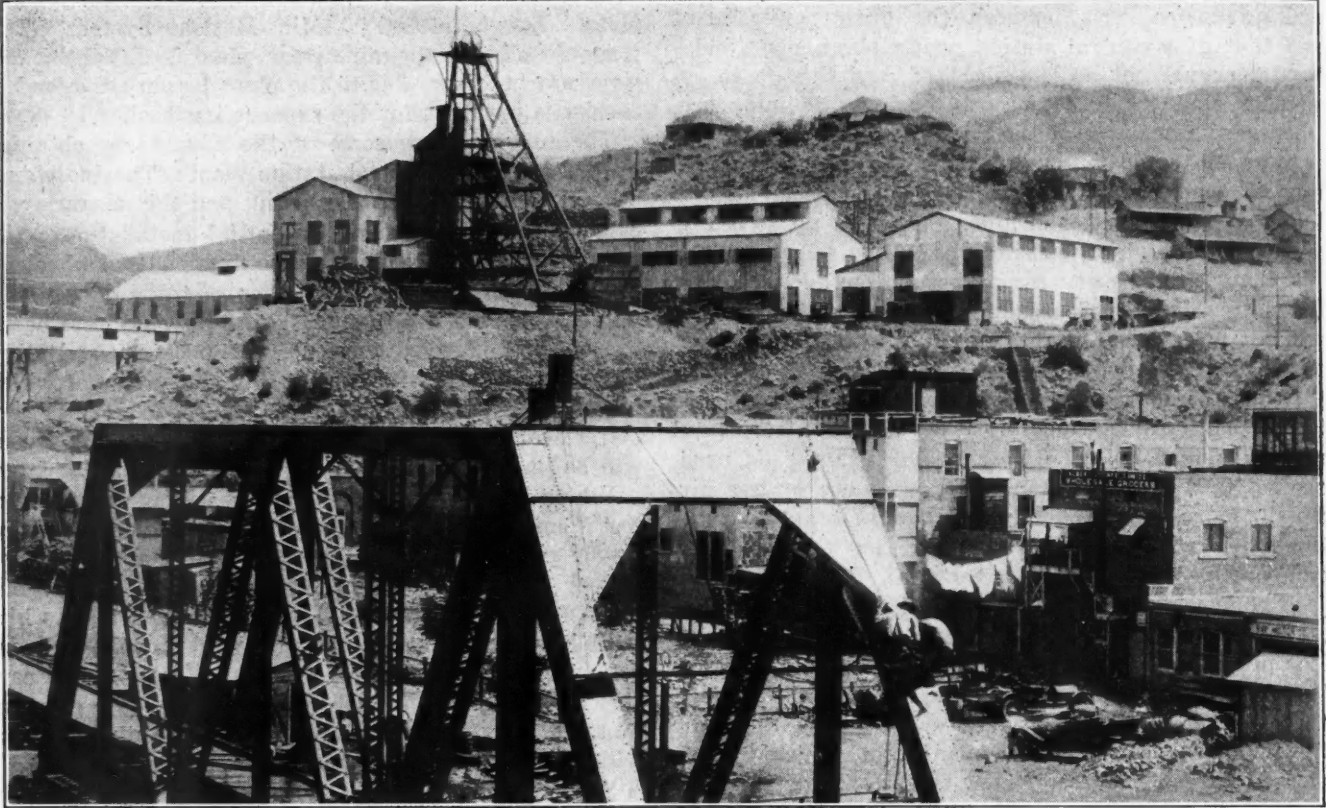
Acting on the recommendation of the Franklin Institute, the city of Philadelphia recently awarded the John Scott Legacy medal and premium to Frank P. Fahy, of New York, for the Fahy permeameter. The fact that measurements taken by the permeameter may be used to obtain information concerning the previous heat or mechanical treatment of magnetic materials makes its use of great importance in industrial plants.

The fifth session of the prospectors' short course held annually at the Mackay School of Mines, Reno, Nev., will open Jan. 6 and continue until Feb. 1, 1919. The course is designed to aid the prospectors of Nevada, but is open to residents of other states as well. No charges are made for the course except a \$5 fee to cover the cost of supplies. Textbooks are not required, though certain books useful to the course are recommended.

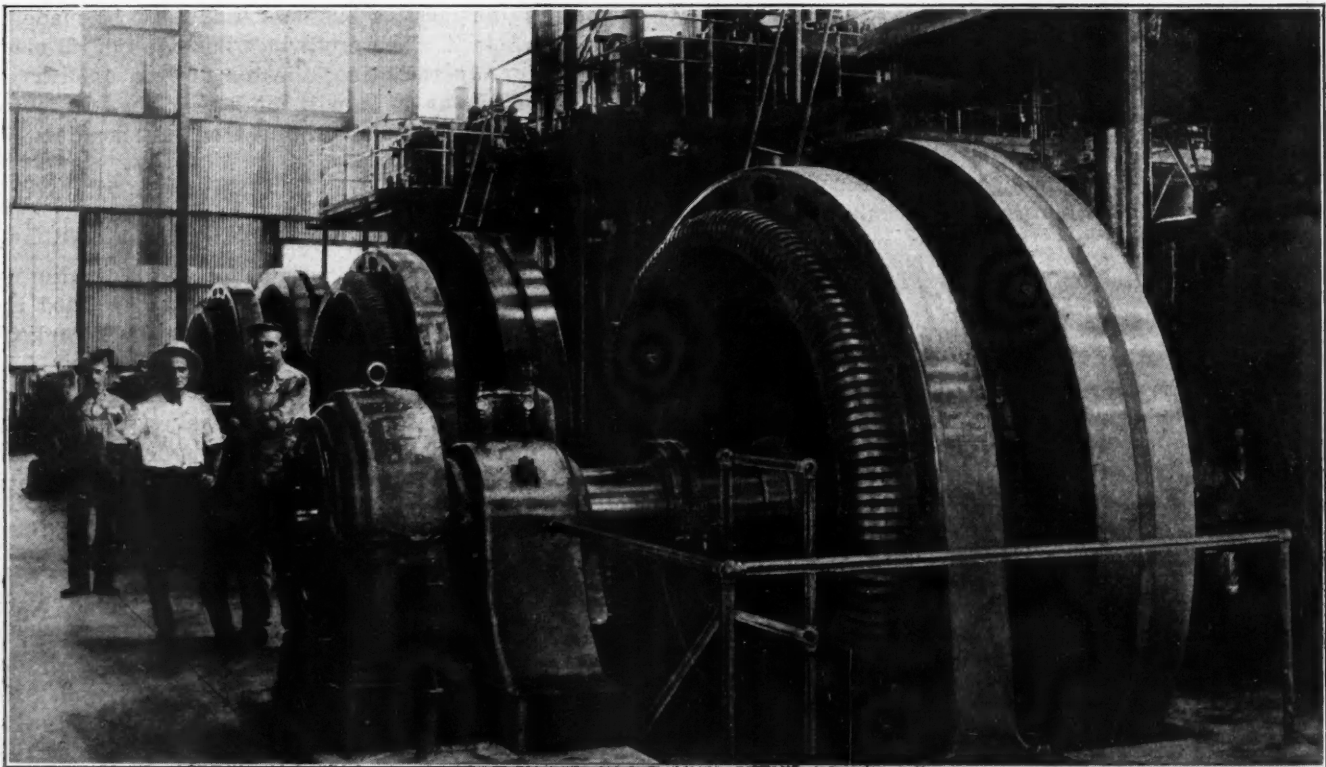
*Excerpt from a paper presented at a meeting of the Engineers' Club of Northern Minnesota, Mar. 12, 1918.

†Mechanical engineer, Shenango Furnace Co., Chisholm, Minnesota.

Ray Hercules Copper Company



HEADFRAME AND SURFACE PLANT AT THE RAY HERCULES MINE, RAY, ARIZONA



RAY HERCULES POWER PLANT, SHOWING INSTALLATION OF THREE 1045-HP. McINTOSH-SEYMOUR DIESEL ENGINES, EACH DIRECT-CONNECTED WITH A 900-KW. G. E. GENERATOR

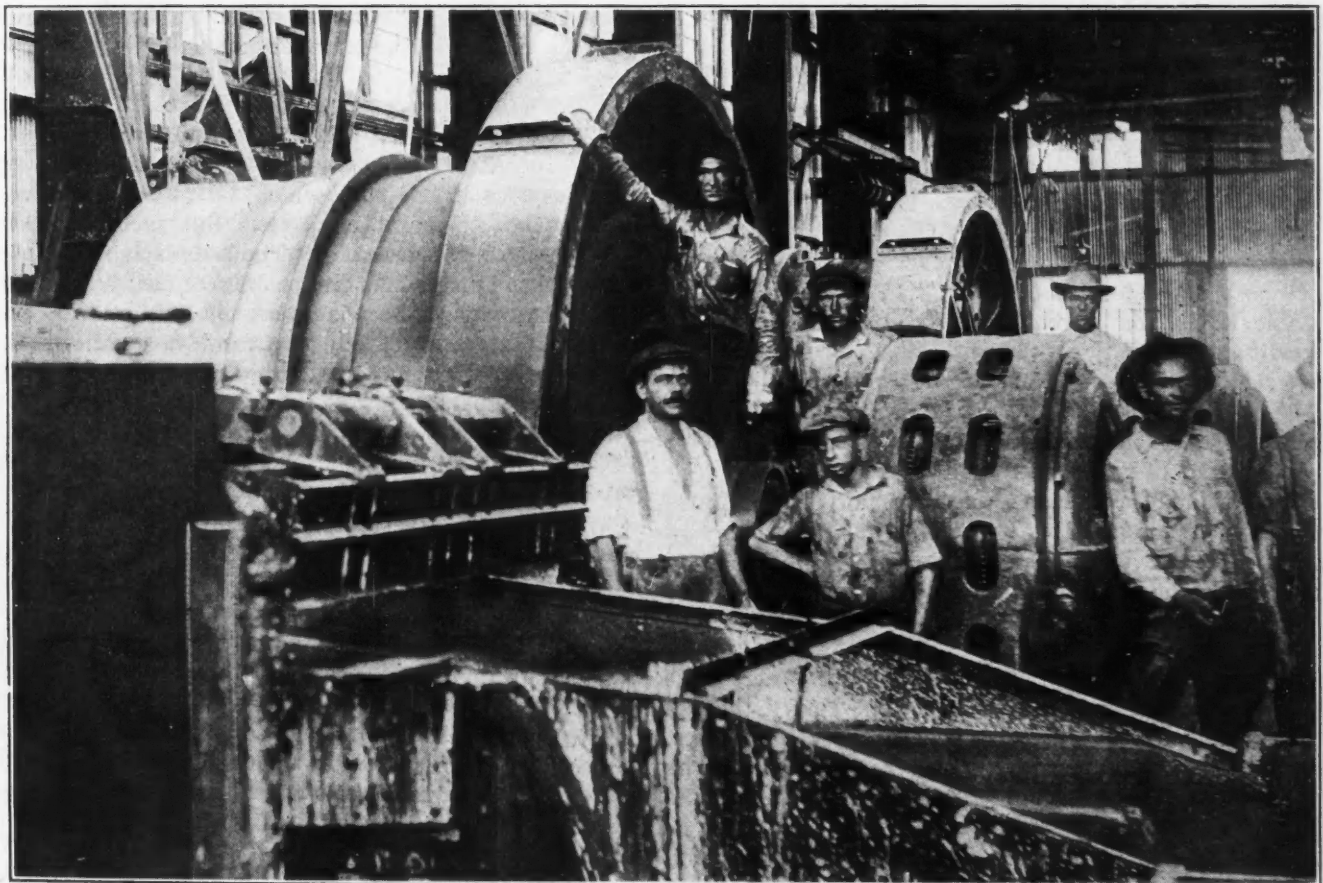


MILL OF RAY HERCULES COPPER CO. AT HERCULES, ARIZONA

The mill building is 137 ft. x 87 ft., with a 90- x 30-ft. filter plant. A 2500-ton ore bin is served by a standard-gage railroad spur from the tracks of the Ray and Gila Valley R.R. Three 16-in. conveyors, with automatic weighers, deliver the ore to three 500-ton Marcy mills. Other equipment includes three 6-ft. Hardinge mills, 15 Overstrom tables, 42 Callow flotation cells, 9 Dorr classifiers and 3 Oliver filters. The present capacity is 1500 tons per day of ore averaging 1.77% copper. The mill site comprises 1500 acres, including an attractive town site, already well improved, and a dumping ground which will accommodate at least 100,000,000 tons of tailings. Water supply from the Gila River is abundant.

At the mine, the headframe is 110 ft. high. The shaft, which is to be a total depth of 930 ft., is three-compartment, and is provided with two 5-ton, self-dumping, Kimberly skips, for which double-deck cages may be substituted. The main hoist is a double-drum Nordberg, capable of handling 300 tons an hour. Coarse-crushing plant has two No. 8 Gates, Type K, gyratory crushers and two heavy Traylor rolls.

Construction and development work was in the hands of C. E. Addams, now in charge of Arizona Council of Defense work. He has been succeeded in the Ray Hercules management by A. A. Wren. The construction engineers were Bradley, Bruff & Labarthe, and the consulting metallurgist was J. M. Callow.



INTERIOR OF RAY HERCULES MILL AT HERCULES, ARIZ., SHOWING ONE OF THE THREE MARCY MILLS, EACH OF 500 TONS' DAILY CAPACITY

Price Readjustment*

BY B. M. ANDERSON, JR.

Liquidation of war conditions as promptly as is consistent with the fulfillment of our purpose in the war is highly to be desired, so that business may return to a basis of peace and the realization of legitimate profits. It is the aim in the following discussion of price control to aid business men to a clearer view of conditions resulting from the return of peace. The contention is presented that the business changes involved in this transitional period should be allowed to follow their normal and natural course, and that they should not be subjected to artificial influences.

PRICE FIXING in this country has served its purpose and should be abandoned at the earliest possible date. It was a temporary subversion of principles of free enterprise that only the war emergency justified. But, like press censorship and other necessary measures incompatible with the genius of American institutions, it should be abolished. A medicine in war, it would prove a poison in peace. There may remain, for a few months, good reasons for a continuance of price fixing in specially scarce foods, as normal food conditions must await new harvests in Europe. But permanent price fixing is no more to be desired than is a permanent standing army of four million men.

A NEW KIND OF PRICE FIXING

Particularly unsound is the form of price fixing for which a demand has arisen in some quarters—a demand for nothing less than price fixing designed to keep prices up against the inevitable drop that will come with the return to conditions of peace. The notion that prices should be kept up is based on the fallacy that a fall in prices is undesirable. The fact is that a drop in prices to stable levels is exactly what is desired. Such stable levels are prerequisite to satisfactory business conditions.

Price fixing is only one of several plans suggested by those who are apprehensive as to the effects of falling prices on business. It has been proposed to prevent the fall in prices: (a) By price fixing; (b) by a continuance of heavy loans by the United States Government to our Allies, to be used for *reconstruction purposes*; and (c) by an organized policy of liberal lending on the part of American banks.

FALL IN PRICES DESIRABLE

Two comments are in order. In the first place, these policies, though they might for a time retard the fall in prices, could not prevent it. In the second place, it is better by far to have prices go down in the natural course, get through with it, and then undertake long-time plans on a sound price basis.

The efficacy of the measures suggested for preventing a fall in prices is essentially limited. Price fixing, for

example, has not been devised for holding prices *up*, but for holding them *down*. We have devised no machinery for holding prices up except in the case of wheat, where the purpose was to make the maximum price also a minimum price, and where the Government has created the Grain Corporation with a "revolving fund" of \$150,000,000 which may be used in purchasing wheat if the market price should fall below the minimum guarantee. But, in general, our price-fixing mechanism has been adjusted to hold prices down, and the procedure has been essentially this: As we have limited prices, we have restricted consumption, rationing out the supplies. We have said to producers: "Produce all you possibly can," but we have said to consumers, "You may buy at such and such price, but you may only buy so much," and to some consumers we have said, "You may not buy at all." The Government organization concerned with handling this problem has been worked out with a view to studying the needs of consumers, and to rationing the supplies in accordance with public policy.

It would, of course, be possible to reverse the procedure, and to make the present maximum prices minimum prices. But in that case we should have also to reverse our instructions to producers and consumers. We should then say to consumers, "Buy all you possibly can," but we should have to say to producers, "Although you may sell at such and such a price, you must restrict production and limit output. If you sell at a high price you can only sell such an such amounts."

ARTIFICIAL PRICE LEVELS

This procedure is, indeed, not unfamiliar in the history of American business. We have had pools and combinations in the past, which, by restricting output, have sought to maintain prices. But such pools have not usually been successful. The temptation to expand the market by breaking the pool agreement and cutting prices has always been a great one. Moreover, such arrangements are clearly contrary to public policy. Whatever else we may seek to do in the present emergency, we must do nothing which would tend to lessen output. The world is impoverished, goods and supplies of all kinds are short, and every effort should be bent toward increasing supplies.

We need not give serious consideration to the idea that a mere legal *flat*, naming a price at which men shall buy and sell, would be efficacious. Price fixing, to the extent that it has been successful during the war, has been successful only by virtue of a control and rationing out of the supplies. Price fixing as a permanent policy is indefensible in any case. The magnificent loyalty of the American business man, and the heavy pressure of public opinion under the stimulus of the war, have made business men submit to it as a temporary measure. But it would do great harm if long continued.

Though it is desirable that our Government should continue to make necessary loans to our Allies to enable them to meet war-time problems, and though it may

*From a pamphlet issued by the National Bank of Commerce, New York.

be desirable that loans to our Allies, even for reconstruction purposes, should be made directly by the Government, it is neither desirable that such loans be made in large volume, to be spent on reconstruction materials at present prices, nor probable that they will be. A factory, built at present prices of building materials and machinery, would be handicapped in competition with a factory built a little later, when building materials and machinery have gone down. A French business man, making a fixed investment which is to bring in returns during a 20- to 25-year period, would not be enthusiastic about using credits, even if unlimited credits were offered him by his government, on the present level of prices. He will feel it wiser to wait till prices fall; and the quicker prices fall, the sooner will he begin his operations.

RECONSTRUCTION AND BANK CREDIT

The world has been forced to reckless buying by the emergencies of the war, and whatever was necessary for carrying on the war, the governments have bought. Civilization itself was at stake, and we did not stop to apply accounting methods. But "reconstruction" is in large degree a *business* matter, to be carried out by private enterprise, even though aided by government credit. Only a government can afford to make expenditures that will not pay—and governments cannot do it indefinitely. We may expect heavy buying of foodstuffs and things necessary for the life and health of the peoples of Europe to continue, but the buying of materials to be used in construction, manufacturing, railroading or other similar operations may be expected to proceed on a hand-to-mouth basis until prices have dropped sufficiently to induce business men to feel that a fairly stable level has been reached.

As much may be said for the notion that an organized policy of liberal lending on the part of American banks would prevent a decline in prices. The process of transition from war organization of industry to peace organization of industry will require the making of a great many loans that would not otherwise be required, and bank credit must be provided to put the transition through. But efforts by banks to control the expansions and contractions of credit are much more likely to be successful when directed toward contraction than when directed toward expansion. Business men do not borrow and pay interest at the banks for amusement, and bankers do not make loans unless they see good prospects for the enterprises to be undertaken by the loans. American business men are not likely to be enthusiastic in borrowing and paying interest to support a falling market, nor would American banks be performing a useful public service in encouraging them to do so.

Much of the consumption demand of the American people, repressed by war-time prices, will be effective as prices go lower. The past unsatisfied demand for food and day-by-day luxuries, for much clothing and many other things, is water which has gone under the mill. It will never affect future prices. But part of that past demand for clothing remains. And there is doubtless a large volume of deferred demand for household furnishings, pianos, automobiles, and other luxuries, which only awaits lower prices to become effective. With the cessation, moreover, of the current production

of steel, copper, and other basic raw materials, now so largely devoted to war purposes, and with the release of large numbers of laborers now engaged in war work, a substantial amount of the most urgent construction work will begin, and with the decline in wages and prices of supplies we may expect a great volume of construction work to be undertaken promptly, keeping laborers and plants actively employed.

FALLING PRICES STIMULATE DEMAND

Nothing in the argument above put forth justifies the suggestion that a period of slack industry must intervene. A tremendous volume of unsatisfied demand is waiting for both labor and goods at lower prices. There is, in fact, a scale of demand prices both for labor and for goods at which supplies will be taken off the market as they come. A given manufacturer will take on 10 more men if he can get them at a slight reduction of wages. If he can get them at a lower wage, he will take on 20. If he can get them at a still lower wage, he will take on 25. With copper and steel at present prices, he will buy only moderate amounts; but with each drop in prices of these commodities, he will increase the amounts which he is ready to purchase. As prices drop, the more urgent demands will be satisfied first, and then, as prices drop still further, less urgent demands will be satisfied. When levels that are expected to be reasonably stable are reached, a great volume of demand will take up all supplies that come into the market. No arbitrary action should be taken to hasten this process, but none should be taken to impede it.

STABILIZATION OF PUBLIC EXPENDITURES

In the interests of active business, it is desirable that this relatively stable level should be speedily reached, and it is undesirable that palliative methods should be used unless actual unemployment appears. It should, however, be made definitely known that large-scale plans for expenditures of the Federal Government, the states, and the municipalities are in readiness, in case unemployment should appear. But it is just as important that governments should curtail expenditure in times when prices are abnormally high and labor is working overtime, as that governments should increase their expenditure in times of unemployment. This use of government expenditure as a balance wheel does not mean that wasteful or useless work should be undertaken, merely to make jobs. It means, rather, that there is a great deal of necessary public work which can be done almost as well at one time as at another, and that the various grades of government should make orderly plans looking ahead through a 10-year cycle, so that they can take advantage of periods of relative depression, with a double gain—lower prices to the governments, and the prevention of unemployment.

The tension of the last two and a half years, with scarcity and high prices of labor and supplies, has led to the interruption of many public works, and has prevented many new ones from starting. *When* prices drop—as they must—and *if* unemployment on a substantial scale should appear—as it may—then the various grades of the government should be prepared to take up the slack by useful public works.

American business need not be unduly apprehensive of the effects of falling prices and some slackening of business activity upon profits. Profits are, after all, a differential—what is left over after meeting costs. A general decline in prices means a general decline in costs. Moreover, with the forced draft under which American industry has been working for the last two or three years, there has necessarily come, in increasing degree, waste and inefficiency. Labor has been working overtime at high wages. It has been shifting rapidly from employment to employment—perhaps as great a factor in inefficiency as could be found. In some cases, it has not been amenable to shop discipline, and the employer has been largely helpless in the face of loafing and inefficiency. In other cases, protracted overtime work has lessened energy and efficiency. In some cases, laborers have lacked interest in the work in hand through the fact that they were constantly considering alternative employments. For these and other reasons, the labor force had become less efficient than it is in normal times. Wholly apart from a decline in wages, therefore, labor costs per unit of output will decline, and it will not be necessary to reduce wages as fast as prices fall in order to break even on labor costs.

Employers, moreover, driven by the pressure of new contracts, and harassed by the multiplicity of details in new undertakings, have not been able to make use of their customary efficiency in bringing about economical production, and the large profits of the war period in many industries seemed to remove the necessity for the elimination of wastes.

With some relaxation of the tension under which both employers and laborers have been working, and with an increasing appreciation of the importance of economies and efficiency in production, we may expect wages to decline less rapidly than prices—especially desirable in view of the fact that food prices are unlikely to decline greatly for some months.

SUMMARY

Artificial control of business and prices should be dispensed with as rapidly as possible. At the earliest possible date, the business man should be free to make his plans and contracts with reference to accounting principles rather than under Government direction. Neither price fixing nor a forced expansion of credits can prevent the fall in prices which the return to peace conditions inevitably involves, nor would they be desirable if they could. If prices could be artificially sustained, it would merely mean a period of hesitation and increasing strain. As they decline naturally, however, we shall see the emergence of successive strata of demand which have been submerged by war-time prices, and the transition to peace-time price levels will be relatively painless. This will be particularly true because current stocks of goods are light, and because the relaxation of the forced draft under which production has been proceeding will make possible large economies and increasing efficiency which will make it unnecessary for either profits or wages to fall as rapidly as prices fall.

There remains, however, a large sphere for Governmental action by ordinary commercial methods in the expansion of public expenditure of various kinds, as prices go lower and if unemployment should appear.

Reconstruction Recommendations

Among the resolutions finally passed at the Reconstruction Conference of the Chamber of Commerce recently held at Atlantic City were the following:

CANCELLATION OF WAR CONTRACTS

It is in the public interest that all war orders placed by any contracting agency of the Government, and accepted in good faith, whether formally and regularly executed or not, should, upon cancellation by such contracting agency, be promptly and equitably adjusted and satisfied as if every formality had been observed; and when so adjusted the amount ascertained to be due by the Government should be promptly paid, to the end that these funds may be utilized by the industries of the country to speed their transition from a war to a peace basis.

If it should be ascertained that legislation is necessary or desirable to accomplish this end, Congress should forthwith enact such legislation.

Officials dealing with questions of adjustment on account of war orders must necessarily be familiar with all the conditions affecting the orders. It will greatly promote expedition and the interests of both the Government and private enterprise for the officials who made the contracts to remain in the Government service to participate in the readjustment.

SURPLUS GOVERNMENT SUPPLIES

Under date of Nov. 29, 1918, the Secretary of War issued a public statement, in which he said: "To prevent too violent dislocation of industry from the standpoint of both employee and employer, accumulations by the War Department of either raw material or finished products will be distributed when and where liquidation of such supplies will least interfere with the return of industry to normal conditions." Such action would seem to insure the stability of the industries affected, which fully appreciate this liberal position.

Therefore, the War Service Committees of American Industries hereby tender to the War Department their services on behalf of their respective industries for the purpose of advising with and assisting the War Department in the disposition of such materials.

INDUSTRIAL COÖPERATION

The war has demonstrated that through industrial coöperation great economies may be achieved, waste eliminated, and efficiency increased. The nation should not forget, but rather should capitalize, these lessons by adapting effective war practices to peace conditions through permitting reasonable coöperation between units of industry under appropriate Federal supervision. It is in the public interest that reasonable trade agreements should be entered into, but the failure of the Government either clearly to define the dividing line between those agreements which are, and those which are not, in unreasonable restraint of commerce, or to provide an agency to speak for it on application of those proposing to enter into such agreement, in effect restricts wholesome coöperation and deprives both industry and the general public of its benefits. The conditions incident to the period of readjustment render it imperative that all obstacles to reasonable coöperation be immediately removed through appropriate legislation.

REMOVAL OF RESTRICTIONS ON INDUSTRY

It is in the public interest that all war regulations of industry should be revoked, and all war restrictions on industry be removed, as speedily as practicable, save in the case of such industries as are engaged in the production, preparation or distribution of foods, feeds, and fuel, and such last-named group of industries should be freed from war regulations and restrictions as early as consistent with the welfare of this nation and of the Allies.

Meso-Thorium as a Radium Substitute

The increasing demand for radium in medical work, but more particularly for the manufacture of luminous paint, indicates the importance of finding radium substitutes. Radium luminous paint was used in the war for many purposes, notably on the dials of aeroplane instruments, so that they could be read at night. The paint is permanently luminous in the dark and contains from 0.1 to 0.25 mg. of radium to 1 gram of zinc sulphide. A luminous watch face requires from 10c. to 20c. worth of radium.

An excellent substitute for radium, for certain purposes, is meso-thorium, which is a radioactive element

found in monazite sand and other thorium minerals. When first extracted it is not in a satisfactory condition for the manufacture of luminous paint; it must be allowed to "ripen" for several months, or even for a year, before it can be used. During this time the alpha radiation which is required for luminous paint becomes sufficiently strong. On the other hand, the beta and gamma radiation of meso-thorium grows rapidly, and it can be used for medical purposes within a few days after preparation.

Radium has a long life, half of it decaying in approximately 1600 years. Meso-thorium, on the other hand, has a short life, five or six years being its useful life for luminous-paint purposes. The price in the past has varied from 40 to 60% of that of radium, the comparison being on products of equal activity. For medical purposes, therefore, it cannot compete with radium as long as there is plenty of the latter; for luminous paint, when used on objects which have a short life, it is an excellent substitute for radium, and should be the means of saving radium for medical purposes. Undoubtedly it was used, during the war, by the Germans. Some of the first luminous watch dials in this country probably contained meso-thorium imported from Europe.

Until recently no meso-thorium was recovered in the United States, although large quantities of monazite sand are treated annually for the manufacture of incandescent gas mantels, a condition that represented an important mineral waste. Soon after the United States entered the war, the Bureau of Mines made a cooperative agreement with the Welsbach Co., of Gloucester, N. J., for the study of methods of extraction and recovery of meso-thorium. The work was carried on at the Rocky Mountain station of the Bureau of Mines, at Golden, Colo., under the direction of Dr. R. B. Moore, superintendent of the station, Dr. Herman Schlundt being assigned to the detailed work on the problem. Successful methods of extraction and recovery have been worked out and added to the regular metallurgical processes of the Welsbach company, so that meso-thorium is now one of the regular products made by that company. The next largest producers of thorium salts in the country about the same time became interested in the recovery of meso-thorium and worked out its own methods. Consequently at present meso-thorium is recovered from practically all the monazite sand treated in the United States.

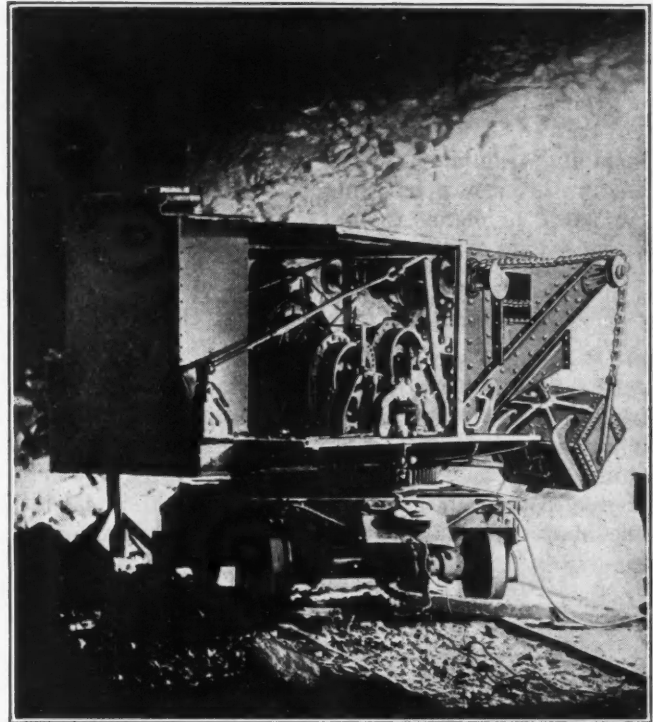
Incorrect press reports of the announcement made by Dr. Moore at the September meeting of the A. I. M. E. at Colorado Springs were responsible for some serious misstatements of fact. The Bureau of Mines has never claimed the discovery of meso-thorium, as this element was first identified and described by Hahn in 1905.

Electric Shovels in Underground Mines

Electric shovels in underground mining are in many ways desirable, and several of them have been employed to good advantage in iron, coal, zinc, limestone, and salt mines, where their performance has proved them to be highly productive and economical factors in this class of excavation. Experience has shown that electricity is an ideal power for underground mining shovels, for

it is economical, safe, and need be used only while the machine is actually digging.

An accompanying illustration shows a Thew electric shovel, built by the Thew Automatic Shovel Co., of Lorain, Ohio, and its construction embraces many of the desirable points that are required of an underground mining shovel. This type is a radical variation of the standard, full-circle swinging steam shovel, and is an abridgment, or a "pocket edition," of the larger shovels, but possesses a pronounced difference in construction and working features that adapt it to advantageous and profitable use under conditions inseparable from underground operations. The shovel has, in concentrated form, all the rugged strength and dependable digging ability of the bigger models, but its compactness does



THEW ELECTRIC SHOVEL IN UNDERGROUND MINE

not complicate the control, for the mechanism is easily operated by one man.

Adapting the construction of the shovel to underground mining consisted in minimizing its over-all dimensions, for it was necessary to consider restricted operating room and narrow entries and passageways, as well as the shaft through which the shovel must be taken into the mine. The shovel is so built that it may be quickly dismantled to pass through restricted areas and be speedily erected for the succeeding operation. As an example of the "knock-down" ability of the Thew shovel, it is stated that a recent installation could be so disassembled as to be taken through a 3-ft. 6-in. x 3-ft. 8-in. shaft.

Conditions often make it inadvisable, impossible, or too expensive to place a track for stopping cars in a definite position. This underground shovel, rotating through a complete circle, has the advantage of being able to work in any direction, to load cars easily and quickly, at the side of or behind the shovel, and the result is increased production and reduced overhead expense. The motor is of the single, constant-speed type,

with friction control. Hoisting, crowding, swinging, and propelling movements are controlled direct from the motor.

One of these shovels operating in a New York iron mine is equipped with a 20-hp. motor, and consumed the following power in loading five consecutive cars of ore: Car No. 1, 16.04 hp.; No. 2, 20.75; No. 3, 16.25; No. 4, 17.00; No. 5, 14.25 hp., or an average of 16.86 hp. for the five cars. Operating costs of this shovel during four months of 1917 and five months of 1918 averaged 16.6c. per ton. An average of 4141 tons per month was loaded at a total cost of \$685.72, of which \$13.59 was the cost of the power. These costs include all expense involved in actually loading the ore, tramping it 300 ft. to the main haulage way, and moving the shovel to different levels and working places. The ore was loaded into three-ton gable-bottom cars. Under identical conditions the per-ton loading cost by hand labor was 30c., the saving effected by the shovel being in this case 13.4c. per ton. At a Western zinc mine a similar shovel loaded 125 cars in 5½ hours at a cost of less than 9c. per ton, including tramping, which figure shows a marked reduction in cost of handling material and hauling it to the shaft by hand, from 16c. and 18c. per ton, or a direct saving of 45 to 50 per cent.

Cathode-Sheet Loop Punching

BY M. A. MOSHER*

The loops by which a cathode starting sheet is suspended from its rod in an electrolytic tank have for a long time been fastened by an automatic punching machine, which cut through the loop and sheet with an H-shaped die, and then turned the flaps of metal back, one above and one below, leaving a rectangular hole,

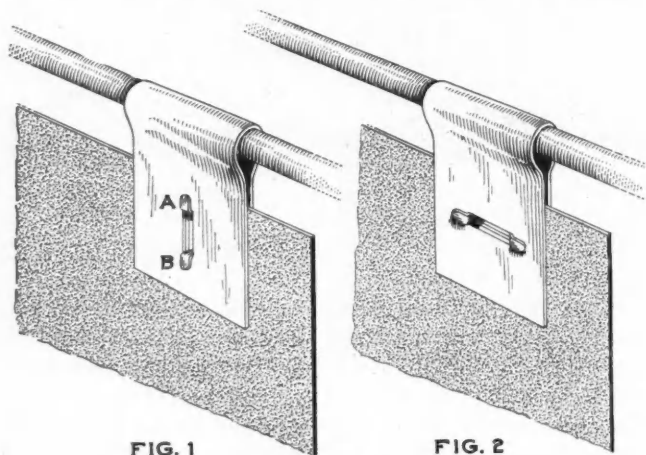


FIG. 1
FIG. 2
LOOPS ON CATHODE STARTING SHEETS

as shown in Fig. 1. However, with even the most careful work, 15 to 20% of the punchings pulled out before the cathode was in operation, and these loops had either to be attached by hand or run through the machine again, causing delay, expense, and waste of material.

The reason for the failure of this style of punching can be understood by noting that the downward pull due to the weight of the suspended sheet, especially when it is being handled roughly by the workmen, puts the entire strain on the flap A (Fig. 1), and flap B is thus of no help and continually tends to pull out.

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Frequent careful adjusting of the machines brought no improvement, so, as an experiment, the dies were turned through an angle of 90°, making a horizontal punch, as shown in Fig. 2, with the flaps bent back to the right and left, instead of one above and one below. This proved to be the solution of the problem, as the strain, taken equally and sidewise by the two flaps, is so greatly decreased that a failure of the punching occurs only rarely.

Daniel Murgue*

On Oct. 9, 1918, Daniel Murgue, the eminent authority upon mine ventilation, died at Lyons, France. From his graduation at the age of 21 from the School of Mines at St. Etienne, until his death, he devoted his engineering energies to the mines of France, especially those in the coal regions. Immediately after the war of 1870 he began the task which was to bring him fame, and in 1876 he propounded his theory on mine ventilation. Previous to his work, this subject had been a source of complete discord among engineers. Murgue established rapid methods for gaging strength of air current in mines, and invented a machine for the continuous registration of these strengths, and many other ingenious pieces of apparatus. He developed laws which have become classic in the art, and applied his theory of ventilation to the circulation of air in mines by ventilators, and established mathematical formulæ for determining the quantity of air necessary.

Murgue introduced into the problem of ventilation the important principle of the "equivalent orifice" of a mine or section in square meters, that is, an orifice such that the same pressure would force through it, during the same time, the same volume of air as through the mine. Murgue also actually determined the "equivalent orifice" for a great number of mines and combined the results in tables which have been of the greatest service.

He was well liked among his associates, as his long tenure of important engineering-society offices testifies. He was for 16 years president of the Society Amicale of Engineers of St. Etienne, and an officer or member of almost all the other mining societies of France. He contributed at the proceedings of these organizations many papers in his chosen field, which are of great value to the mining world. Murgue can rightfully be called the father of the study and application of systematic mine ventilation.

Davis-Daly Copper Co.

The quarterly report of the Davis-Daly Copper Co. for the period ended Sept. 30, 1918, indicates that 17,697 tons of ore was shipped, which produced 2,071,886 lb. of copper and 101,705 oz. silver. Total receipts amounted to \$412,443.92, and disbursements were \$301,978.17. Mention is made of the fact that no improvement is apparent in the labor situation, and it is contended that the low efficiency of the mine workers is a contributory cause to the high cost of operations.

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

*Abstract of translation of article appearing in Oct. 20, 1918, number of *Texte de l'Echo des Mines et de la Metallurgie*.

Why Minerals Float

BY GEO. J. YOUNG

A suggestive discussion of some principles controlling the flotation of sulphide minerals. The writer puts forward the hypothesis that conditions favoring flocculation are necessary before flotation can take place. Adherence of oil films is explained as being due to chemical action.

THERE has been much discussion of the principles affecting the flotation of heavy minerals, and many attempts have been made to explain the phenomenon, but apparently without a satisfactory outcome. The present article is offered as a contribution to the discussion, in the hope that further expression of opinion and experience along somewhat different lines than have been customary will result.

A mineral froth floats because it displaces a greater weight of water than its own weight. Under what conditions is such a froth formed? The question can best be answered by a specific case. Suspend 50 gm. of finely crushed galena in 5000 c.c. of water rendered alkaline with 25 gm. caustic soda, and maintain it in suspension by vigorous agitation in one part of the vessel. Now add some flotation agent. No froth, except under conditions to be stated afterward, will form. Gradually acidify the solution. As soon as acidity is reached a froth will appear and rise to the surface in the quieter portions of the vessel (an experimental flotation machine).

What is the explanation? Consider a suspension of galena particles in distilled water in a glass tube, and, without agitation, gradually add sulphuric acid until the solution is acid. No oil is present. As soon as the solution is acid the particles of galena flocculate and form larger particles, which fall rapidly. Flocculation of suspensions by the addition of an electrolyte is a common phenomenon. In the first experiment described agitation and oil failed to produce a froth, but as soon as an electrolyte was added a froth appeared. Evidently the flocculation of a suspension is as necessary as the use of a flotation agent.

USE OF ELECTRODE

The first experiment was repeated with all of the conditions the same except that sulphuric acid was not added and an electrode connected to a water pipe was suspended in the spitzkasten portion of the flotation machine. A froth formed. The explanation is not difficult. The electrode caused the discharge of the charged particles in the suspension. In other words, the presence of the electrode facilitated the flocculation of the particles of the suspension. I venture the hypothesis that before a froth can be formed it is necessary to have conditions present that will permit of the flocculation of the mineral particles. The floccules can trap and hold the globules of air with sufficient tenacity to cause the froth to form. It will be asked at once that, if this is true, why would not the fine particles (gangue) also flocculate and also trap air and rise to the surface. In

other words, why should there be any differentiation between particles of a different nature in a suspension. To satisfy this it is necessary for me to invent a term—the degree of the intensity of flocculation. The hypothesis must be further extended by stating that the intensity of flocculation varies with different minerals. Minerals like galena are wetted by certain oils (flotation agents). Whether this is an example of simple adherence of an oil film or the slight adsorption of the oil is an open question. The fact remains that an oily film does form on some minerals and not on others.

What is the difference between the flocculation of oiled galena particles and oil-free galena particles? The oiled particles of galena would adhere and form a more tenacious floccule than the unoiled. It is probable that the intensity of flocculation is increased by the presence of oiled particles in the suspension, and this would affect the galena particles. The oily floccule of galena particles may be expected to more readily entrap the air globules than a floccule composed of unoiled particles. There is sufficient movement of the solution to break up the floccules of gangue minerals, but evidently not enough to interfere with the floccules of galena.

Here is an explanation, perhaps not complete, of the differentiation between particles of different substances in a suspension when subjected to the action of a flotation machine. It should be further remarked that where gangue and mineral particles are together the froth is never free from a certain amount of admixed gangue minerals. This would indicate that some of the gangue floccules are not broken up, and therefore act like the galena floccules.

FROTH PRODUCTION

An additional fact must now be added. Bancroft states that a froth cannot be produced with a pure liquid and air. A third substance in colloidal solution in the liquid in question is necessary. He defines a froth as an emulsion of air in liquid. Thus, to obtain a suspension of fine air globules in a liquid, it is essential to add a substance which goes into colloidal suspension in the liquid. Bancroft adds that ore flotation requires a froth of air in oil. This air emulsion possesses the distinct advantage of distributing minute air bubbles and thin films of oil throughout the pulp, where they can come in contact with the particles of heavy mineral. Without further discussion of this phase, or of the question that might be raised as to other conditions, the presence of an electrolyte or its equivalent, which might influence the formation of the froth, it can be stated that a froth of air in the liquid is highly advantageous and necessary for flotation.

In the Elmore vacuum apparatus the mineral particles were thoroughly mixed with oil and then drawn into a vacuum chamber. The vacuum under which the pulp was maintained caused the air in solution to be liberated in fine bubbles throughout the pulp, and these bubbles were of great assistance in forming and in lifting the froth to the discharge lip of the vacuum chamber. There is thus only a difference in method between the formation of a froth as Bancroft describes it and its

formation in the Elmore system. The results are similar.

Why does oil stick to a sulphide mineral and not to a gangue mineral such as quartz? Sulphide minerals are oxidizable substances, and may be expected to sensibly occlude (adsorb) oxygen. Oil is an oxidizable substance, and when brought in contact with a sulphide particle which has already a thin film of oxygen in its pores and on its surface it may be expected to adhere. Wetting a mineral particle with oil is only another way of indicating that obscure chemical reactions supply the force which causes the oil and the particle to adhere. The same explanation applies to the adherence of air to the oily particle.

In flotation experiments upon cinnabar I have encountered considerable difficulty in thoroughly wetting the crushed cinnabar with water. There was a distinct tendency of the cinnabar particles to adhere and form clots. Even without the addition of a flotation agent, some of the cinnabar would rise and form a thin layer on the surface of the water in the spitzkasten. This was probably due to the strong occlusion (adsorption) of oxygen. The fact is significant in indicating that the degree of occlusion (adsorption) varies with different minerals.

SUMMARY OF CONDITIONS

Summarized, the hypothesis advanced is that the formation of a froth is due to conditions which permit flocculation, to the occlusion (adsorption) of oxygen by both the mineral particles and the oily particles, and to the presence of an oily substance in which there is a colloidal suspension. A fine state of subdivision and thorough contact are essential for the completeness of a chemical reaction. In flotation, the mineral particles are finely divided and thoroughly mixed with air and a flotation agent. Agitation plays the important part of subdividing the air and oil and bringing them in contact with the mineral particles.

Flocculation may be brought about by the use of suitable electrolytes, by heat, or by the discharge of the charged particles in the suspension. Occlusion (adsorption) cannot be controlled, but undoubtedly is more active in the presence of a fine degree of subdivision of the sulphide particles and vigorous agitation. Air is in great excess, whereas the amount of the flotation agent is usually limited. The flotation agent which I have stated to be necessary, and which probably is in the majority of cases, can be controlled both as to quantity and kind.

In a series of experiments that were conducted by some of my former students, and which were made upon portions of pure minerals, finely divided, all of the flotation agents tried did not react equally well. There was some difference, but not as great a difference as might have been expected. Though the experiments were not completed, enough data were accumulated to enable me to form the opinion that the kind of flotation agent was of secondary importance compared to the attainment of the proper physical conditions. The quantity is important from a theoretical point of view, for, if the statement that oil is oxidizable be accepted, a relatively large quantity present in the agitation chamber will reduce the quantity of oxygen and inter-

fere with the occlusion of oxygen by the sulphide particles. Excess of oil may operate to produce a mineral oil and air froth that will be less tenacious than one in which the oil is smaller in quantity.

The hypothesis advanced and the observations and opinions stated were derived from different sets of experiments made at different times, and therefore lack the conclusiveness of systematic work.

Salvage From the Battlefields

Iron and steel merchants are showing keen interest in the intentions of the British government with regard to the distribution of the huge dumps of steel scrap, consisting of broken shells and the metal parts of transport and railway wagons, which have been gathered on the battlefields of France and Belgium, says the *Iron-monger*. Some of this material is now being used by the French steel works, but their consumption represents only a small proportion of the whole, and the bulk of the material must be disposed of in Great Britain. During the present year quantities have been loaded into wagons, ferried across the English Channel and conveyed to Swansea. It has been suggested that the intimate knowledge of the scrap trade gained by the Ministry of Munitions will enable that department to sell the material economically directly to users without employing an intermediate agency, but the merchants express confidence that their services will be found indispensable in disposing of the material to the best advantage. In the meantime it is announced that a Ministry of Supply is to be set up, and that, pending its formation, the Ministry of Munitions will undertake the work of disposing of all government property.

Mining in Greece in 1917

The important mineral products of Greece are magnesite, marble, and emery, says *Commerce Reports*. Most of the magnesite mines of the country are on the island of Euboea. The production of magnesite during the last four years has been as follows: 117,430 metric tons in 1914, 133,858 tons in 1915, 176,363 tons in 1916, and 99,518 tons in 1917. Only the larger mines whose output was sold to the Allied governments were able to continue operations, as the smaller properties were unable to secure tonnage for export and supplies for operating their mines. The large mines were given every facility by the Allied governments for obtaining explosives, railway materials, oil, greases, food, and other necessities unobtainable by mines not running under this management.

The mining of emery is a monopoly of the Greek government. The only mines in operation are on the island of Naxos. Exports in 1916 were 19,950 metric tons, but in 1917 they amounted to only 17,000 metric tons, shipped entirely to Marseilles. Marble production has been almost completely stopped on account of transport difficulties.

Bottoms of Mine Cars may be cleaned by means of a drill of the jack-hammer type, fitted with a flat or wedge-shaped bit. The operator manipulates the machine with a short "scooping" motion to loosen the material, which is afterward removed with a short-handled shovel.

Details of Practical Mining

A Concrete Water-Seal Ring for Shaft

BY G. G. WALD*

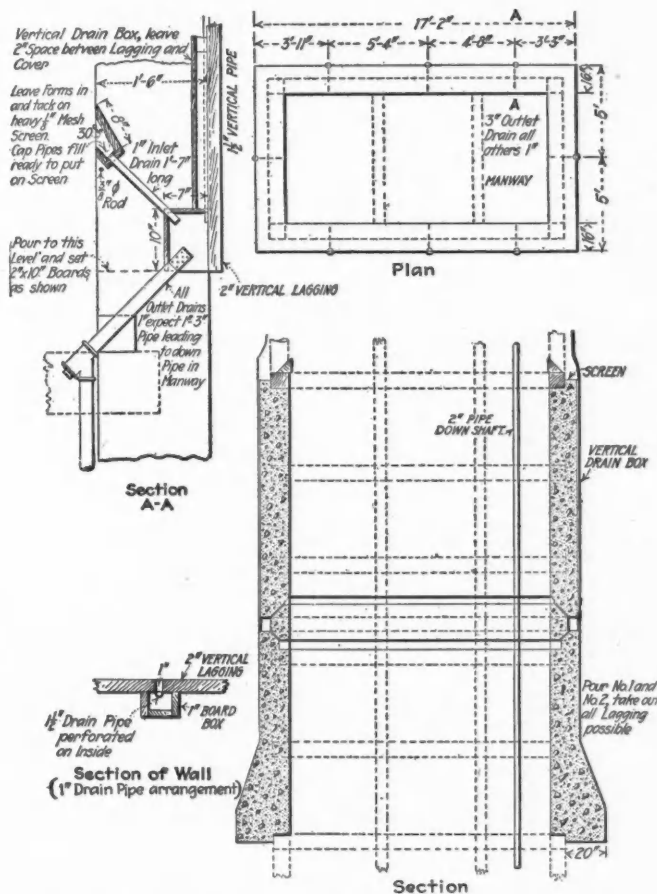
An effective method of sealing off water in a shaft where the inflow is confined to a restricted, well-defined area was evolved at the main shaft of the Arizona Hercules Copper Co. at Ray, Arizona. In instances where the water-bearing strata is extensive, the only method of waterproofing a shaft is to concrete it completely, but at the Arizona Hercules practically all of the water came in on a flat dacite-conglomerate contact 220 ft. from the collar of the shaft, and it was possible

15,000 gal. per 24 hours, was first sealed off. In this operation, 30 ft. of the shaft was lined with concrete, a distance 12 ft. below and 18 ft. above the water-bearing contact. The concrete mix was six sacks of cement to one cubic yard of creek gravel, and 40 lb. of hydrated lime per cubic yard were added for waterproofing and for the purpose of making the concrete flow easily through the troughs. The concrete was mixed on surface in a one-yard Ransome mixer and so placed as to discharge directly into a 6-in. pipe hung in the southeast corner of the west hoist compartment. At the working level the concrete was caught in a bucket 2 ft. 6 in. high and 20 in. in diameter. The bottom of the bucket was set 6½ ft. above the top of the pour to be made, and from the bucket the concrete was run into the form by means of launders, made of 1-in. plank.

The shaft sets were not removed, and the 2-in. form-planks were nailed to the inside face of the shaft timbers after they had been dressed or bushed to conform to plumb. The concrete was reinforced with ½-in. square twisted bars, having 1-ft. horizontal centers, and ¾-in. round iron having 2-ft. vertical centers. The concrete walls are 18 in. thick, except for the bottom wall, which is 2 ft. thick, and averaged 2.75 cu.yd. per linear foot of shaft over the 30 ft. poured.

The men worked on a three-shift basis, one jigger boss and four timbermen on each shift. The average time taken to make a 5-ft. pour of concrete after the forms were ready was three hours. Work was started 12 ft. below the contact, and all the lagging entirely removed from two sets. The ground was solid conglomerate, and a hitch was cut at a point 2 ft. behind the timbers at the bottom, to insure cutting off and holding back the water, and was then tapered to 1 ft. back of the timber and to 5 ft. above the bottom. The first pour of 5 ft. was then made, lagging was removed from the third set, and the second pour of concrete completed, and so on to the top.

Had the water been simply sealed off, it would no doubt have found its way over or under the concrete. The following method was therefore adopted to collect and drain the water down a pipe to the sump: The top of the second section or pour brought the lining 1 ft. below the dacite-conglomerate contact, and a 3-in. outlet pipe was set in the concrete on a 45° slope, with its upper end projecting above the concrete near the back of the wall and its lower end projecting into the shaft in the center of the end of the manway compartment. Seven 1-in. pipes were placed similarly, one in the center of each compartment and in the center of each end of the shaft, and capped so that they would be used only in case the 3-in. pipe clogged. A 6-in. square recess was allowed all around the shaft so that if it becomes necessary to use the 1-in. emergency drain pipes, the gathering pipe can be strung outside of the shaft clearance. Above the second section, vertical back



WATER COLLAR AT ARIZONA HERCULES SHAFT

completely to seal off this water by lining 30 ft. of the shaft with concrete.

The Arizona Hercules shaft is 900 ft. deep, 14 ft. 2 in. x 7 ft. inside in the clear, and consists of two hoist compartments 4 ft. 10 in. x 7 ft. and a 3-ft. 6-in. x 7-ft. manway. A station and a pocket are cut at the 475 level. It was desired to line a heavy section of the shaft (from 395 ft. to 555 ft. from the collar) with concrete, and, to improve the working conditions below, the water flow at a point 220 ft. from the collar,

*Mining engineer, Hanington & Wald, Contractors, Ray, Ariz.

lagging was placed around the shaft with the face of the lagging 18 in. back of the inside face of the shaft timbers. This lagging was put in tight and caulked so that no grouting could get through and a free space would be left for the water to circulate behind the lagging.

A 2-in. space was left between the laggings at the center of each compartment and the center of each end. Opposite each space a perforated pipe was carried up vertically to the top of the concrete collar and set in a 3 x 4-in. box of 1-in. plank to collect the water and carry it to the 7 x 8-in. gathering box of 2-in. plank. This latter was placed completely around the shaft and against the back lagging, covering the open ends of the pipes that were set during the second pouring. To catch any water that might run down the face of the concrete, a niche was left all around the face of the shaft, and from this eight 1-in. pipes carried such water down to the inner gathering box. The water collar, which was designed and constructed by Hanington & Wald, contractors, of Phoenix, Ariz., has been successful, as the 3-in. drain pipe is carrying all the water, and the shaft is dry.

Station Box for Dull Tools

By C. T. RICE

Dull tools are much more likely to go on top at the end of the day if there is some regular place for them to be left at the station as the men go off shift. At the Hecla mine, Burke, Idaho, a small portable box is used that may easily be slid over to the shaft on the turn sheet to facilitate loading by the station tenders. This is divided into two compartments, one for saws and the other for dull axes and picaroons. The box is kept in such a position in the station that it can be seen easily from the shaft by the cagemen.

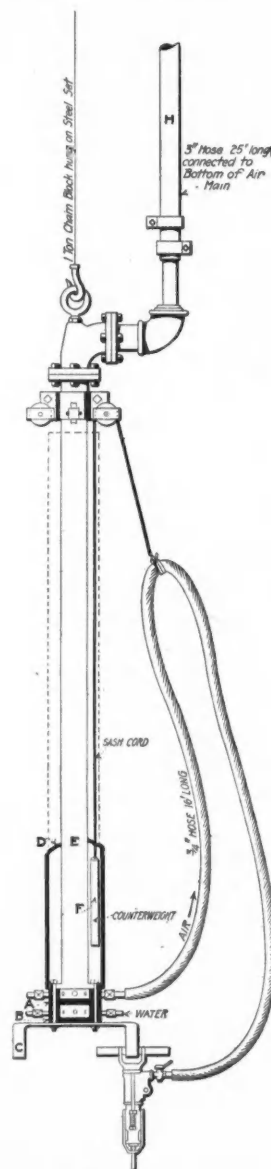
Shaft Sinking at the Seneca Mine

In the *Journal* of Sept. 28 appeared a short article on the sinking of the Seneca shaft at Mohawk, Mich., which mentioned the use of a header as a part of the drilling apparatus used. It is interesting to note that a similar header was utilized in sinking the Woodbury shaft, at the Newport mine, Ironwood, Mich., in 1915. J. M. Broan, who was in charge of the shaft sinking at the Newport, is the superintendent at the Seneca, and it was through him that the information for Mr. Featherly's article was obtained.

An accompanying sketch shows the general arrangement of the header at the Woodbury shaft, concerning which Mr. Broan writes¹ as follows:

"The drilling equipment in sinking is somewhat different from that used in ordinary practice in that a header is used to distribute air to the machines. The sketch shows a single machine hanging in position when not in use. The casting *A* is of 9-in. diameter, bored out in the center, and has a bolt circle of a standard 4-in. flange. Eight holes, evenly spaced, are drilled in the sides and tapped for $\frac{1}{2}$ -in. nipples, to which the ma-

chine-hose connections are made. *B* is a duplicate of *A*, except that the holes for the nipples are of different size. There are seven $\frac{1}{2}$ -in. and one 1-in. connections, the latter being an inlet for the water and the others for water discharges to the drills, to be used only with water-tube type jack-hammers. The hooks or hangers *C* are made of $\frac{3}{8}$ x 2-in. strap iron. *A*, *B*, and *C* are held together by four $\frac{3}{4}$ -in. bolts passing through the 4-in. flange at the bottom of the 4-in. air pipe *E*. The ell at the top is made with a lug cast on it to accommodate the 1-in. I-bolt by means of which the header is suspended. *D* is a 9-in. pipe and serves as a casing



GENERAL ARRANGEMENT OF DRILL HEADER USED IN SHAFT SINKING

to inclose the counterweight *F*, which holds the slack hose out of the way while drilling is being done.

"Two headers are used and each accommodates seven jack-hammers and one blowpipe. When not in use, the apparatus is hung to one side in the headframe and can be easily lowered by means of a sling beneath the bucket. In service it is handled by means of a small chain-block fastened to the bottom shaft set and brought to any desired height, the adjustment being allowed by means of a 3-in. air hose *H*, which connects to the air main."

¹Vol. 20, *Proceedings* of the Lake Superior Mining Institute.

The Twenty-seventh Engineers

The 27th Engineers went over in sections, first A Co., then B and C, and finally D, E and F. Co. A naturally got first into the activities, and its men will receive two gold chevrons, while the men of the other companies will get one. Toward the end of the campaign the entire regiment was together and did splendid work, particularly in the last offensive, as is evidenced by the following letter from the Chief Engineer of the First Army:

HEADQUARTERS, FIRST ARMY.
OFFICE OF CHIEF ENGINEER.

23 November, 1918.

From the Chief Engineer, First Army,
To Commanding Officer, 27th Engineers.
Subject: Services Rendered During Offensives.

1. I desire to express my appreciation to you, and, through you, to your regiment, of the excellent service rendered by the officers and men of the 27th Engineers during the Meuse-Argonne offensive, beginning Sept. 26, and continuing until the conclusion of the armistice on Nov. 12th.
2. At the time when the building of bridges was of paramount importance to the advance of the Army and its supply, the men of your command met every demand made upon them, and by their energy and ability contributed in no small degree to the success of the First Army.
3. A copy of this is being sent to the Chief of Staff, First Army.
4. Please publish this letter to all the officers and men of your command at the earliest opportunity.

GEORGE R. SPAULDING,
Colonel, Engineers, U. S. A.
Chief Engineer, First Army.

After four months of nearly continuous campaigning, most of the time in pup tents and under more or less continuous shellfire, working day and night in all kinds of weather, particularly the wet and cold kinds, the boys are now entitled to a rest and some good feeds. Colonel Perry saw to it that they had a treat on Thanksgiving, with the aid of the Comfort Fund; and provisions were made for another treat on Christmas. After that they will soon be on their way home, if present plans are maintained.

HOW THE COMFORT FUND STANDS

Previously acknowledged.....	\$18,492.77
C. M. Eye.....	10.00
C. A. Burdick.....	5.00
Mining and Metals Section, National Safety Council.....	125.00
John Herman.....	10.00
Lane Pearl.....	5.00
W. L. Gibson.....	5.00
C. M. Fenton.....	10.00
Charles Le Vasseur, monthly.....	5.00
B. N. Jackson.....	10.00
H. A. Johann.....	10.00
Mrs. A. B. Emery, Messina, Transvaal.....	10.50
A. C. Stoddard.....	5.00
Robert E. Tally.....	25.00
Nelson P. Hulst.....	20.00
Lawrence Addicks.....	20.00
R. R. Boyd.....	25.00
E. R. Varela.....	5.00
W. J. Olcott.....	25.00
J. E. Clennell.....	10.00
C. M. Eye (monthly).....	10.00
A. H. Hoffman.....	10.00
Francis Drake.....	25.00
Employees of Sociedad Minera Backus y Johnston del Perú.....	176.29
Charles Le Vasseur (monthly).....	5.00
F. Wartenweiler.....	10.00
Walter Douglas.....	100.00
Robert E. Dye.....	10.00
R. T. Hancock.....	3.00
Total.....	\$19,182.56

Friends are urged to make an effort to carry the Comfort Fund to its goal.

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

Control of Influenza

A meeting of the New York Section of the Mining and Metallurgical Society was held on Dec. 16, at which the subject of influenza was discussed, with particular reference to its nature and control in mining camps, in many of which the ravages of the disease have materially affected production. The chairman of the section, Sidney H. Ball, in his opening remarks, drew attention to the unusual experience of the two large South African diamond mines. At the De Beers mine, where there are normally about 12,000 employees, about 4000 have died from the after-effects of the disease. At the Premier mine drastic preventive measures were undertaken before the disease had made any headway, with the result that there was practically no loss of life.

Dr. Charles F. Collins, of New York, called attention to the history of the disease. From the early part of the sixteenth century up to 1870 the records show that about ninety influenza epidemics have been described. Some were sporadic, though others swept rapidly over the entire world; some were of short duration, and others lasted for several months. Many fatalities have accompanied the outbreaks, but in all cases, so far as records show, deaths have not been directly due to influenza, but to other diseases that immediately follow and attack those who are already much weakened and thoroughly poisoned by the influenza.

There are so many varieties of the symptoms that accompany influenza that it is an open question as to whether all the epidemics have originated from the same germ. It always starts with infection of the mucous membranes of the nose or throat, spreads more or less to all the other mucous membranes of the body, and, in the milder forms, the patients always present practically the same symptoms.

Dr. Collins pointed out that, although a large number of the fatalities have been due to pneumonia, this complication differed from the pneumonia that seems to be always more or less prevalent. The pneumonia following the influenza develops at a single spot and creeps gradually over one or both lungs. In the recovery phase it recedes in the same manner, instead of enveloping the whole of the lung tissue at once, and clearing gradually but equally from the entire lung.

Dr. William H. Park, of the Research Laboratory of the New York Board of Health, opened his remarks by making a rather surprising statement to his audience, namely that he and his associates did not know the germ that caused influenza. On several occasions since 1890 scientists have thought that they identified the germ, and have followed it on its course for a time through the disease, only to find it missing later, though the disease traveled on in unabated virulence. During the present epidemic a germ was identified in the Eastern states, but it was almost lacking in the Middle West. Several vaccines have been tried, and the records from their use have been most encouraging; but other records upon the same material show no favorable results. There is a fair consensus of opinion among bacteriologists that they neither know the germ nor how to destroy it, but they do believe that they know how to prevent its spread, and that is by isolation, avoidance of contact, the protection of a healthy person from any and all excretions which may come from the nose,

mouth, or eyes of the patient. Five thousand marines isolated near San Francisco, in an island in the bay, have not had influenza. It develops slower in sparsely settled localities, and properly made masks have undoubtedly protected their wearers in many cases. All are in agreement as to the necessity for taking to one's bed as soon as there is the least evidence of the disease, and staying there until all danger is past.

Dr. Charles E. Baldwin, of Derby, Conn., spoke of a solution of lime and creosote that he had been using for several months both for influenza in its incipient form and for pneumonia, where that disease had already developed. Dr. Baldwin claimed that the solution is not an immunizer, but kills the influenza and pneumonia germs when they are present. This idea has been adopted at Cripple Creek, Victor, and Colorado Springs, where six physicians have been using the solution, apparently with good results. The remedy has also been sent to the Anaconda physicians at Butte, Mont., but they have not yet reported the result.

Mining Congress To Enlarge Work

The American Mining Congress held its annual meeting of members in New York on Dec. 10. Representatives from several other states were present. The discussions upon the questions propounded in the questionnaire recently sent out developed many angles as to the post-war conditions affecting costs and treatment of the wage problem. These discussions led into a final consideration of a plan for enlarging the work of the Mining Congress upon the basis of divisional organizations, with specialized men in charge of the grand divisions, under following general headings: "Copper"; "Iron and Ferrous Minerals"; "Gold and Precious Metals"; "Oil and Gas"; "Non-Metalliferous Minerals"; "Coal"; "Base Metals"; "Transportation"; and "Industrial Relations and Welfare." The background of the enlarged work was the Bureau of Mining Economics, with such subdivisions as "Educational Publicity" and "Statistics."

The plan submitted by Secretary Callbreath met with general approval, with the understanding that the "Industrial Relations Division" devote most of its energy to educational work and general welfare of employees.

The following resolution was presented by Bulkeley Wells, and adopted by unanimous vote:

That the American Mining Congress accept, as a general program of reorganization and development, the plans submitted by the secretary, the actual adoption of these plans to be effected only in the discretion and by order of the directors and only as the assured income of the congress will cover the increased expenses so to be incurred.

A special committee consisting of Messrs. Wells, Howard, and Crosby reported in favor of financing the enlarged work upon the basis of a production tax of 10c. for each \$1000 in values produced. The secretary was instructed to enter into contracts with producers for a permanent service through the Bureau of Mining Economics, upon the above basis, a minimum of \$60 and a maximum of \$6000 per year being fixed for such service. The president was authorized to appoint committees representing each division of production, to proceed with the organization.

The nominating committee, Messrs. Barnett, of Col-

orado; Payne, of New York, and McCutcheon, of Pennsylvania, nominated the following directors: John C. Howard, Salt Lake City, Utah; Bulkeley Wells, Denver, Colo; Harry L. Day, Wallace, Idaho; E. L. Doheny, Los Angeles, Calif.; and E. P. Mathewson, New York. The report was adopted. The "hold-over" directors are: Walter Douglas, New York; M. S. Kemmerer, New York; George H. Crosby, Duluth; W. J. Richards, Pottsville, Penn., Samuel A. Taylor, Pittsburgh, Penn.; L. A. Friedman, Lovelock, Nev.; Carl Scholz, Chicago, Ill.; and Charles S. Keith, Kansas City, Missouri.

The board of directors elected the following officers: President, Bulkeley Wells, Colorado; first vice-president, Harry L. Day, Idaho; second vice-president, M. S. Kemmerer, New York; third vice-president, George H. Crosby, Minnesota; secretary, James F. Callbreath, Washington, D. C.

Pulverized Fuel in Blast Furnaces

A company has been formed under the title of the Garred-Cavers Corporation, with offices at 43 Exchange Place, New York, to introduce the use of pulverized fuel in blast furnaces. The company has acquired the patents of the Garred and Cavers processes and has made arrangements for the use of the same at the blast furnace plant of the Tennessee Copper Co., Copperhill, Tenn., and at the smeltery of the International Nickel Co. of Canada, Ltd., Copper Cliff, Ontario.

A large amount of experimental and development work has already been done, with encouraging results, both from an operating and economic point of view, and the engineers and metallurgists interested in blast-furnace practice will fully appreciate the many advantages that will accrue if this system, which utilizes cheap pulverized fuel in place of coke, is generally adopted.

U. A. Garred was formerly chief engineer at the Washoe smeltery of the Anaconda Copper Mining Co., and was later engaged at the Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia. More recently he was chief engineer at the Nichols Copper Co.'s smeltery, at Laurel Hill, L. I., and is now devoting his time to the problems connected with the use of pulverized fuel in metallurgical furnaces.

Marketing Government Property

Benedict Crowell, Assistant Secretary of War and Director of Munitions, has been requested by the President to assume responsibility for the proper disposition of all property acquired by the War Department since Apr. 6, 1917. Mr. Crowell has appointed C. W. Hare, Assistant Director of Munitions, to have general supervision of this work, and Brig. Gen. C. C. Jamieson has been appointed Director of Sales in direct charge of an organization to be perfected for the disposal of surplus property.

The policies and procedures upon which sales will be made are being formulated by the Director of Munitions, the Assistant Director of Munitions, and the Director of Sales. It is the intention of the Director of Munitions to so market Government property as to interfere as little as possible with business conditions, and to this end the Assistant Director of Munitions and the

Director of Sales will, as occasions may require, confer with committees representing the industries affected.

Any information in connection with the various problems involved will be furnished by either the Assistant Director of Munitions or the Director of Sales at their offices in the Munitions Building, Nineteenth and B Streets, Washington, D. C.

Monthly Copper Production for 1918

The table which appears herewith is compiled from reports received from the respective companies (except in the cases noted as estimated), together with the reports of the U. S. Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

MONTHLY CRUDE COPPER PRODUCTION, 1918

	August	September	October	November
Alaska shipments.....	4,245,557	4,216,816	4,142,744	6,607,216
Arizona:				
Arizona Copper.....	4,300,000	4,330,000	4,060,000	4,000,000
Cons. Ariz. Smelting....	1,250,000	1,200,000	1,200,000	7,500,000
Inspiration.....	9,000,000	7,800,000	8,125,000	992,271
Magma.....	900,000	747,805	949,455	.....
Miami.....	5,374,198	5,012,865	4,945,178	4,382,170
New Cornelia (a).....	2,838,000	2,468,000	2,390,000	2,272,000
Old Dominion.....	2,064,500	2,292,000	2,373,000	2,101,000
Ray.....	6,625,000	7,250,000	7,490,000	7,020,000
Shannon.....	708,000	722,000	800,000	684,000
Shattuck Arizona.....	682,861	686,844	744,069	583,655
United Verde Extension..	4,627,260	4,623,300	4,702,500	.....
Other Arizona.....	26,363,078	25,002,934	26,604,700	.....
California:				
Mammoth.....	1,320,000	1,140,000	910,000	1,140,000
Michigan:				
Calumet & Hecla.....	10,718,520	10,341,468	11,929,929	10,499,711
Other Lake Superior (b) .	7,000,000	7,000,000	7,000,000	.....
Montana:				
Anaconda.....	24,900,000	21,800,000	23,450,000	22,600,000
East Butte.....	1,714,358	2,134,700	1,823,000	2,100,000
Nevada:				
Mason Valley.....	1,032,702	1,682,340	1,086,200	1,073,400
Nevada Cons.....	6,500,000	6,670,415	6,700,000	6,601,000
New Mexico:				
Chino.....	5,065,818	7,936,000	7,063,000	6,464,285
Utah:				
Utah Copper.....	19,920,947	17,785,000	19,000,000	16,500,000
Eastern smelters (b).....	1,750,000	1,750,000	1,750,000	.....
Total reported.....	148,900,799	144,592,487	149,238,775	.....
Others, estimated.....	16,650,000	13,400,000	4,100,000	.....
Total United States....	165,550,799	157,992,487	153,338,775	.....
Imports: Ore and concentrates, etc.....	18,546,115	10,828,810	10,112,365	.....
Imports in blister, etc....	42,519,271	37,570,650	33,884,114	.....
Grand total.....	226,616,185	206,391,947	197,335,254	.....
British Columbia:				
Canada Copper Corpn....	159,821	142,466	191,433	.....
Granby Cons.....	2,820,207	3,371,535	2,549,474	2,147,405
Mexico:				
Boleo.....	.....	1,764,000	1,873,760	.....
Cananea.....	5,000,000	4,900,000	4,300,000	5,100,000
Phelps Dodge, Mexican properties.....	4,063,322	4,308,845	3,791,602	3,551,418
Other Foreign:				
Braden.....	6,690,000	6,020,000	(a).....	(c).....
Cerro de Pasco.....	5,786,000	6,150,000	5,836,000	5,398,000
Chile.....	8,496,000	7,346,000	8,548,000	9,854,000
Katanga.....	4,894,200	4,887,598	3,306,900	551,250
Bakus & Johnston.....	2,052,091	2,435,442	.....	.....

(a) Only electrolytic cathodes are entered. New Cornelia also produces some copper from ores sent to Calumet & Arizona smeltery, which is included under "Other Arizona." (b) Estimated. (c) Not reported.

The production of the United States by months since the beginning of the year is as follows:

	Pounds
January.....	165,431,568
February.....	160,011,364
March.....	185,525,168
April.....	163,207,096
May.....	181,070,350
June.....	166,723,599
July.....	159,329,031
August.....	165,550,799
September.....	157,992,487
October.....	153,338,775

The item "Alaska shipments" gives the official figure of the U. S. Department of Commerce. Kennecott production from its Alaskan mines for August and September was 5,280,000, and 5,508,000 lb., respectively. Beginning with the month of October, the Kennecott

Copper Corporation discontinued reporting the output of its Alaska mines and the Braden mines separately. In October its copper production from both sources was 13,286,000 lb., and in November, 12,146,000 pounds.

The grand total includes, under "Imports in ore and blister copper," the production of such companies as Canada Copper, Granby, Cananea, Braden, Cerro de Pasco and Chile. As a matter of record, however, the individual figures are given after the total. We also report the production of the Boleo and Katanga companies, whose copper does not come to the United States.

The Tin Situation

G. N. Armsby, chief in charge of tin, of the War Industries Board, authorized the publication of the following letter dated Dec. 18 and addressed by him to John Hughes, chairman of the sub-committee on pig tin, of the American Iron and Steel Institute:

Referring to my letter of Dec. 2, fixing the price, terms, and conditions under which this tin is to be distributed to consumers, dealers, and jobbers, the total quantity allocated is approximately 10,000 gross tons, and the estimated overhead cost from f.o.b. port of shipment, either Singapore or Sydney, to f.o.b. delivery point in United States, including ocean freight, marine and war risk insurance, interest, railroad freight, storage, weighing, and all other charges, will be covered by the provisional prices announced in Circular Letter No. 8 of American Iron and Steel Institute, dated Dec. 3, 1918, namely, 72½c. per lb. ex dock or store port of New York or Chicago, or f.o.b. delivery points at Chicago and points east, seller's option, or 71½c. per lb. ex dock or store Pacific Coast ports, seller's option.

In my letter of Dec. 2, 1918, which was published in your Circular Letter No. 8, above referred to, the United States Steel Products Co. was authorized to make sales at the above prices for shipment during the months of December, 1918, and January, 1919. After due consideration, the War Industries Board has decided to extend the period, during which the base prices will be maintained, beyond Jan. 31, 1919, until such time as all of this tin has been distributed.

The War Industries Board has further decided that, when the importation and distribution of this tin shall have been completed, and all charges and costs accruing thereon shall have been finally and definitely ascertained, the actual net price per pound be determined and proper refund be made on the cost basis by the United States Steel Products Co. to each buyer to whom said company has made a sale.

Careful consideration is being given to the needs of American consumers with respect to further importation of pig tin from the various producing centers, and when the proper time comes, a formal announcement will be made as to when and under what conditions import licenses will be granted permitting importations to be made.

Mr. Hughes has made the following statement to the trade: "Sales of tin made by the United States Steel Products Co. will be adjusted after final distribution, as soon as the cost price has been ascertained and determined under Government authority."

Tomboy Gold Mines Co., Ltd.

At the annual meeting of the Tomboy Gold Mines Co., Ltd., held recently in London, the report of the directors and the statement of accounts were approved and adopted. The operations for the year show a net profit of £57,364 6s 6d. Shortage of labor is given as the principal reason for the fact that development work was not carried out on so extensive a scale as it otherwise might have been. During the year experiments were made on a practical scale to indicate the suitability of the oil flotation process as a method of treatment for the ore. The results showed that a net saving of at least \$1 per ton can be made. The question of the necessary plant has been deferred until conditions warrant the expenditure involved.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Reopening French Mines of Interest

Much valuable technological information will be available to mining engineers who have an opportunity to watch the reclamation of the French mines. As the mines were systematically destroyed by opening their workings to underground quicksands and water and by the blasting of shaft linings, it is certain that some very unusual methods must be employed to save them. The hope is expressed that competent observers will follow the restoration of these mines, so that the industry generally may take advantage of the practices developed.

War-Mineral Producers Convene

Producers of war minerals who wish to obtain Government relief held a convention in Washington Dec. 16 and 17 under the auspices of the American Mining Congress. As a result of the deliberations it is probable that a resolution will be introduced in Congress, authorizing the Secretary of the Interior to determine the measure of damage suffered in each case and liquidate these amounts from the appropriation authorized by the War-Minerals Act.

A committee from the convention called on the Secretary of the Interior, while the sessions were in progress, to inquire as to his policy in administering the War-Minerals Act. Secretary Lane admitted that he possibly has the technical right under that law to undertake to adjust the situation as to some of the war minerals, but as there is doubt whether such action would come within the intention of Congress, he declined positively to act without specific authorization from the President or from Congress.

The producers at the convention summed up their reasons for asking relief as follows:

By reason of urgent appeals made by representatives of the U. S. Government, many persons throughout the United States have expended varied sums of money in producing and in preparation for the production of the minerals specified in the War-Minerals Act, and will lose much or all of their investments unless the legislative intent of the act shall be carried out. This will result principally because of the fact that competitive material from foreign nations can and is being delivered to American users at prices much below the cost of the American product.

The persons so induced to undertake production were led to make such expenditure upon the representation that legislation was being considered by the Congress of the United States, and its early enactment expected, and that provision would be made to reimburse such expenditures.

The War-Minerals Act authorized the President "to develop and operate such mine or deposit" with the funds thereby appropriated. By reason of individual investment, ample supplies of nearly all the specific minerals have been developed in the United States, the expense thereof having been borne by individuals who now find themselves suffering financial losses because the markets have been supplied by heavy importation from cheap-labor countries, while the fund provided by the act for such purpose remains intact.

There were 55 delegates present at the convention. Twenty-two states were represented. It was estimated that 1000 employers and 20,000 employees are affected

to a greater or less extent by the present situation in war minerals.

The meetings were attended by a number of senators and representatives. Senator Henderson, chairman of the Senate Committee on Mines and Mining, and Representative Foster, chairman of the corresponding committee in the House, assured those assembled that Congress would give sympathetic attention to their petition, and each pledged himself to take up the matter in committee as soon as definite proposals were available.

Sulphuric-Acid Capacity Estimated

A report on the present sulphuric-acid capacity of plants in the United States and on the requirements for 1919 has been made to the Chemical Alliance by Arthur E. Wells, who is one of the sulphuric-acid specialists of the War Industries Board. The report reads as follows:

On Jan. 1 of this year, the total manufacturing capacity of the country for acid was 427,000 tons per month (basis 100% H₂SO₄), or 8,200,000 tons per year (basis 50° Bé), of which 29% was at contact acid plants.

On Nov. 1 of this year, the total manufacturing capacity of the country was 500,000 tons per month (basis 100% H₂SO₄), or 9,600,000 tons per year (basis 50° Bé). Of this total capacity 40% was at contact acid plants.

This capacity was divided among (1) Government, (2) explosives companies, (3) all others, including commercial manufacturers and byproduct manufacturers, as follows:

SULPHURIC ACID MANUFACTURING CAPACITY OF UNITED STATES		
	Expressed as Tons per Month 100% H ₂ SO ₄	Expressed as Tons per Year 50° Bé
(1) At Government plants.....	54,000	1,040,000
(2) At plants of explosives manufacturers	58,000	1,120,000
(3) All others	388,000	7,440,000
Totals	500,000	9,600,000

The total capacity east of the Mississippi River, and also including the plant at Argentine, Kan., and the plants in Louisiana and Arkansas, is 454,000 tons per month as 100% H₂SO₄. The report continues:

If it be assumed that the Government plants and the contact plants, which were built by the explosives companies primarily to supply acid for munitions explosives, are not operated in 1919, or, if operated at all, that the production will be utilized only for munitions, and thus will not be placed on the market, there remains a total capacity to be considered in the eastern part of the United States amounting to 365,000 tons per month (basis 100% H₂SO₄), or 7,000,000 tons per year (basis 50° Bé).

During the first nine months of 1918 the actual rate of production was only about 90% of the rated maximum capacity, although many plants were operating much above the rate capacities. Therefore, it is fair to conclude that the probable maximum output from these plants for 1919 cannot be greater than 90% of the rated capacity, or, in other words, the maximum output could be only about 328,000 tons per month (basis 100% H₂SO₄) or 6,300,000 tons per year (basis 50° Bé).

Copper Prices Expire Jan. 1

The War Industries Board announced on Dec. 20 that price regulation of the copper industry by the Government would end on Jan. 1, when the board will go out of existence. The price has been fixed by agreement at 26c. The board expressed the opinion that the great need for copper, including that needed for recon-

struction work abroad, will create a demand equal at least to normal times.

After a meeting of the price-fixing committee with the copper industry, held on the same day, a statement was issued which reads in part:

The chairman called attention to the fact that among the vital war needs of the Government copper ranked second only to steel, and wished to place on record the Government's appreciation of the patriotic spirit in which the copper producers had accepted maximum prices suggested by the price-fixing committee, and the industry's unceasing efforts to produce the abnormally large quantity of copper required to supply the war needs of ourselves and those associated with us in the war.

The industry through its spokesman testified to the courtesy and consideration it has always received at the hands of the price-fixing committee, and to the fact that the fixing of maximum prices by the Government had developed, at the numerous meetings, a vast amount of information which had been most helpful in stabilizing and standardizing the industry.

Copper Ore Import Rules Changed

Regulations covering the importation of copper ore and copper concentrates have been modified, according to an announcement by the War Trade Board. These commodities will hereafter be admitted as follows:

1. Copper ore originating in and coming from Korea, Newfoundland, the West Indies, France, England, the West Coast of South America, Cuba, Canada, and Mexico, irrespective of the content of copper.
2. Copper ore originating in and coming from Spain only when containing more than 2% of copper.
3. Copper concentrates from Cuba, Canada, and Mexico, irrespective of the copper content.
4. Copper concentrates from any non-enemy country, other than Cuba, Canada, and Mexico, only when containing 50% copper or over.

There is no restriction upon the importation of copper matte or blister copper.

Tin Import Negotiations Described

In his report to Congress, the chief of the Bureau of Foreign and Domestic Commerce comments as follows on tin imports:

At the beginning of the fiscal year the commercial adviser of the British Embassy in Washington was informed of our desire to make some arrangement with his government under which sufficient quantities of British-controlled tin to supply the requirements of our trade would be released monthly and distributed in this country through the American Iron and Steel Institute, under the guidance and control of the Department of Commerce. A plan to control the use and distribution of all British tin imported into this country was prepared and approved by the solicitor. Before it could be approved by the department, the executive order creating the Exports Council and vesting in that body the control of foreign trade was signed by the President. In the meantime, Commercial Attaché Williams, in London, with the assistance of Mr. Sheldon, representing our Food Administration there, continued to represent the interest of our consumers, both as a whole and in individual cases, before the British rubber and tin exports committee. Finally, in October, the War Trade Board, successor to the Exports Council, received authority of law to control imports, and in November regulations for controlling this importation, as well as the distribution of tin in this country, after being agreed upon by the War Trade Board, the Food Administration, and a representative of the bureau, were promulgated by the War Trade Board.

From this time the actual tin negotiations with Great Britain were conducted for our Government by the War Trade Board, Great Britain finally agreeing to allocate to us a certain amount of British tin each month. It was also agreed that all shipments of Straits and Australian tin should henceforth come to us via the Pacific instead of via London.

In February the War Industries Board assumed control over the importation and distribution of pig tin, and, with the assistance of the Bureau of Standards, took up the question of greater economy in the use of tin, a subject to which this bureau had already given attention, with gratifying but not sufficiently universal results. Our commercial attaché in London has remained in charge of the London end of our negotiations respecting this commodity.

Navy's Purchase of Non-Ferrous Metals

Total purchase of the non-ferrous metals for the requirements for the Navy, during the fiscal year ended June 30, 1918, are given as follows in the annual report of Rear Admiral McGowan, head of the Bureau of Supplies and Accounts:

PURCHASES OF NON-FERROUS METALS BY THE U. S. NAVY IN YEAR ENDED JUNE 30, 1918

Commodity:	Quantity (in Pounds)	Value
Copper	150,031,522	\$35,257,407.67
Lead	24,833,000	1,800,392.50
Tin	1,850,500	1,184,320.00
Antimony	222,008	28,632.41
Monel metal	1,263,404	514,837.13
Steel wire rope	85,105,281	7,750,884.36
Nickel	219,900	83,560.00
Zinc	45,810,433	5,997,251.96
Aluminum	597,229	197,085.56
Portland cement	1,151,098(a)	1,980,403.25
Copper products	7,695,998	6,623,502.94
Brass products	28,527,258	9,798,010.00

\$71,218,289.78

(a) = Barrels.

Geological Survey's Part in War

In the course of his report to Congress, submitted Dec. 17, George Otis Smith, the director of the U. S. Geological Survey, says:

Every activity of the Geological Survey that could possibly contribute to the prosecution of the war has been so directed. . . . The increase in the Survey's representation in the Army from 61 men who had held appointments of the Secretary at the beginning of the year to 322 at the end, necessarily involved a serious reduction in the man-power available for other contributions to war work.

The field search for new occurrences of war minerals, the prompt examination of newly reported deposits, and the field estimates of the reserves thus made available have constituted a large part of the duties of the geologists of the Survey. In the effort to meet the urgent demand for essential minerals, the Survey geologists have visited not only the mining districts of the United States but also deposits of potash and nitrate and chrome and manganese in Central and South America and in the West Indies.

The geologic work connected with the mineral fuels has been concentrated on the search for oil pools to stimulate increased production. Close coöperation with the Fuel Administration has made all the geologic data obtained quickly available for use in directing new drilling.

Navy Got the Tin

Under the caption "We Got the Tin," Rear Admiral McGowan, in his annual report to Congress, tells of the commandeering of tin supplies in storage at New York. He says:

In the fall of 1917, 27,000 lb. of tin was urgently needed. The tin market was jumping out of bounds. Several dealers were called upon without result. The Collector of Customs at the Port of New York was called by long distance telephone. He advised that a ship was in with a cargo of 250 tons consigned to three companies. The 13 tons required by the Navy was apportioned among those three companies, and the tin was paid for at 64c. per lb., the approximate value before the market began to rise. With this beginning, arrangements were gradually made to restrain all tin warehoused in New York found to meet Navy specifications. Through the Commandant at New York, approximately 2000 tons was placed under seal. This action prompted a dealer to place at the Navy's disposal 700 tons additional, which was contracted for at 64c. per lb., the market price at that time being 80c. per lb. Complaints with regard to procedure were adjusted by the subcommittee on pig tin of the American Iron and Steel Institute. The following statement appeared in a letter from the chairman of the subcommittee and was subsequently incorporated in the report of the House Investigation Committee on Conduct and Administration of Naval Affairs: "The action of the Navy in commandeering tin which was hoarded in the possession of importers and dealers, and thereby held from the market when an acute shortage prevailed, was commendable."

Editorials

The Situation in the Metals

THE more fully are details revealed respecting governmental positions in copper, lead, zinc, and tin, the more serious does the position of those metals appear to be. In each case the stocks on hand are greater than anyone engaged in production and commerce ventured to estimate, and the officials to whom were available the statistics of the invisible stocks, especially of tin, apparently paid no great attention to them, or did not know what they meant.

In copper, American producers were estimated about a month ago to have approximately 800,000,000 lb. of crude copper in stock and in transit, and the quantity must have been increased during December. Australia has about 50,000,000 lb., and Japan must have a large supply. It has become known within a few days that the British government has 62,000,000 lb. of refined and the American Government between 75,000,000 and 100,000,000 lb. How much is held by the French government and by manufacturers everywhere? How much has been, or will be, salvaged from the battlefields and from sunken ships that will be raised?

The surplus of copper has not resulted from any great increase in production in 1918. On the contrary, the indications are rather strong that the statistics of the world's production in 1918, for which preliminary figures will be available in a few days, will show a considerable decrease from 1917.

In lead we find a similar situation. Large stocks exist in America and Great Britain, the British government reporting 49,000 long tons of its own, while supplies have backed up in Australia.

The British government has reported holding 18,769 long tons of common spelter and 6544 tons of high grade. Stocks in the hands of American producers are about 35,000 tons, a decrease from the figure of Oct. 1, but there is reason to surmise that the invisible supply in this country is large. Stocks of zinc ore are superfluous in the Joplin district and in Australia.

American consumers of tin are supposed to have had about 20,000 tons of tin on hand in November, and 10,000 tons bought in the Orient by the United States Steel Products Co. is on the way hither. This would provide for the normal consumption of this country for about six months, irrespective of the production from Bolivian ore by American smelters, who will soon be turning out nearly 2000 tons per month. In Great Britain the stocks of tin are also reported to be large.

With this situation there is no reason for surprise respecting the failure of buyers to appear in want of metals at recent prices. Nor that lead broke to offerings at 6c. when free market was declared last Saturday. Nor that on the London Metal Exchange quotations for copper opened at about 20c. Nor that tin declined in London to about 57c. Nor that high-grade zinc here has been unsalable on offerings at 9c. The rise

in lead in London to £40 on Nov. 26, which quotation has since then been maintained, was manifestly an arbitrary matter, for American and Mexican producers could, and would, have undersold that price sharply if they had been able to arrange with the steamship companies for carriage of the metal, which they could not do.

The talk that there has been about maintaining prices, large orders in prospect, etc., has been a sort of camouflage of a disagreeable situation. The matter that has been most in the minds of the producers has been the orderly liquidation of governmental stocks. In the early days following the armistice some of them resented the cancellation of orders and in an obtuse way thought that they were accomplishing something helpful when they obtained rescindment of cancellations and could continue to put metal into the hands of the Government. It was soon seen, however, that the accumulation and holding of large stocks by the Government would be a menace to the market, and the present thought, economically sound, is to see that such stocks are distributed as soon as possible, with the minimum of disturbance. The plans that are being urged are based on the idea of a regular disposition spread over a period of a year, say, the distribution to be managed *pro rata* by the producers in connection with the sale of their new product.

It will be best to defer discussion of the conditions that have produced the present situation until the statistics of production in 1918, and other statistics, are available. It looks, however, as if the world's output of tin will show only a small increase, if any, as compared with 1917, while the totals for copper and lead are all but certain to show a decrease. Zinc will surely show a decrease. Thus, the producing of these metals was not overdone. On the other hand, the curtailment of "non-essential consumption" was probably carried too far.

What About Mexico?

NOW that the first act of the great drama in Europe approaches its end, and the second act, the readjustment of international affairs, looms large on the horizon, we hope that one scene of that act will be laid in Mexico. No scene can be of greater interest to those interested in foreign commerce, and particularly to miners, than one in which Americans and Mexicans take the leading parts.

We do not speak solely for the miners but for Americans and Mexicans and for all commercial interests. The United States is large and contains ample undeveloped resources to occupy the energy of all of our people for years to come. The same may be said of Mexico, but we are learning, as every European nation has learned, and as Mexico will some day learn, that no country is so large and so self-contained that it may

remain forever isolated and have no business relations with foreign countries. We have learned that we can give and receive benefits through intercourse with all portions of the globe, and that the cultivation of this intercourse will redound to the great advantage of all participants.

More than once it has been correctly stated that commerce follows the flag, but the flag follows the prospector; or, in other words, where conditions are such that mining industries may be advantageously conducted by foreign capital, other commercial undertakings follow, and the participating countries are mutually benefited.

Through internal disorders in Mexico her mining industries have been ruined, and with their destruction the state has fallen into a deplorable condition morally, financially, and commercially.

"Let Mexico do her own housecleaning," was the answer for several years to those who knew Mexico and asked for help from the American people; but the American people are finally waking up to a realization of the opportunities and duties lying just across the Rio Grande, and we anticipate that when the more important work on the other side of the Atlantic is finished appeals from Mexico will not fall on deaf ears. Measures will then be taken that will lead to a better mutual understanding, a stabilizing of the government, and a reign of order throughout the country.

This can be done, and at no great effort on our part, if done in the right way; for there is a right and a wrong way of doing these things. We read of the suggestion of making Mexico a military camp of the United States; we see her officials cartooned and held up to ridicule, her people deprecatingly spoken of and contemptuously treated; and these things all go to make up the wrong way.

The atrocious treatment that has been meted out to foreigners in the oil fields is unpardonable, but this was not inflicted by those who ought to be in power in Mexico and whom we should like to see there. Banditry as it has been practiced throughout the country, at times as the acts of pseudo or self-appointed officials, and at times as pure devilry, challenges comparison with the brutality of the lowest type of savagery. The confiscation of property through taxation or decrees has been inexcusable and unwarranted, and merely shows the incompetency of those who, by physical force, are in authority. Mexican officials have done enough to irritate us, have done enough to call for condemnation and ridicule; but when we adopt this kind of criticism, and include all Mexicans in our censure, we go too far, for we speak of the mass of the people, who are no more to blame for conditions than as though they were not living there.

The educated, the intelligent, Mexican knows the treatment that Americans have been receiving; he regrets it deeply, though powerless to prevent it, and he feels it keenly when he is blamed for that condition which renders this treatment possible. By far the largest percentage of the Mexican people, her uneducated class, her peons, are mere children, easily controlled and easily led. These, too, would be our friends if they could, and must not be classed with the trouble-making officials.

Our policy toward Mexico should be helpful criticism,

frank, straightforward advice, clear and explicit. The educated Mexican will appreciate and not resent it. It is safe to say that a great many of them desire it. The official with power and authority, but lacking ability to use either, will understand it, and may have the good judgment to make use of it. If not, then our advice should take a more positive form, insistence upon order and good government, to originate within, if possible, but from without if she cannot do it herself. We would all gladly see Mexico solve her own problems if she can, but eight years of misrule must be discouraging to her unhappy people. They certainly have been so to us. We are ready to help her if she would ask, but we have had no hint that this would be acceptable. Only one course appears to be open: that we take the initiative and help her whether those in authority wish it or not. If we do not, European nations will, and they may not do it with so gentle a hand as will her next-door neighbors.

The existence of satisfactory relations between Mexico and the United States will depend upon mutual respect. We can certainly have no respect for an authority, a government, that permits of banditry such as has existed in the oil fields for several months, where robberies are committed by men wearing the uniform of the government and carrying government rifles. We can have little respect for a government that confiscates or destroys enterprise by taxing it to death, and issuing decrees as often and as variable as the winds of heaven.

Nor can any class in Mexico have much respect for Americans, when recalling the advice that was sent to our nationals from the States—"At any sign of disorder you should leave the country."

Upon a later occasion a timorous statesman gave like advice to American citizens. He advised them to stay off the high seas when other peoples were at war. The majority of Americans thought otherwise, and when a few of them were mistreated, two million of our boys went many thousand miles to demonstrate that the rights of a few American citizens must not be tampered with.

We do not threaten Mexico with two million soldiers, but merely point out to her that the viewpoint of the American public has changed somewhat within the last few years. We have come to that point when, in the event of a few well-behaved citizens being disturbed, Uncle Sam does not hesitate to go to considerable trouble and expense to see that their rights are preserved.

President Wilson has already set forth the attitude of the United States in a note which he recently sent Carranza. He said:

The United States cannot acquiesce in any procedure ostensibly or nominally in the form of taxation or the exercise of eminent domain but really resulting in the confiscation of private property and arbitrary deprivation of vested rights. In the absence of the establishment of any procedure looking to the prevention of spoliation of American citizens, and in the absence of any assurance, were such procedure established, that it would not uphold in defiance of international law and justice the arbitrary confiscations of Mexican authorities, it becomes the function of the Government of the United States most earnestly and respectfully to call the attention of the Mexican government to the necessity which may arise to impel it to protect the property of its citizens in Mexico divested or injuriously affected by the decree above cited.

Mexico will respect us and our Government for taking this attitude. When she learns that what we ask her

to do is for her own good more than ours, her respect will increase, and when those in authority have had the strength and good judgment to act wisely and well, we will have an equal respect for Mexico.

Standardization of Mining Methods

IN THIS issue we publish the last one of a series of notable papers on mining practices. Mr. Mitke's papers are good. They cover many important details of mining that do not receive the attention they deserve. Out of many small economies there appears the resultant of a large economy. Mr. Mitke strikes at two important points of a general nature. One is the desirability for the intensive study of the smaller features of mining practice by the engineer. Experimentation is a part of this study. The second, and equally important, point is the training of the miners.

The success of modern quantity production in manufacturing lies in the segregation of processes into sequential steps and the training of each group of workers until they are able to execute their part thoroughly and quickly. Necessarily, the coöperation of the worker must be secured.

In mining operations there are similarities in principle to manufacturing methods, although there is the important difference that the work is distributed and cannot be concentrated, as is done in well-organized factories. The effect of this is to throw a considerable amount of initiative upon the miner or group of miners. Unrestrained or untrained initiative results in waste and therefore uneconomical labor. Efficient supervision and direction by foremen and shift bosses go a long way toward remedying this state of affairs, and together with sufficient training of the workers to enable them to catch the objectives of the system, will produce results exceeding the expectations of the most sanguine.

BY THE WAY

The immediate death of "Dora" is unanimously demanded by British business men, according to reports from the American Chamber of Commerce in London. "Dora," the Defense of the Realm Act, is evidently unpopular. Only a few restrictions are approved by business men generally, except that men engaged on what they believe to be "key" industries are much interested in developments in the government's plans for protecting them.

Rumors were abroad regarding cuts in copper prices, remarked the *Evening Post*, but among the principal copper people it is asserted that the price is still held stiffly at 26c. per lb. What is the use in cutting prices, they ask, when people would not buy even at lower levels, unless the reduction was extremely drastic? So the market has for the moment resolved itself into a state of mind. Some of the copper men take a long, long view. Prices will go lower, they freely admit; but a year from now, when people know where they stand, prices are apt to be higher than at present. Thus the optimists of the trade apparently look either for a reduction of output or for a "reconstruction demand" equal to the recent demand for destructive purposes.

Instead of our usual copy of the annual cotton report, we have been startled by receiving this year a reply postal from Washington to be used if we really want that valuable document. Right on top of it comes the following item from London *Truth*, showing how much room for improvement there has been over there:

How paper has been wasted and money squandered on war propaganda literature is now proved by the report of a select committee on the demands the Stationery Office has had to meet. The War Aims Committee wanted 5,000,000 copies of one booklet, "Parliament's Vote of Thanks to the Forces," but the order was reduced to 500,000, and of those 440,000 were not used. The Prime Minister's "Message to All at Home" was another example of the same kind, 730,000 copies out of 1,000,000 being undistributed. No wonder there has been a shortage of paper!

THE LILT OF THE ANCIENT PROSPECTOR

BY WALTER H. GARDNER

To Hector Bean, just turned sixteen, with feet that itched to roam,
Was shown a nugget—some one dug it on the beach at Nome.
He made his mind the like to find—and ran away from home.

He had a pan, a water can, for traveling an itch,
Flour, coffee, tea, ability to throw a diamond hitch.
Equipment thorough! "Mush, you burro!" Soon he would be rich!

A whole decade our Hector stayed within the Panamints,
He found all sorts of barren quartz—but none with golden glints;
Then left that range in search of change, as many a man has since.

Bewhiskered, swarthy, headed north he sought the Arctic Zone,
Up-turning gravel, pausing travel by each likely stone;
The while his poor old aged burro shrunk to skin and bone.

And there he drifted, sluiced and sifted bar and bench and bluff,
Becoming weazened, growing seasoned (whiskers like a ruff).
Finding traces many places—never quite enough.

He cinched his pack and started back. With undiminished hope
He picked and panned and swept and scanned the whole Pacific Slope.
At one outcrop he made a stop; but vain his shaft and stope.

From Culiacan to Mazatlan he panned and panned and panned;
Then two springs on the Amazon—a hard fall on the Rand.
On Gila Creek he swung his pick; some colors, mostly sand.

At last he tried where Telluride has since achieved renown,
To ascertain if one slim vein would broaden deeper down.
It did! Four hundred to the ton read assays from the town!

Immediately, tall and stately, came a millionaire;
Around he stalked, with hammer knocked some samples here and there.
Then said to Hector, "Well, prospector, set a price that's fair!"

Old man Bean peered o'er the scene, "She sure is proper ore!"
And paused to scratch his shaggy thatch, "I ain't seen sich before!
I'd like to make a little stake—then look around some more!"

"If I could get a new outfit, the claim is your'n, my son,
While I opine she's sure some mine, it's looking that's the fun!
'N I think I know right where to go to find a better one!"

Personals

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

C. Carleton Semple will leave for Peru immediately after Christmas.

Pope Yeatman, together with **Irwin H. Cornell**, arrived home from Europe last Saturday.

H. B. Johnson is on a professional trip in Texas, and will return to Boston in three weeks.

Mark L. Requa has been presented with a loving cup by the personnel of the oil division of the Fuel Administration.

O. E. Jager recently returned from England on the "Megantic," and will spend a short time at Corvallis, Oregon.

Charles Wigglesworth, mining and construction engineer, is now in Burnet, Tex., where he is doing consulting work.

J. B. Enlow, of the Chihuahua smeltery of the American Smelting and Refining Co., recently visited his family in El Paso, Texas.

L. P. Pressler, of the Canadian Johns-Manville Co., will be in Santa Fe, N. M., on personal business during the month of January.

Martin Fishback, who is connected with the newly incorporated Arizona Smelting and Power Co., Benson, Ariz., is now in New York.

F. H. McLearn, of the Canadian Geographical Society, has been investigating the geological section along the Peace and Smoky rivers.

Dr. Sergio Bagnara has resigned as metallurgical engineer to the Ordnance Department, U. S. A., and will take up professional work in New York.

K. E. Humbert, of Perin & Marshall, consulting engineers, 2 Recor St., New York, has returned from a business trip to India, Malay States, China, and Japan.

J. J. Warren, managing director of the Consolidated Mining and Smelting Co. of Canada, has returned to Trail, B. C., from a business trip to Toronto and Montreal.

E. A. S. Clarke, president of the Lackawanna Steel Co., has been elected to head the new export steel company which is being organized by the independent steel producers.

Fred Alley, general manager of the El Carmen mine, Inde mining district, Durango, Mexico, left El Paso, Tex., recently to visit that property, going by way of Parral and Rosario.

Robert T. Hill, geologist, has opened an office at 612 American Exchange Bldg., Dallas, Tex., and will continue his office at Room 800, Central Bldg., Los Angeles, California.

William J. Young, Jr., one of the owners of the Great Western mines at Courtland, Ariz., and Mrs. Edith Choate Oesting, late of San Diego, were married recently in Pasadena, California.

Thomas Varley is at present in charge of the ore-dressing branch of the U. S. Bureau of Mines at the University of Utah, having succeeded A. E. Wells, who has been transferred to Washington.

Charles Plez, vice president and general manager of the Emergency Fleet Corporation, Philadelphia, has been elected to succeed Charles M. Schwab, who recently resigned as director general.

Gordon Bullock, chief clerk at the Arizona Copper Co.'s smeltery at Clifton, Ariz., has returned from Halifax, N. S., where he was stationed in the Quartermaster's Corps of the Canadian Army.

H. W. Clarke, formerly connected with the advertising service department of the McGraw-Hill Co., of Chicago, Ill., has been appointed manager of advertising for the Chicago Pneumatic Tool Co., Chicago.

A. S. Knowles, consulting engineer of Freyn, Brassert & Co., engineers, Chicago, sailed for France, Nov. 30, on an inspection trip of byproduct coke ovens and allied industries. He is expected to return in about six weeks.

Lieut. Roy B. Earling, formerly superintendent of the Arizona Copper Co.'s Metcalf group of mines, in the Clifton-Morenci district of Arizona, has been discharged from the artillery division of the National Army and has returned to Morenci.

F. H. Hawkins, chief assayer for the Standard-Silver Lead Mining Co., of Silverton, B. C., has gone to Anox, B. C., to accept a situation with the Granby Consolidated Mining, Smelting and Power Co. **Thomas Brown** will succeed Mr. Hawkins at Silverton.

E. E. Campbell, superintendent of the Anox mine of the Granby Consolidated Mining, Smelting and Power Co., and **O. B. Smith**, general superintendent of the company's mining operations, recently returned to Anox after visiting the Ketchikan district of northern British Columbia.

Norman Carmichael, general manager of the Arizona Copper Co., Joseph P. Hodgson, manager of the Morenci branch of the Phelps Dodge Corporation and J. W. Bennie, general manager of the Shannon Copper Co., Clifton, Ariz., are members of the Greenlee County, Ariz., community committee, which will secure employment for returned soldiers.

Douglas B. Sterrett, of St. Cyr, Quebec, recently registered at the office of the American Institute of Mining Engineers. Others who registered there during the last week were **Walter A. Rukeyer**, Ensign, U. S. N., Blue Hill Station, Boston, Mass.; **Lieut. D. F. Schindler**, Havana, Cuba; **Lieut. Fred S. Porter**, Kennebec, Alaska; **Lieut. Clinton R. Lewis**, Dawson, Y. T., Canada; **H. W. Nichols**, Chicago, Ill., and **Lieut. J. L. White**, Humboldt, Arizona.

Obituary

J. King McLanahan, of Hollidaysburg, Penn., one of the best-known iron manufacturers in central Pennsylvania, died Dec. 13, aged 91 years.

Fitzhugh Lee, manager of the manufacturing department of the Grasselli Chemical Co., Cleveland, Ohio, died Dec. 14, aged 48 years.

H. E. Martin, district mining engineer of the Eastern Division of the Mesabi Range for the Oliver Iron Mining Co., died of influenza Dec. 15, at Eveleth, Minn. Mr. Martin was chief mining engineer of the Hibbing district for the same company for several years, having entered their employ in 1906. He was a graduate of the University of Wisconsin.

Charles C. Christensen, an authority on mining machinery, died Dec. 13 at his home in Chicago, Ill. He was born in Copenhagen, Denmark, and came to this country in 1880. He became associated with the old firm of Fraser & Chalmers, which is now the Allis-Chalmers Manufacturing Co., as consulting engineer. Mr. Christensen was 67 years old.

Charles H. Johnson, engineer, died at his home in New Castle, Penn., Dec. 10, after a four-weeks' illness. He was born near Clinton, Lawrence County, Penn., in 1870, and was graduated from Massachusetts Institute of Technology as a mining engineer. For a time he was engaged in engineering on the Mesabi Range, in Minnesota, and then returned to New Castle and became associated with his father, George W. Johnson, in operating an old sheet mill which was converted into a tin mill and later sold to the American Sheet and Tin Plate Co. From then on he was actively engaged in the limestone quarrying business and in other industries. At the time of his death Mr. Johnson was general manager of the Pittsburgh Limestone Co., the Lawrence Limestone Co., the G. W. Johnson Limestone Co., the Keystone Limestone Co., and the Mahoning Limestone Co., which companies have quarries in Lawrence, Butler, Blair, and Armstrong counties, Penn., and also in Maryland and West Virginia. He was president of the Johnson Bronze Co., the National Stone Co., and the Bessemer Loam-Sand Co., and was also interested in various other companies.

Societies

Chemical, Metallurgical, and Mining Society, South Africa, recently held a meeting. The new president, H. Meyer, delivered his inaugural address and dealt with many questions connected with the industry.

Institute of Metals (British). A general discussion on "The Relation of Science to the Non-Ferrous Metals Industry" was the central feature of the annual general meeting recently held. Several important papers were also presented.

Trade Catalogs

Mine-Duty Self-Starters. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. 2 pp.; illustrated. Leaflet, known as publication No. 408, describes two chief types of mine-duty self-starters.

Industrial News

Ricketts & Co., Inc., formerly of 80 Maiden Lane, New York, announces that it has moved its offices to 280 Madison Avenue.

Huff Electrostatic Separator Co., having outgrown its quarters at 60 India St., Boston, Mass., has moved its factory and laboratories to Arlington, Mass., where it will have ample electric and water-power facilities.

New Patents

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

Antimony Smelting, Starring mixture for. **Chung Yu Wang**, Hankow, China. (U. S. No. 1,284,164; Nov. 5, 1918.)

Boring Machine. **Eduardo Murphy** and **Americo Anzulovich**, Buenos Aires, Argentina. (U. S. No. 1,283,542; Nov. 5, 1918.)

Cement Material and Method of Producing. **Arthur S. Dwight** and **Richard Lewis Lloyd**, New York, N. Y., assignors to **Dwight & Lloyd Metallurgical Co.**, New York, N. Y. (U. S. No. 1,283,483; Nov. 5, 1918.)

Excavating Apparatus. **Karl R. Slocum**, Drybranch, Ga. (U. S. No. 1,283,932; Nov. 5, 1918.)

Excavating Machine. **Oliver Oscar App**, New York, N. Y. (U. S. No. 1,283,618; Nov. 5, 1918.)

Excavating Machine. **Hans J. Bentson**, Winthrop Harbor, Ill., assignor to **Frederick C. Austin**, Chicago, Ill. (U. S. No. 1,283,460; Nov. 5, 1918.)

Explosive. **Benjamin P. Allen**, Great Neck Station, N. Y. (U. S. No. 1,284,032; Nov. 5, 1918.)

Filtering Apparatus. **Orange James Silsbury**, Salt Lake City, Utah, assignor to **United Filters Corporation**, Salt Lake City, Utah. (U. S. No. 1,283,925; Nov. 5, 1918.)

Furnace. **Frank R. Hill**, Keeler, Calif., assignor to **Wilfred W. Watterson**, Bishop, Calif. (U. S. No. 1,283,515; Nov. 5, 1918.)

Gas Producer. **Henry C. Perdue**, Valparaiso, Ind., assignor to **Morgan Construction Co.**, Worcester, Mass. (U. S. No. 1,284,138; Nov. 5, 1918.)

Gold-Dry Sluice Placer-Gold Separator. **Laurence E. Meyer**, San Diego, Calif. U. S. No. 1,283,857; Nov. 5, 1918.)

Mine Locomotives, Chair for. **Richard S. Morgan**, Edwardsville, Penn. (U. S. No. 1,284,130; Nov. 5, 1918.)

Miner's Lamp. **Adolph C. Recker**, Oakville, Conn., assignor to **Waterbury Manufacturing Co.**, Waterbury, Conn. (U. S. No. 1,283,897; Nov. 5, 1918.)

Oil Shales—Apparatus for Treatment of Oil-Bearing Shale, Bitumens, Hydrocarbons, and Other Elements of Volatile Nature. **John H. Galloupe**, Denver, Colo. (U. S. No. 1,283,723; Nov. 5, 1918.)

Pebble or Ball Mill. **Charles Henry Stave**, Thornton, Ill. (U. S. No. 1,283,589; Nov. 5, 1918.)

Phosphorus—Method for Recovery of Phosphorus Fumes Evolved in Volatilization Method of Treating Phosphate Rock. **Albert R. Merz**, **William H. Ross**, and **John N. Corothers**, Washington, D. C. (Dedicated to the public.) (U. S. No. 1,284,200; Nov. 5, 1918.)

Potash From Kelp and Similar Materials, Process for Recovering. **Simon Rudolph Oppenheim**, Keeler, Calif. (U. S. No. 1,283,547; Nov. 5, 1918.)

Rock-Drill Bit. **Charles A. Brawn**, Philadelphia, Penn. (U. S. No. 1,283,646; Nov. 5, 1918.)

Screening Apparatus. **Paul J. Alwart**, Chicago, Ill. (U. S. No. 1,284,034; Nov. 5, 1918.)

Silicates—Process of Treating Siliceous Minerals for Production of Chemical Compounds. **Jordan Homer Stover**, Trenton, N. J. (U. S. No. 1,283,951; Nov. 5, 1918.)

Smelting—Process of Reducing Metallic Compounds. **Hans Foersterling**, Perth Amboy, N. J. (U. S. No. 1,283,716; Nov. 5, 1918.)

Smelting—Process of Roasting Ores. **William A. Ingham**, Los Angeles, Calif. (U. S. No. 1,283,782; Nov. 5, 1918.)

Smelting Ore, Process of. **James H. Gray**, New York, N. Y. (U. S. No. 1,283,500; Nov. 5, 1918.)

Editorial Correspondence

SAN FRANCISCO, CALIF.—Dec. 19

Many of the Gold Properties in California, shut down because of high costs, are today being rapidly filled with water, as the pumps have been pulled and the mines abandoned to whomever may have the money and the courage to reopen them. Other mine owners, who estimated that the loss would be greater through abandonment, have devoted their labor to keeping the properties alive, stopped all development, stopped the payment of dividends because they have no surplus to pay dividends with, and are biding their time till the conditions readjust themselves.

Concessions to Oil-Well Operators sought to be written into the new revenue bill pending in Congress, according to the report of Claude I. Parker, of Los Angeles, made to J. K. Firth, secretary of the Pacific Coast Petroleum War Service Committee, now at Washington, will, if adopted, result in a large annual saving to the petroleum and metal-mining industry of California. These concessions include recognition of the right of lessees as well as lessors to depletion allowance in the payment of Federal income and excess-profits taxes; authorization of a reserve deduction, in addition to depletion and depreciation, from returns of net annual income of 10% of the sale price of the product to replace extracted oil or minerals; provision for constructive capital allowance where the net income from the business is disproportionate to the invested capital, and depreciation allowance of 10% on permanent equipment of oil and mining companies and 5% on oil tanks. Mr. Parker states that the manner of arriving at depletion of an oil-operating company is to be upon a reduction of flow basis, to be ascertained by chart system to be prepared by the Internal Revenue Bureau. If the oil or mining operator be a lessee, and the royalty agreement be one-eighth to the lessor, then in such case the lessee operator will be entitled to deduct from gross income an amount equivalent to seven-eighths of the total allowable depletion, and the lessor will be entitled to deduct from gross income the remaining one-eighth of total depletion.

SALT LAKE CITY—Dec. 20

Utah Consolidated Mining Co. filed two new suits against the Utah Apex Mining Co. in the U. S. district court Dec. 10. One suit is regarding the Yampa lode claim, and the complaint alleges that the property and also the cause for action were purchased by the plaintiff from a third party on Aug. 2 of this year, and that since then and prior to that time the Utah Apex company has been working certain veins in the property. The complaint asks for a temporary restraining order against the Utah Apex company, a decree setting forth the title of the Utah Consolidated company to the property, and an accounting and judgment for ores taken from the property. The second suit concerns the Mercer lode claim and the Mercer lode claim No. 2. The same petition and the same claims are made as in the case of the Yampa lode claim.

Twenty Utah Mining Companies filed suit in the U. S. district court Dec. 13 against the State Treasurer, Daniel O. Larsen, to test the validity of the so-called occupation tax on mines, amounting to 3% of the net proceeds, attempted to be assessed under the statutes passed by the Legislature in 1917. The taxes in question aggregate about \$800,000. Those interested are the Utah Copper, Pleasant Valley Coal, Utah Fuel, Silver King Coalition, Grand Central, Gold Chain, Chief Consolidated, Eagle and Blue Bell, Bingham Mines, Victoria, Mammoth Bullion Consolidated, American Fuel, Standard Coal, Utah Apex, Cameron Coal, Schofield Coal, Ohio Copper, Western Utah Copper, and Cardiff. The complaint states that the plaintiffs paid all the property taxes assessed against them for 1917 and 1918, and that the attempted occupation tax is invalid for several reasons, among them being that the statute was attempted to be passed by the Legislature after the constitutional time fixed for the legislative session had expired. It is also alleged that the act was never properly passed because the necessary steps prescribed by the constitution were not taken by the Legislature. Also that the constitution of the state provides that when the taxable property in the state exceeds in value \$300,000,000, the

tax rate cannot exceed 4 mills, and the operative effect of the tax that is contested would be to raise the levy to about 19 mills. Also that the tax involved in the suit is an additional property tax and double taxation, and, therefore, was not assessed or levied uniformly and equally, as required by the constitution of the state, and that it is discriminatory and attempts to take the property of the plaintiffs without due process of law, and denies to them the equal protection of the laws, in violation and contravention of the Constitution of the United States. The complaint mentions the various steps taken by the State Board of Equalization to assess a tax under the act of 1917, and the proceedings taken by the defendant State Treasurer in the attempted collection of the tax. It alleges that the defendant has advertised for sale as for delinquent taxes the properties of all the plaintiffs, and that the statute and the action of the defendant in attempting to sell the property cast a cloud, in the nature of an attempted lien, on the property of the plaintiffs. The complaint seeks to enjoin the enforcement of the 1917 statute and to enjoin the threatened sale of the property by the State Treasurer. Application was made for a temporary restraining order to stop the sale until the questions of law involved can be decided by three judges, as required by the Federal law. Argument regarding the above was heard by Judge Tillman D. Johnson on Dec. 14, and a temporary restraining order was issued to the State Treasurer forbidding the collection of the occupation tax, plus a tax of 3% on net earnings of mines, until the question of the legality of the tax has been determined. Pending the decision, Judge Johnson fixed the bond of the Utah Copper Co. at \$50,000, the Silver King Coalition at \$3000, and that of the Judge Mining and Smelting Co. and others at \$2000 each.

DENVER, COLO.—Dec. 19

The Roosevelt Tunnel in the Cripple Creek district is credited with the opening of five important oreshoots in 1918, at depths ranging from 1850 ft., on Raven Hill, to 2130 ft., on Battle Mountain. Advocates of deep-level development for the district point to these discoveries to support their views. The first discovery of the year was made when a drift was advanced northeast from the main tunnel through the property of the United Gold Mines Co. to a point directly under the winze sunk from the 1650 level of the main shaft of the Cresson Consolidated, on Raven Hill. In crosscutting under the shaft, a second important discovery was made in Cresson territory. Shipments from both orebodies are being made through the main shaft of the Elkton Consolidated company. As the tunnel passed through the territory of the Rose Nicol Gold Mining Co., at a depth of 2000 ft., a third important oreshoot was opened on the Rose Nicol vein. Beyond this property the tunnel entered ground of the Portland Company, and a crosscut was driven southeasterly toward Portland No. 2 shaft. This crosscut has opened two important orebodies, the latest discovery being made on Nov. 30 at 2137-ft. depth. Portland No. 2 shaft will now be sunk to the tunnel level, and systematic development of these deeper orebodies will be undertaken. The advance in the crosscut is continuing.

Breckenridge has had a successful season, with five dredges in operation. Two of these boats have stopped operations for the winter, and will undergo the usual overhauling and repairs. The Tonopah Placers Co. has been operating three dredges, having a combined capacity of 10,000 cu.yd. of gravel per day. This company's No. 1 Bucyrus dredge is digging in the Westernman ground in the Blue River Valley. The No. 2 Bucyrus dredge, of 2000 cu.yd. capacity, is operating in Swan Valley at Snyder's camp on ground leased from the Farncomb Hill Gold Dredging Co. The No. 3 dredge in French Gulch continued operations until forced to shut down by water shortage. J. E. Hopkins is manager. The Power River Gold Dredging Co. is operating a modern 2000-cu.yd. dredge on the B. & L. placer in the Blue River Valley, two miles north of Breckenridge. The boat was completed last winter, and has put in a full season except for time lost in repairs. The French Gulch Dredging Co. dredged about a mile

of French Gulch this season with a 1000-cu.yd. boat. The last clean-up in November yielded over \$18,000. Warren F. Sears is superintendent. The Farncomb Hill Gold Dredging Co. paid a dividend of \$15,000 out of royalties paid to it by the Tonopah Placers Co. Robert W. Foote, of Breckenridge is president. The outlook for all these dredges is favorable.

Uranium in Fluorspar mined near Jamestown, Boulder County, Colo., is responsible for four different kinds of activity recently: First, that of the fluorspar operators, who immediately proceeded to acquire title to as much of the territory as possible; second, the rush of prospectors to the district; third, the almost immediate development of wild-cat organizations by irresponsible promoters; and, fourth, the protest from a quickly organized group of honest and substantial business and mining men of Boulder County against the premature reports of optimists and dishonest representations of others. The occurrence of minute quantities of uranium in fluorspar deposits of the Jamestown district has been known for a number of years. Investigators have found that the element is present in such small quantities that its extraction is commercially impossible. Recently uranium has been discovered in the residues resulting from concentration of the fluorspar. A black streak of an unknown substance on the concentrating tables attracted attention. The iron and lead concentrates containing this were reconcentrated, and a sample was submitted for examination at the Bureau of Mines experiment station at Golden. This material was the result of concentrating the original ore about 1200 to 1, and was found to contain a very small quantity of uranium oxide. This information fell into irresponsible hands, unfortunately, the result being a premature uranium boom. Mining men of Boulder County are incensed over the attempts of certain unscrupulous promoters to sell wild-cat stock, and have proposed stringent local legislation to curb fake promotions of all kinds.

JOPLIN, MO.—Dec. 19

Tri-State Mine Safety and Sanitation Association, the largest mine-operators' organization in the Joplin district, has elected C. F. Dyke, of Joplin, manager of the Montreal mine, as president; A. E. Bendelari, manager for the Eagle-Picher Lead Co. mines, treasurer; W. B. Shackelford, manager of the Admiralty Zinc Co., secretary; and the following as vice-presidents: D. J. Muir of the U. S. Smelting Co.; W. J. Borries, White Mining Co.; J. W. Newton, Commerce Mining and Royalty Co.; Temple Chapman, independent operator; C. E. Schwarz, St. Louis Smelting and Refining Co., and F. C. Wallower, Golden Rod Mining and Smelting Co. The following directors were named: F. H. Gartung, M. D. Draper, P. B. Butler, H. I. Young, Charles Heron, Charles T. Neil, F. N. Bendelari, and John Hoffman.

Renewed activity in the Joplin camp is predicted and is being partly realized, as a result of high costs and high royalties prevailing in the newer sections of the district, in Oklahoma and west of Baxter Springs, Kan. Truck haulage from Joplin, where most of the supply houses have their headquarters, to the Oklahoma field is expensive. Royalties also are much higher in the newer field, and operators are inclining to the belief that the average richness of the ground is little, if any, better in Oklahoma than in the older camps in Missouri. It is known that the largest producing company in Oklahoma showed a recovery of only about 6% during the present year, and many Joplin soft-ground mines have done as well and better. Among the recently developed mines in the Joplin camp are the Julian, Lucky Joe, the Bankers, and the Henryetta. The latter two have just completed new concentrating plants, and the Julian is operating a hand-jig plant and will probably erect a mill later. Small mining operations are fewer in the district than they have been for the last 10 or 15 years, the high costs and present poor demand for zinc blende being responsible. At a number of properties, however, the present dullness is being utilized for careful drilling work in blocking out ground, with the idea that when prices improve there will be nothing in the way to hinder steady operation.

HOUGHTON, MICH.—Dec. 20

An I. W. W. Outbreak in Northern Michigan is extremely unlikely, either in the lumbering woods, where most of the workers are foreign born, or in the iron and copper mining camps, where 75% of the workers are foreign born and fully 90% of alien parentage. There are many socialists, some "red socialists," in the mining districts, but few sympathize with Bolshevik teachings or with I. W. W. principles. There is no labor shortage in the districts at present, men returning from munitions plants readily finding their old places at almost as high wages as they received on war work. The woodsmen who formerly got \$25 a month and mediocre board is now demanding and getting \$60 and board, and, in many cases, more. Employment agents of the mining companies report that their forces are 95% of normal.

Copper Production in Northern Michigan was hampered by labor scarcity during the last season. Usually shipments of refined metal are made only by lake, the copper piling up on the docks through the winter and being taken east gradually in the spring, while water shipments continue throughout the summer. Enormous shipments were made by rail this year, however, because of demands for immediate delivery. One company, the Quincy, sent most of its output to the French government. The Calumet & Hecla sent a great amount of its copper to England and Italy. With labor back at normal, the big companies anticipate an increase in copper output next season. It is feared, however, by some mine managers, that much of the foreign labor will return to Europe after the peace settlement, because of improved labor conditions and the promise of work near or at their old homes and at living wages for years to come.

VICTORIA, B. C.—Dec. 19

Prospecting of the Phoenix Mines by diamond drill, with a view to demonstrating sufficient ore to warrant operation of the now idle Greenwood (B. C.) smelter, has been suggested by residents of the district. It is said that the provincial government is to be asked for financial aid in starting the work. J. D. MacLean, provincial secretary and member for Greenwood, and J. E.

Thompson, member of Parliament for Grand Forks, B. C., are said to be in sympathy with the proposal. Through Oscar Lachmund, formerly general manager of the Canada Copper Corporation, commercial interests of Greenwood City have asked the corporation to lease the plant in order that a company organized by citizens may operate it.

Records of Applications for Leases on Placer Grounds of British Columbia show the effect of market demand and general conditions during the last few years. In 1915, values had not become so inflated and the labor problem was less serious, with the result that mining of placer areas of the province for gold proceeded much as usual, about 160 leases being issued during the year. In 1916, however, quotations advanced on all commercial metals, though gold remained stationary. This, together with labor shortage and high costs, had its effect, for leases dropped to 87. But in 1917, although the same conditions obtained, the insistent demand for platinum and the high price once more fired the enthusiasm of prospectors and operators. This is conclusively indicated by the issuance by the Provincial Department of Mines of 139 leases. The total for 1918 will show that the interest was maintained, as it will reach approximately 137 leases. Of the latter, 35 bench leases and 9 dredging leases were granted in October and November, which would seem to indicate that the predicted revival of gold production following the declaration of peace is being anticipated.

TORONTO, ONT.—Dec. 21

Laborers Are Arriving at Porcupine in large numbers. Many of them were employed in the mines before the high wages attracted them to munition work, and they speedily obtain employment. It will be some time, however, before the labor supply equals the demand, the present requirements of the Porcupine camp alone, without allowing for new developments or extensions, being conservatively estimated at 2000. Moreover, the lumber companies and the pulp and paper mills are keen competitors, and are absorbing a large proportion of the men coming north.

The Ontario Department of Lands, Forests and Mines will not be able to proceed

this year with its experiments in the utilization of peat for fuel. Orders for the requisite machines were placed in the spring, but, owing to the difficulty of obtaining material from the United States, and to other causes, delivery was much delayed. One of the machines has just been placed in the large peat bog at Alfred, in the Ottawa district, but the frost prevented experiments from being carried out. Another machine is expected to be completed during the winter, and it will be put in place so as to begin operations as early as possible in the spring.

The Adoption of an Industrial Relationship Plan was announced on Dec. 19 by W. J. Hanna, president of the Imperial Oil Co., at Sarnia, Ont. The plan is to harmonize the interests of capital and labor. It involves an agreement between company and employees providing for conferences between representatives, regularly elected by the men and an equal number of representatives of the company, who shall adjudicate on all questions as to wages, hours, living conditions, and the rights of wage earners. Every employee having a grievance can bring it before the conference, and no employee is to be dismissed without the right of appeal to that body for a review of his case. No employee is to be discriminated against on account of membership or non-membership in any union, fraternity or other organization. In addition, the company has established an insurance system, under which anyone who has been with it for 12 months is to be insured for an amount based on his term of service and earnings, the minimum being \$500 and the maximum \$2000. Old-age pensions will also be established, enabling those who have reached the age of 65 to retire with the assurance of being provided for, and a sick benefit plan will also be put in operation. These systems will be absolutely without cost to the beneficiaries, and are not to be considered in reference to the rate of wages. All employees who have served as soldiers will be re-instated without any reduction of their former pay, and adjustments will be made to meet the physical condition of any who have suffered disabilities. The plan affects over 6000 employees, 1000 of whom, at the Sarnia refinery, have elected 15 representatives to the conference.

The Mining News

ARIZONA**Cochise County**

ARIZONA SMELTING AND POWER (Benson)—Recently incorporated. Charles E. Goetz, president. Has taken over old smelting plant at Benson, including never-used 250-ton copper blast furnace. Will blow in latter in about 90 days. Has old slag dump of good fluxing material. Expects to draw ore from Johnson, Patagonia, Helvetia, and other districts.

PHELPS DODGE (Bisbee)—Will take back all former employees who left to enter service.

GREAT WESTERN (Courtland)—Work resumed under owner, William J. Young. Lessees extracting ore for shipment.

LEADVILLE (Courtland)—Shipping carload of copper ore daily to Copper Queen smeltery at Douglas. W. M. Holmes in charge.

Gila County

PORPHYRY COPPER (Globe)—Shaft bottomed at 770 ft., and 2800 ft. of development work done. Twenty-five men employed.

LAVELLE (Hayden)—Considering installation of small mill using amalgamation and concentration. Concentrates to be shipped to El Paso.

MIAMI MINE AND MILLING (Miami)—Installing 50-hp. I-R compressor for drilling.

Greenlee County

GOLDFIELD EXTENSION (Duncan)—Work stopped on Ash Peak property, after two years' development.

Maricopa County

ABE LINCOLN (Wickenburg)—Driving tunnel along main vein to connect with main shaft at 230 ft. depth. Surface ores changed to high-grade chalcopryite, for which concentrator is planned. Break in

hoist recently stopped work in shaft, from which crosscut will be run at present 700 level to main vein, passed on dip in shaft. Charles E. Nathurst, former metallurgist with United Verde, is in charge.

Pinal County

RAY-KELVIN (Ray)—J. C. Reed, of Phoenix, appointed receiver on application of H. E. Easterday.

Santa Cruz County

HARDSHELL (Patagonia)—To sink new working shaft, present hoisting facilities being inadequate.

MORNING GLORY (Patagonia)—New compressor plant installed.

PIERCE-GARDNER (Patagonia)—C. A. Pierce and Thomas Gardner shipped six carloads of silver ore to El Paso, without sorting, from claims leased near the Hardshell primarily for manganese.

RUBY COPPER (Patagonia)—Starting upon fifth drill hole.

Yavapai County

DUNDEE-ARIZONA (Jerome)—Old tunnel cutting shaft at 120 ft. to be extended northeast into fractured limestone and copper carbonate. Sinking on main shaft continued with one shift. Present depth is 750 ft.; will go to level of Extension tunnel at 960 feet.

GRAND ISLAND (Jerome)—Shaft down 420 ft. Soft ground encountered. Formation black diorite.

SHEA (Jerome)—Company planning small concentrator to remove silica.

SIMMS GROUP (Mayer)—Sold by Martin Simms and others to Halling P. Overton and associates.

ANGLO-SAXON SMELTING AND REFINING (Prescott)—John E. Russell, managing director, states that those in charge of company's affairs in London ad-

vised that project will be resumed upon conclusion of peace.

ARKANSAS**Marion County**

DIXIE GIRL (Buffalo)—Drill installed to test lower ground. Mine producing zinc carbonate.

PIGEON RIDGE (Buffalo)—Leased by Henry Hand and associates. Drifting into carbonate ore. Making good production of hand-cobbed ore.

BIG BELL (Rush)—Mill completed; capacity, 100 tons per shift. Ore is high-grade zinc carbonate. Shipping point, Yellville.

MATTIE MAY (Rush)—Machinery for concentrator arriving. Mill building nearing completion. Mill capacity 100 tons per shift. Ore is zinc carbonate.

CALIFORNIA**Amador County**

LIGNITE DEPOSITS in lone district being tested for use by a process said to involve blowing dust into furnace by atomizer.

LINCOLN CONSOLIDATED (Sutter Creek)—To be reopened and operated under same management as Old Eureka. Embraces Lincoln and Wildman-Mahoney.

Butte County

FEATHER NO. 2 DREDGE (Oroville)—To be closed and dismantled after 10 years' operation by Natomas company. One of last wooden-hull dredges built by Natomas. Ground will be finished by other dredges. G. W. Akers was dredgemaster during life of dredge.

Los Angeles County

LOS ANGELES GRAPHITE (Los Angeles)—To install reduction plant for recovering graphite from Crescenta Canada tract, near Los Angeles.

Nevada County

ALLISON RANCH (Grass Valley)—Shaft and drifts unwatered to 1400 level. Expect to complete unwatering 200 ft. deeper in January. Mill running full capacity 16 hours a day.

QUAKER HILL (Nevada City)—Installing electric locomotive, capacity 50 loaded cars, for hauling gravel to mill under construction. Will start about Jan. 1. Forty-five men employed.

Shasta County

BALAKLALA (Coram)—To extend aerial tram two miles west of mine to aid development. Labor more plentiful, and tram line running night and day shifts. Large hospital and two cottages completed.

SHASTA BELMONT (Winthrop)—Arrangements completed for resuming operation in January. Expect to intersect ore-body 60 ft. from present end of tunnel. Flotation plant in prospect if ground shows continuation of upper-level orebodies.

COLORADO**Clear Creek County**

CLEAR CREEK-GILPIN ORE (Idaho Springs)—Incorporated by W. E. Renshaw, W. E. Passmore and E. L. Regennitter, of Idaho Springs, to operate community sampler in Clear Creek County. Remodeling of North American sampler, recently taken over, almost complete. Ore shipments arriving. Operations to start soon. Principal office at Idaho Springs.

STANLEY (Idaho Springs)—Recently reopened under leasing system. Road Adit level and tributary workings leased to A. L. Hauquitz & Co., Lower and upper Whale levels to John Symons, and Hukill workings on north side of Clear Creek to John Thomas & Co. Compressor plant, run by water power, supplying air to lessees in Stanley, to Byron Mining Co., operating Lord Byron mine in Spring Gulch, and to other small operators in Clear Creek Gulch.

Teller County

CRESSON (Cripple Creek)—Influenza cut November shipments. Cresson shaft connected with Roosevelt tunnel at 1918-ft. depth. Station cut at tunnel level and timbering completed. Ore from shoots under development at tunnel level being hoisted through Elkton shaft.

LINCOLN MINES AND REDUCTION (Cripple Creek)—Twenty men employed on construction at new concentrator on Ironclad Hill. Concrete retaining walls completed. Work under way on machinery foundations delayed by bad weather. Will let contract for 200,000 ft. of lumber. Plant ready in 90 days. Thomas Kavanaugh in charge of construction.

FLORIDA**Duval County**

BUCKMAN & PRITCHARD (Pablo Beach)—Have installed Huff electrostatic equipment for concentrating monazite sand. Carload of high-grade concentrates shipped.

KANSAS**Joplin District**

PHILLIPS (Baxter)—One shaft down to ore and second down 90 ft. on Cooper land, near Southern. Expect to erect mill.

SOUTHERN LEAD AND ZINC (Baxter)—Finished community boarding houses and other improvements at property.

MINNESOTA**Mesabi Range**

OLIVER IRON (Virginia)—Ore-shipment season closed, and stockpiling operations proceeding at Alpena and Ordean mines. Three shovels are stripping at Missabe Mountain mine. Wanless and Shiras mines at Buhl stockpiling; Deacon mine closed since Nov. 17.

MISSOURI**Joplin District**

BANKERS (Joplin)—New 200-ton mill in operation in East Hollow, near Joplin. I. P. Jones, manager.

HENRYETTA (Joplin)—Completing 250-ton mill at Smelter Hill. Three shafts in ore, 80 ft. face indicated. Lease, 25 acres. Plant to be operated by gas engines. Sludge room, equipped with Deister and Arbutnot tables, operated separately from mill. Fireproof changehouse for men. Mine owned by Henryetta, Okla., and Joplin people. M. C. Brady, Joplin, is manager.

JULIAN (Joplin)—Developing good lead mine on Robinson land at depth of 120 ft. Hand jigs used exclusively at present. May build mill. Charles McDonald, manager.

MONTANA**Silver Bow County**

BUTTE & SUPERIOR (Butte)—Operations reduced to one shift, or 50%, following Anaconda's suspending its receipt of custom zinc ore from Butte district.

NEVADA**Churchill County**

NEVADA-WONDER (Wonder)—Mine and mill operating steadily.

Elko County

HOLDEN M. AND M. (Tuscarora)—Acquired control of several old mines in Tuscarora district. Examinations made, and work under way. Operations to be increased in spring. J. E. Harrington, president.

Esmeralda County

C. O. D. (Goldfield)—Lessees breaking shipping-grade ore in workings from Gold Bar shaft. Several groups of lessees operating.

CRACKER JACK (Goldfield)—Developing 40-acre block leased from Goldfield Consolidated and Florence companies. Unworked from surface to 450 level.

RED HILL FLORENCE (Goldfield)—Shipping regularly from 400 and 500 levels. Will ship from 600 level soon.

Lincoln County

VIRGINIA LOUISE (Pioche)—Since resuming in July improvements consist of 1000-ft. spur from track at Prince Consolidated mine, 100-ton loading bin, inclined tramway from shaft to bin, office, warehouse, changeroom for miners, two bunk houses, and superintendent's residence. Ore pockets cut on three levels preparatory to increasing output. Development has opened large tonnage, probably extension of ore worked in Prince Consolidated mine. New 10-drill compressor to be set up at once.

Lyon County

MASON VALLEY MINES (Thompson)—Ore receipts at Thompson smeltery for week ended Dec. 10 were: Bluestone, 2083 tons; Mason Valley, 2213 tons; Nevada-Douglas, 1401 tons; miscellaneous, 290 tons.

SOUTH DAKOTA**Custer County**

OLD MIKE (Custer)—Mine sold to Idaho interests, which will incorporate as Berne Mica Corporation. Preparing to operate.

RARE MINERALS (Custer)—Concentrator near completion. Will start in January. Breaking ore at Hebert mine for plant. Will also take ore properties near Custer.

SPOKANE LEAD AND SILVER (Custer)—Shipping lead-silver concentrates to Keystone in trucks, thence to smeltery at Omaha.

FIRST NATIONAL (Hill City)—Shaft unwatered and property being examined by engineers from Michigan.

MALONEY-BLUE LEAD (Sheridan)—Copper shipments continue. Boiler and compressor recently installed.

UTAH**Salt Lake County**

CARDIFF (Salt Lake City)—Permission to haul ore down Big Cottonwood Canyon with teams during winter refused by City Commission on ground that accumulated waste would find its way into watercourse with spring thaw.

Summit County

GLEN ALLEN (Park City)—Property in Blue Ledge district making surface improvements and erecting gallow's frame. Milling ore carrying lead and zinc opened. J. B. Allen is manager.

PARK UTAH (Park City)—Property operating through Ontario drain tunnel. Is building houses for men near portal of tunnel. South drift from tunnel still in mineralized ground.

SILVER KING COALITION (Park City)—Examination of property being made. Park City office discontinued on Dec. 1. All business will be done through Salt Lake office.

SILVER KING CONSOLIDATED (Park City)—Making changes in Thaynes Canyon mill. Drain and operating tunnel now in 8750 ft. and advancing about 10 ft. a day.

Utah County

GLOBE (American Fork)—Tunnel in 6000 ft. John Cleghorn is manager.

MILLER (American Fork)—Carbonate lead ore, carrying gold, being shipped by Smith & Armstrong, lessees.

PACIFIC (American Fork)—Work mainly exploration and development. Some concentrates being produced.

WASHINGTON**Ferry County**

LONE PINE-SURPRISE (Republic)—Since resuming work Sept. 15, 1917, has

shipped 14,040 tons of ore from Last Chance mine. Will sink main shaft 150 ft. deeper.

Pend Oreille County

BEAD LAKE GOLD-COPPER (Newport)—Machinery for 100-ton concentrator on ground or at Newport. Will install this winter. New body of milling ore struck.

Stevens County

LOON LAKE COPPER (Loon Lake)—To build complete crushing and flotation plant with a capacity of 100 tons per 24 hours. Work to cost \$40,000 and will begin Dec. 1. Ralph L. Flanders is secretary.

CANADA**British Columbia**

GRANBY CONSOLIDATED production for November was 2,147,405 lb. of copper, against 2,549,474 in October.

IVA FERN (Nelson)—Consolidated Mining and Smelting Co. developing this property extensively.

ROCK CANDY (Grand Forks)—Bins, tramway and wagon road built on this fluorspar property by Consolidated M. & S. Co. Diamond drilling and development in progress.

INLAND (Paulson)—Recent development on Berlin claims consists of 100 ft. shaft and 200 ft. of drift.

PRINCETON MINING AND DEV. (Princeton)—New compressor and 150-ton ore bin considered for Copper Farm group. Recent development has raised daily capacity to 50 tons.

SOUTH EASTERN (Skidegate)—Gold property on Queen Charlotte Islands to be developed. Cyanide mill is planned. A. S. Holmes, manager.

CONSOLIDATED M. & S. (Trail) Conditions at smeltery following influenza improving. Cost of epidemic estimated at more than \$50,000. Over 300,000 tons of ores and concentrates received to second week in December. Three new shippers on last list, namely: Silver Hoard, Ainsworth, 21 tons; Grant, Woodbury Creek, 4; Spokane mine, Salmo, 20.

PLACER DEVELOPMENT (Tulameen)—Ground 25 miles from Princeton on Tulameen River leased from Efanjay Gold Mining Co. Sluicing gravel from river bed for gold and platinum. Dam and flume built.

NAOMI (Vavenby Station)—Working option taken by W. E. Butler, Calgary, Alta., and J. L. Miller, Lethbridge, Alta. Building wagon road.

LIGHTNING CREEK GOLD GRAVELS (Wingdam)—Drilling with keystone drill on Lightning Creek.

Ontario

GRAPHITE PROPERTY 35 miles north of Ottawa and four miles from Canadian Pacific R.R. and Gatineau River will be diamond drilled. R. A. Bryce, 801 Traders Bank Bldg., Toronto, is superintendent.

CROWN RESERVE (Cobalt)—Vein struck on 200-ft. level in virgin territory.

BALDWIN (Kirkland Lake)—Camp buildings erected. Shaft down 193 ft., and crosscut in 60 ft., cutting 5-ft. quartz vein.

HILL GOLD (Matheson)—Will resume work soon.

DOMB (Porcupine)—Force being rapidly increased with view of resuming production soon.

GOLD LAKE (Porcupine)—Has purchased mining equipment of Slade Forbes Asbestos Company.

McINTYRE (Porcupine)—Preparing to increase mill capacity from 600 to 1000 tons a day. With increased capacity, lower cost of supplies, and improved labor situation expected that cost of \$3.50 to \$4 a ton will be reached.

SOVEREIGN (Timmins)—Plans adopted for exploring this claim.

MEXICO**Sonora**

GREENE-CANANEA (Cananea)—Mining operations curtailed for about two weeks in November owing to strike of peons. Ore on hand kept mill running. Mexican labor returning from United States.

SOUTH AMERICA**Bolivia**

BOLIVIAN TIN CORPORATION (Potosi)—One of two dredges operating near Potosi destroyed by fire in November.

Chili

CHILI COPPER (Chugucamata)—November production was 9,854,000 lb. of copper. October production was 8,548,000 pounds.

The Market Report

SILVER AND STERLING EXCHANGE

Dec.	Sterling Exchange	Silver		Dec.	Sterling Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
19	4.7580	101½	48½	23	4.7580	101½	48½
20	4.7585	101½	48½	24	4.7580	101½	48½
21	4.7580	101½	48½	25			

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

Dec.	Copper		Tin		Lead		Zinc
	Electrolytic	Spot	N. Y.	St. L.	N. Y.	St. L.	
19	*	↑	7.05	6.75			7.60
20	*	↑	7.05	6.75			7.60
21	*	↑	6.00	5.85			7.55
23	*	↑	5.75	5.60			7.50
24	*	↑	5.50	5.35			7.50
25							7.60

The above quotations 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.

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

* No market. Producers ask 26c. No buyers.

† No market. Major supplies held for distribution at an arbitrary price of 72½c.

LONDON

Dec.	Copper			Tin		Lead		Zinc
	Standard	Electrolytic	Spot	3 M.	Spot	3 M.	Spot	
19	111½	100	254	248	40.5	39.5	56	
20	108½	100	264	255	40.5	39.5	56	
21								
23	108½	100	266	254	40.5	39.5	56	
24								
25								

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

The quotations for copper have come in a rather confused way this week. We have given the mean of the figures cabled. The figures will be subject to correction when more definite information is received.

Metal Markets

The prime feature this week was the sharp break in the price for lead. Otherwise the markets remained about in statu quo. The general situation is treated editorially. Consumers of all metals appear everywhere either to be overstocked or else to have no orders.

There has been considerable uncertainty respecting the quotations for pig lead in London. Previous to the change of price, toward the end of November, they were cabled to this side as "£29 10s. spot, £28 10s. futures." The figure of £29 was variously stated as the "official" or settling price. There was similar irregularity in the publication of the London metal papers, some giving "official quotations" £28½ to £29½, settlement £29, while others have given "spot £29½, futures £28½" and "spot £29½, and one month £28½." Official publications, so far as we have been able to

ascertain, simply stated the price of £29. We communicated recently with an authoritative quarter in London to clear up this confusion, and obtained the reply that since Jan. 2 the official maximum price permitted in any dealings was £29, and that quotations for spot and forwards issued through the Metal Exchange did not represent any dealings. Since the change of price in November, exactly the same conditions have existed, with the quotations of £39½ to £40½, settlement £40. There has been also some uncertainty respecting the actual date of the change of price, which has been variously given as Nov. 25 to Nov. 28. We have previously reported the date as Nov. 28. Confusions and delays with respect to cables explain this. Our latest, direct advices are that the advance to £40 was made on Nov. 26.

The official and settlement price for lead in London from Jan. 2 to Nov. 25, 1918, both dates inclusive, was £29, and from Nov. 25 onward it has been £40. We have corrected our tables of monthly average prices of metals in accordance with this latest information.

It has been ordered in Germany that 20% of all confiscated metals, and also of all new production, be forthwith released for peace purposes.

Copper—There is nothing of importance to report. Producers still unitedly ask 26c. and find no buyers. There has been the usual gossip about resales at low prices, bids at lower prices, etc. Everybody expects a market to begin at lower prices on Jan. 2. The most authentic information is that electrolytic copper was offered for resale this week at 21c., and intimations that London might buy copper at about 19c.

A few of the producers met Mr. Brookings in Washington on Dec. 20 and exchanged formal felicitations and farewells.

The Anaconda Copper Mining Co. today reduced its quarterly dividend from \$2 to \$1.50.

Copper Sheets—The base price of copper sheets is 35½@36c. per lb. Copper wire is quoted at 28c. per lb. f.o.b. mill, carload lots.

Lead—The Lead Producers' Committee met in New York on the afternoon of Dec. 20 and decided to dissolve and let a free market be instituted on the following day. On Dec. 21 lead was offered in tonnage at 6c. New York, without finding buyers. On Dec. 23 the American Smelting and Refining Co. reduced its price to 6½c. This meant simply that it considered lead to be worth that much and would not, for the present, anyhow, meet the competition. On the same day, lead was offered by other sellers at 5½c. New York, with only a few sales resulting. Today it was offered at 5½c. and sales were effected at that figure, but in no significant tonnage. It is probable that the lead market will go lower. The rapid action is the attempt of this market, long restricted, to find itself. The point will, of course, be reached on some day when buyers will be interested in taking in lead, after which the market will have an opportunity to re-establish itself at higher figures. Lead has been offered for delivery in St. Louis at the arbitrary differential of 0.15c. below the New York price.

The Lead Producers' Committee, under date of Dec. 20, made the following official announcement: "Effective Dec. 21, this committee has ceased to be the exclusive central agency of all producers, who are now free to quote individually. There are no restrictions on resales."

The Consolidated Mining and Smelting Co. reports large stocks of lead in Canada. Besides about 8000 tons of pooled lead remaining unsold, there is a large quantity in the hands of the Imperial Munitions Board hanging over the market, but arrangements have been made to avert any sudden dumping of the latter. J. J. Warren, managing director, adds: "We are quite willing for the present to continue receiving lead from Canadian shippers in normal quantities, but advance payments for lead will be calculated on a basis of 7c. per lb. instead of the basis we have used recently, with the understanding that we may vary this estimated price if circumstances warrant. Whatever price is used will be adjusted finally to the sales price by the pooling scheme."

Tin—A formal announcement appears elsewhere in this paper. This is to the effect that 10,000 tons of tin was purchased by the U. S. Steel Products Co., and 72½c. per lb. has got to be paid for it. In the meanwhile, American smelters and resellers hover a little under that figure. There was a sporadic market during the week in lots offered for resale and in American tin. At the beginning of the week Straits and equivalent grades were quoted at 72c. and 99% grades at 71c. At the close quotations were 71 and 70c., respectively. A 25-ton lot of Straits tin was being offered for resale at 71c., without finding buyer.

The London tin quotations for Dec. 4 and 11 are respectively: Spot, £275, £275; 3 mo., £270, £270.

Zinc—This market became weaker from day to day on relatively small business. The statistical position as reflected by visible stocks is becoming impaired, and there is a great deal of uncertainty with regard to the invisible stocks. Consumers who are approached by sellers generally express themselves as being well provided with supplies.

The new official prices for spelter in Great Britain are £57 for good ordinary brands delivered at buyers' works, and £75 for refined (99.9%).

The company operating the zinc smelteries at Overpelt and Lommel in Belgium, declared the usual dividends last fall. The report of the Austro-Belge Co., however, showed an operating loss.

Some of the Belgian zinc smelteries were operated during the war, as appeared from the occasional financial statements and production reports that were published in German papers. Since the armistice, we received word from an authoritative British quarter that the plants of the country have not experienced material damage. On Dec. 23 we received a dispatch dated in Brussels, Dec. 22, from an authority (than which there is none higher) in the zinc industry of Belgium to the effect that owing to various causes it will be impossible to resume work in zinc smelteries of Belgium for an indeterminate time.

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

Other Metals

Aluminum—Unchanged at 33c. per lb. There is much aluminum on the market.

Antimony—This market was dull and weaker. During the first half of the week some sales were reported at 7½@7¾c., but during the latter half, beginning with Monday, carload lots were offered at 7½c., and we quote that price at the close.

British metal papers say that the quantity of the stocks of antimony that have been revealed in European markets is surprising.

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

Cadmium—Quoted at \$1.50@1.75 per pound.

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

Quicksilver—Weaker, but quiet. We quote New York at \$115. San Francisco telegraphs \$115, weak.

Gold, Silver and Platinum

Silver—The market is steady. London and New York unchanged. Production of silver for the year 1918 is estimated at 180,000,000 oz. Shipments for the week ended Dec. 21 were 1,285,000 ounces.

Mexican dollars at New York: Dec. 19, 77½; Dec. 20, 77½; Dec. 21, 77½; Dec. 23, 77½; Dec. 24, 77½; Dec. 25, 77½.

Platinum—By a typographical error our quotation read last week \$150@108, when, of course, \$105@108 was meant. This week the market has been a little easier, the Government Assay Office offering to sell from its accumulated stock at \$105. We quote

that price for refined ingot. Refiners bought sponge platinum at \$100.

The New York Assay Office was the sole refinery for crude platinum bought by the Government during the last year. It handled upward of 60,000 oz., and has unused supplies which are now being sold at \$105 per ounce.

Palladium—Quoted at \$125.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 21—Blende, per ton, high, \$49.40; basis 60% zinc, no premium sold; Class B, \$44; Prime Western, \$42.50 @40; sludge and flotation, \$37.50; calamine, basis 40% zinc, \$35@30. Average selling prices: Blende, \$42.10; calamine, \$36; all zinc ores, \$42.05.

Lead, high, \$101.75; basis 80% lead, \$100@80; average selling price, all grades of lead, \$83.02 per ton.

Shipments the week: Blende, 9223; calamine, 148; lead, 1160 tons. Value, all ores the week, \$490,320.

For the third week purchasers of ore on a premium basis have not appeared in the market, this week cleaning up on advance purchases, with no orders for purchases next week expected. Next week being holiday week, light business in all grades is expected. Buyers will attempt to load up advance purchases. There is no restriction of output. The output of 1916 averaged 5747 tons per week, filling a pre-war demand. Today it is in excess of 8000 tons per week, with stock accumulating.

Platteville, Wis., Dec. 21—Although the Government schedule was still effective, theoretically at least, no offerings were made by buyers on premium-grade zinc ore during the week. Neither were any sales of high-lead blende of 60% zinc reported. Lead ore, basis 80% lead, \$75 per ton. Shipments reported for the week were 1022 tons blende, 103 tons galena, and 98 tons sulphur ore. For the year to date the totals are 119,875 tons blende, 7791 tons galena, and 39,523 tons sulphur ore. During the week 2409 tons blende was shipped to separating plants.

Other Minerals

Pyrites—Spanish pyrites is quoted, subject to the raising of the embargo, at 16c. on the basis of 10s. ocean freight. Restrictions still continue. Unchanged. Ocean freights have fallen to 30s.

Iron Trade Review

PITTSBURGH—Dec. 23

There is little demand for steel products, in the aggregate, on contract, and practically no demand from new buyers. In pig iron, contract shipments are being taken fairly well, relatively speaking, but there is no new demand. Many mills, perhaps the majority, have closed for the present week, and some that found occasion to operate this week will close later. In several instances, indeed, mills operate this week only because they wish to clean up orders for a protracted closing.

Three influences conspire to make the demand for steel particularly light at this time. The first, of course, is the readjustments that customers must make in their affairs in shifting from a war to a peace basis. The second is the reduction in steel prices, as reductions always cause a halt. The third is the season of the year, which is always a dull one in the steel market, on account of inventories and other matters.

The real test of the steel market will hardly come before the second half of January, so extensive are the adjustments and rearrangements that buyers of steel must make. Though the mills, in the aggregate, have a considerable volume of specifications on hand, it will not require many weeks to fill them, and unless there is a sudden and extensive revival in demand, steel mill operations will probably be at less than 70% of capacity by the end of January, perhaps at less than 60 per cent.

Steel producers intend to hold to the recently reduced price levels as long as possible, by reason of the fact that for a few months at least demand will be chiefly against contracts rather than in the form of new buying. If demand continues light, there may be further declines, but the present attitude of the trade is that they can hardly be looked for before April 1, and possibly not until June. No heavy demand can spring up overnight, as there are so many adjustments to be made. To the average steel producer, the matter of his customers' wage cost is of more concern than his own wage cost. This is the case with investments in particular, as permanent structures, for purely investment purposes,

will not be erected as long as wage rates are so high and at the same time labor performance is so unsatisfactory.

Pig Iron—To date the blast furnaces have been altogether indisposed to reduce their prices \$3 a ton, in accordance with the general program suggested by the price committee of the American Iron and Steel Institute, although the steel producers promptly adopted their part of the program. Some furnace interests seem to think reductions may occur immediately after Jan. 1, but the general feeling among merchant blast furnacemen is not to reduce prices until this is absolutely necessary. The furnaces are fairly well sold up, and customers are expected to take their iron. There are occasional lots of resale iron offered at cut prices, but they do not make a market. We quote the market steady but absolutely inactive at the old Government prices: Bessemer, \$35.20; basic, \$33; foundry, \$34; malleable, \$34.50; forge, \$33, f.o.b. basing point, freight from Valleys to Pittsburgh being \$1.40 and from six detached furnaces somewhat less.

Steel—There are freer offerings of soft steel and discard steel, but little demand. Discard steel would not bring over \$40 at the outside. Soft steel is quotable at the \$4 reduction: Billets, \$43.50; sheet bars and small billets, \$47; slabs, \$46. Rods are \$57, the old Government price not having been reduced.

Ferroalloys

Ferroalloys—There is absolutely no market, buyers showing no interest, and it would probably require heavy cuts to effect sales of either ferromanganese or spiegeleisen. As previously reported, resale ferromanganese has been offered at \$240, delivered, or \$10 under the old price, without effecting sales. As stated, furnaces recently reduced their asking price on spiegeleisen \$5 to \$70, f.o.b. furnace, which remains the asking price.

Coke—Indications remain that the Fuel Administration will relinquish its control of coke prices at the end of this month. By reason of the curtailment in production caused by influenza, coke has been scarce, and unless furnaces slow down their operations, as they may do, an open market in coke might result in higher prices. So many mills are closing for the week, however, that blast furnaces are likely to slow down, though without actually banking.

MONTHLY AVERAGE PRICES OF METALS

Table with columns for New York, London, and Electrolytic prices for Copper from 1917 to 1918.

Table with columns for New York, St. Louis, and London prices for Lead from 1917 to 1918.

Table with columns for New York, St. Louis, and London prices for Spelter from 1917 to 1918.

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

STOCK QUOTATIONS

Table of stock quotations for N. Y. EXCH. and BOSTON EXCH. listing various companies and their prices.

Table of stock quotations for BOSTON CURB* listing various companies and their prices.

Table of stock quotations for SAN FRAN.* listing various companies and their prices.

Table of stock quotations for TORONTO* listing various companies and their prices.

Table of stock quotations for COLO. SPRINGS* listing various companies and their prices.

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

TUNGSTEN

is becoming more important and valuable every day—there's lots of it, too—in the form of Wolframite ores, but Wolframite usually contains tin in the form of Cassiterite, as well as a quantity of magnetic iron.

Tables will separate these three out from the gangue, but no gravity method ever devised will separate them from each other. That's where

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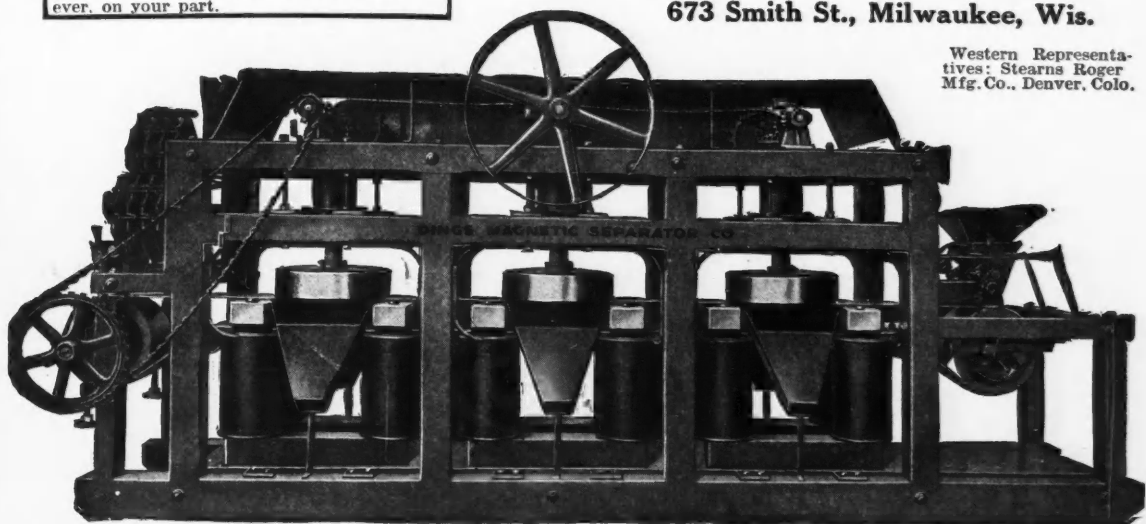
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