

OCT 24 1921

# ENGINEERING AND MINING JOURNAL

McGraw-Hill Co., Inc.

A Weekly Journal of the Mining and Mineral Industries

25 Cents Per Copy

October 22, 1921

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## Drilling Results and Dredging Returns—I

By Charles W. Gardner

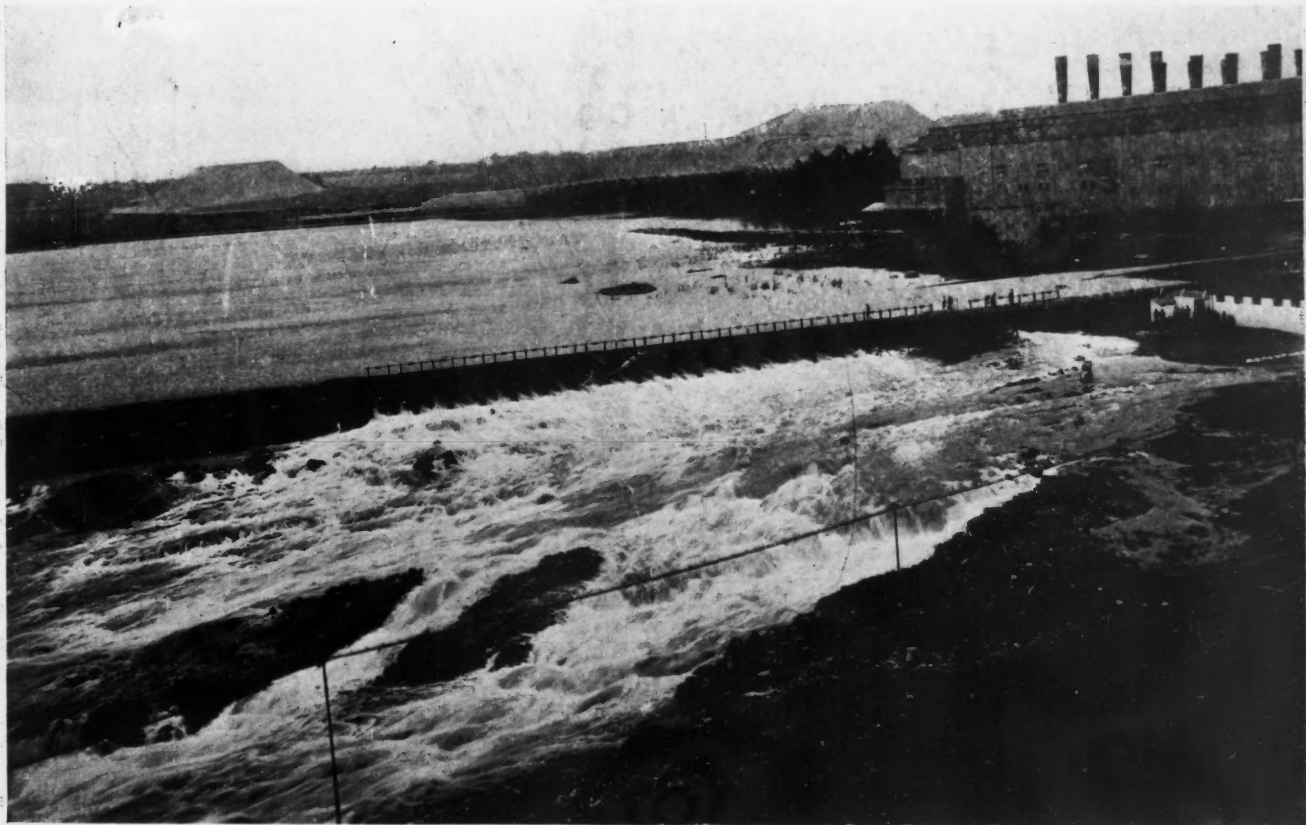
## War Problems in Minerals III—The War Minerals Investigations of the Bureau of Mines

By J. E. Spurr

*Biography of A. H. Fay*

The largest power undertaking in the British Empire is that of the Victoria Falls and Transvaal Power Co. near Johannesburg, S. A., which supplies power for the Rand mines. A description of this plant appears on page 667.

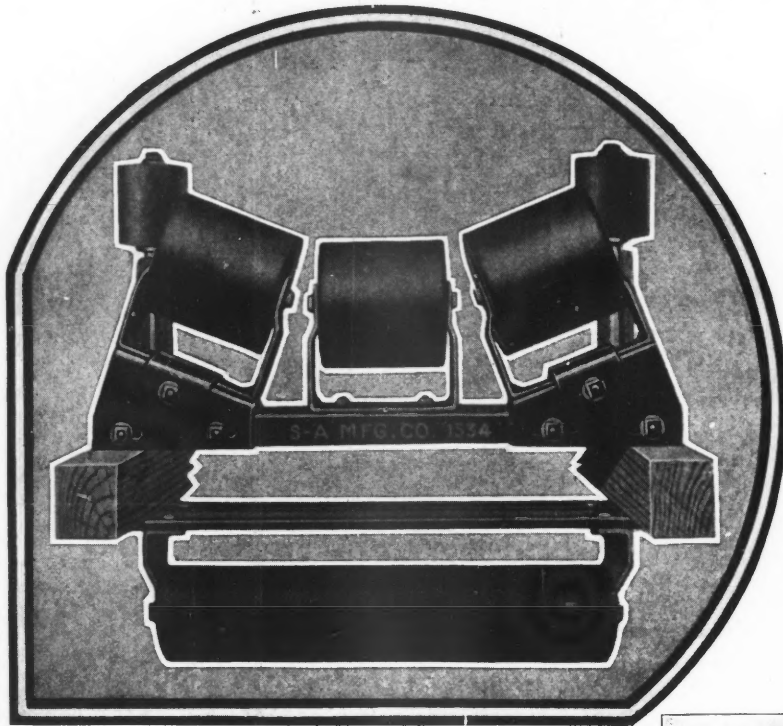
In an address given by Dr. F. W. Laist before the American Zinc Institute, the success that has attended the production of electrolytic zinc at Anaconda was outlined. Page 663 contains an abstract of this paper.



*The Rosherville Dam Near Johannesburg*

One of the units of the Victoria Falls and Transvaal Power Co., Ltd., furnishing power for the Rand mines. Note gold mine dumps in the background.

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# Engineering and Mining Journal

*A Weekly Journal of the Mining and Mineral Industries*

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Volume 112

New York, October 22, 1921

Number 17

## The Merits and Demerits of the Mining Law Bill

THE BILL for a revised mining law, introduced by Representative Arentz, of Nevada, and which has been drafted by a committee of engineers selected by the Bureau of Mines, should be considered very carefully by our readers. It abolishes extralateral rights for all mining claims to be located in the future; it substitutes for the extralateral rights of such claims, vertical boundary lines; it removes the necessity of a real or faked discovery before filing a claim; it makes the form of the claim square, instead of oblong-rectangular, or oblong-rhomboid, as at present. There is nothing new about these proposals to experienced mining men. It is the old Spanish law, with which they are familiar, especially through experience in Mexico; it has been abundantly tested and found good. There is no use in arguing about that, to those whose experience has been broad. It is a better law than our existing mining law of the United States. Everybody agrees to that; and the propositions are, therefore, not only simple but tried.

There are some minor things in the bill that are not so evidently advisable: For example, the stipulation that the lines of claims be surveyed in conformity to the existing lines of public land surveys; and that on public lands the claims shall be a regular subdivision of the land-office divisions—that is, shall be a regular “forty” of a regularly surveyed section in a regularly surveyed township. So we interpret the proposed law; and it is certainly a mistaken provision. There is no adequate and natural reason why it should do so.

When a prospector makes a discovery of ore—there will always be in most cases a real discovery—he should be allowed to stake his claim, so that his forty acres will be advantageously selected with reference to his deposit, because he will not wish to hold any useless ground on which to pay the costs. He may, under the new law, find ore on the line between two “forties,” in which case he will have to take up both forties, or eighty acres, equivalent to four claims of the present size, in order to hold his one find; or if he should find ore on or near a “quarter corner” he would have to take up four claims, or 160 acres, equal to eight present claims, to hold his find.

Moreover, the requirement of the proposed law involves this, that before legally staking a claim in a surveyed region, the prospector must ascertain the lines and monuments of the land survey. Those of us who are familiar with the mountains and desert know that as a practical matter these monuments and lines in many cases do not exist; they may be found only in the maps in the land office. It would require not only a surveyor, but a detective, and finally a research into the checkered annals of land surveying practice and dead-and-gone governmental graft, before the prospector could drive his stakes and establish a legal right.

Senator Pittman, we hear, has observed that the new

law has been drafted “very carelessly”—an observation that strikes rather humorously those who know the years the committee has put upon it. But it is this unfortunate provision as to survey and location which is attracting the unfavorable attention of the prospectors and miners of the West, and which is giving, colloquially speaking, a “black eye” to the whole of this otherwise plainly meritorious and desirable piece of legislation. This feature must be eliminated. We cannot understand how it could have been allowed to slip in.

The membership of the Mining and Metallurgical Society of America, in which the present movement started, voted in 1916 in favor of the vertical boundary lines, the abolition of the necessity for a discovery, and the square claim, but voted distinctly against the proposition that the mining claim should be located to conform to a regular subdivision of the public land surveys. The committee would have done well to have heeded this referendum, as is now evident.

As for us, we hope the bill will be amended as to its objectionable features, and pass. It should be strongly supported, as to its main proposals. The law will not, of course, take away rights from any of the existing claims.

## Conditions in Mexico

RECENT TRAVELERS in Mexico take a soberly optimistic view of the situation there. The country has been immensely impoverished and reduced as the result of the years of turmoil, but there is left a great distaste and weariness of war. The country is quiet, Villa tills his vast ranch, the reward of the wicked. Mining activity is increasing a little here and there. There is a growing tendency to gamble upon a long-continued period of peace and a return of government. Yet the country has far to go before being even as far along as was the old Mexico of Porfirio Diaz. The railroads are largely stripped of rolling stock. Many of the large companies have to purchase and bring in their own freight cars in order to move their ore. The government, which owns and operates the railways, provides the engines and the train crews, and the company the cars, which when dumped are returned empty to the owning company.

## The Passing of Bolshevism in Mexico

THE MEXICAN CHARACTER has naturally been affected by the stirring events of the last decade. Political doctrines, scaling all the way in liberality down to Bolshevism, have been fed on and assimilated, or left undigested, by the populace. The old-time servility of the peon is largely extinct. There was a period when the opposite extreme was sometimes reached. A mine operator of our acquaintance caught a Mexican stealing ore, and haled him before a judge.

At this period the judge was inclined to take the view of the peon, that, being a free citizen of Mexico, he had a right to help himself to ore in the mine in which he worked. Did not the mines belong to the miners, more than to anyone else? Whereupon the mine operator waxed wroth, indignant, and wordy; and the judge promptly fined him for contempt of court, with imprisonment as an alternative. So the ore thief went without punishment, and the mine operator was punished. But the pendulum has swung back from this extreme, and Bolshevism is a dead issue in Mexico, as it is all over the world.

### How To Get Back to Hard Money

SOME WHO HAVE LIVED through the vicissitudes of Mexico during the last few years, and studied her economic and fiscal conditions, feel that they have some precedent for predicting what may happen to the currency of Austria and Germany and the countries of eastern Europe. In Mexico there was flood after flood of paper money, growing, as was inevitable, cheaper and cheaper, more and more worthless, as it became more and more hopelessly remote from any solid underlying security. Finally a revulsion seized the people, running more or less simultaneously throughout the nation. They would not bother further with the truck. There were severe legal penalties against refusing to receive the paper currency as legal tender; but the revulsion and the refusal to accept it were so widespread that the law was inoperative from the reason of the broad nature of the movement and the attitude of the population.

The paper dollars were repudiated, not by the government but by the people. They would take only hard money—silver or gold. So, with the swiftness of a revolutionary movement, and without any governmental action, the nation, almost overnight, speaking figuratively, changed from paper to gold and silver; and today in Mexico only gold and silver are used as money. Thus a new economic and monetary law, a sequel to the oft-quoted law of Gresham, was evidenced. Gresham's law, as we remember, was that in times of depreciated and varying currency, the cheap money drives out the good. In France, for example, the paper money has driven out the silver coins, which have disappeared—sold into Switzerland or England or hoarded. But the new law as displayed in Mexico (and not alone there) is that at a certain stage of cheapness, when the cheap money becomes practically worthless, the good money drives it out. So all the mining and other enterprises in Mexico now are compelled to pay their wages only in solid coin.

Such an event is accordingly predicted by these observers for certain countries in Europe. In Russia and in Austria the revulsion would appear to be overdue; and such a happening in Germany would provide an avenue back to sound money not contemplated by economists. The revaluation of the mark or the repudiation of paper currency by the government are the probabilities contemplated by many financiers; and either avenue is a repudiation. But, if the people should drop their paper rolls, as worthless, into the gutter, and trade only with something else, the government would be saved the trouble of solving the puzzle and the paper marks would have the same status as Confederate currency, now valued solely as a historic curiosity of our Civil War period, has with us.

### Drill-Hole Results and Gold-Dredge Recovery

THE DIFFERENCE between expectation, as determined by preliminary examination, and recovery, as attained by a given plant and equipment, is a subject of considerable interest not alone to engineers but also to financiers and others who put their money into mining enterprises. There is a well-justified belief that in the great majority of examples, where the deposit in question is accessible at a sufficient number of places, a thorough preliminary examination by experienced engineers reduces the difference between expectation and actual recovery to a comparatively narrow margin. As the number of places examined in a single deposit becomes smaller, the element of uncertainty becomes greater. There thus can be placed a limit predicated on the degree of accessibility to the accuracy of the results obtained in the examination. This limit will vary with different types of deposits and with the vagaries of individual deposits.

Charles W. Gardner presents a review on pp. 646-649 of this issue of the differences that arise in gold-dredging practice between expectation and recovery. It is a valuable contribution in that it cites a number of examples where the recovery is less than anticipated, others where it is greater, and some where it is approximately the same. The method of examination of dredging ground is usually by bore holes of relatively small diameter, spaced at considerable intervals. In some instances shafts are sunk to bedrock to check the results of the bore holes.

It is impossible to escape the conclusion, after a study of Mr. Gardner's examples, that the method of depending upon bore holes is not universally applicable to such deposits, and with this conclusion most engineers will agree. Just where to draw the line is the hard question. What deposits can be safely drilled? What deposits must be examined by other methods?

Mr. Gardner does not analyze individual cases, nor is the accompanying information sufficient to enable a reader to analyze them for himself. He discusses the factor used in calculating the value per cubic yard and points out the importance of the personal equation. He leaves us with the idea that there is a large element of uncertainty, but does not definitely tell us why.

In the discussion which followed Mr. Gardner's paper at the California Gold Dredge Operators' meeting at Natoma, on Sept. 27, R. G. Smith, engineer with the Natoma Company of California, suggested that the gold dredge was not doing its work and that part of the difference should be laid to the failure of the dredge in some instances to secure a high recovery of the gold actually present. Thus a reduction factor, personal equation, and the dredge itself received the blame. All, no doubt, are concerned in the problem. We should like to see them discussed in the light of carefully studied examples.

At the Nevada meeting of the dredge operators, Gerald H. Hutton introduced this subject for discussion. He advocated the successive placing of groups of drill holes and the comparison of the results from the different groups. As soon as sufficiently close agreement was obtained, in his opinion, further drilling is unnecessary. In computing averages, he suggests that drill holes of extremely high values be cancelled with the same number of holes extremely low in value, and the value content of the ground be derived from the number



of tests of average or mean value remaining. The first suggestion is in principle at least used by many engineers in making preliminary examinations. Usually, however, a different method rather than a repetition of the one used in the first testing is employed. The second suggestion might sometimes apply, but a more definite reason for such cancellations in specific instances should be found.

It appears to us that the nature of the deposit, whether river channel, terrace, or flood plain, would be of importance. The physical nature of the gravel, whether fine or coarse, loose, compact, or cemented, whether charged with water or not, enters into each investigation. The presence of clay beds and sand beds would also have a bearing. How fine or how coarse are the particles of gold, and what is their distribution? Is the gold relatively coarse in those instances where there is a wide spread between expectation and recovery? On the other hand, where the gold is in a finely divided state, and more or less distributed over a considerable depth of bore hole, is the spread between expectation and recovery negligible? Do compact gravels give close agreement between expectations and recovery and do loose gravels increase this? Does the sinking of a certain number of shafts in proportion to the number of drill holes guard against a wide discrepancy? These questions suggest themselves to us as important in reaching a decision as to the reliability of the bore-hole method of testing dredging ground.

Charles Janin, in his excellent treatise on "Gold Dredging in the United States," says: "To assure the success of a gold-dredging venture, experience and judgment are requisite to the conduct of every detail of the work and pre-eminently in prospecting and examining the ground." He further says: "The reliability of the tests and the accuracy of the average value indicated either by drilling or by sinking shafts depend on the care taken in prospecting, the number of samples procured, the location of the holes in relation to the deposit, and the experience and ability of the men in charge. If these factors are satisfactory, the estimate of the value of the property should require no discounting other than to recognize that the recovery of the dredge is always less than the gold content indicated by prospecting and that the returns on the investment should be enough to compensate for any risks that may be taken."

We agree with Mr. Janin, but we would like to see the discussion of this question extended on more specific lines than have as yet appeared.

### Lead and Chewing Gum

ONE OF THE EVILS of the present period of readjustment in metal markets and prices is the necessary stimulation of new and the resurrection of old uses for the metals in an effort to increase their wider employment, and aiding consumption in what has been a sluggish market. Naturally, the high prices of the war period forced, and generally encouraged, the use of substitute materials whenever that was possible. The attempt of the copper producers, through an organization formed for the purpose, to delve into the use of copper and to popularize its employment is too well known to mining engineers to require emphasis here. Some of the old uses will return without much persuasion, aided by the low price of the metal. Others will necessitate the application of stronger methods.

The predicament of the copper producers is duplicated to a greater or smaller extent in the other metal markets. Occasionally, heartening reports come to us from producers that a manufacturer who reluctantly discarded the use of a non-ferrous metal during the war is gladly returning to it. A recent illustration is the problem that has confronted chewing-gum manufacturers—chewing-gum manufacturers also have their troubles—in adequately protecting the slabs of chicle from dryness and deterioration. Being considered relatively unimportant or subordinate to war industries, chewing-gum factories did not obtain their customary supply of lead for foil purposes during the war. Rather than allow the populace to go gumless, they generally, with one or two exceptions we believe, turned to the use of waxed paper in wrapping the individual and collective slices. Those of us who occasionally exercise our jaws on the rubbery product of *Mimusops globosa* will recall how hard and dry the gum became, despite the paraffined cover. We have no doubt that many a gum addict changed brands when he discovered that the quality of his pet licorice, mint, or wintergreen gum had changed in character. Fortunately, one or two manufacturers steadfastly adhered to the use of metallic foil, so that a comparison was constantly available and some relief given from the dry, crackling variety of covering so widely used as a substitute during the period of war scarcity.

Now, however, it appears that the gum people are again entering the lead market, the metal to be converted into foil, the superiority of which is generally admitted, and that the foil business is picking up. Lead and tin foils make unexcelled cheap protective coverings for a variety of products, from tea to tobacco, and although the consumers of foil were somewhat hard hit by their inability to secure all the lead they desired during the war, their return to it with relish is one good example of the failure of substitutes to measure up to expectations.

It probably is not the only example, for our readers may be personally familiar, through their own experience, with the inefficacy of substitutes for copper, lead, and zinc. The metals in general gained their pre-war positions in industry on merit, and are returning to them for similar reasons. It is an encouraging and hopeful sign for the non-ferrous mining that this transition is taking place.

### Flotation Experiments

WALTER S. MORLEY'S paper on the "Flotation of Pyrite," prepared for the A. I. M. E., and recently mentioned elsewhere in this journal, represents an attempt to investigate the limitations of flotation by a series of simple synthetic experiments. This is a decided advance over the promiscuous work that has been published on flotation. The number of variables which influence flotation is such that accurate conclusions are difficult to draw. Only by the laborious method of controlled and known conditions in numerous experiments can definite improvement in the knowledge of the art be made.

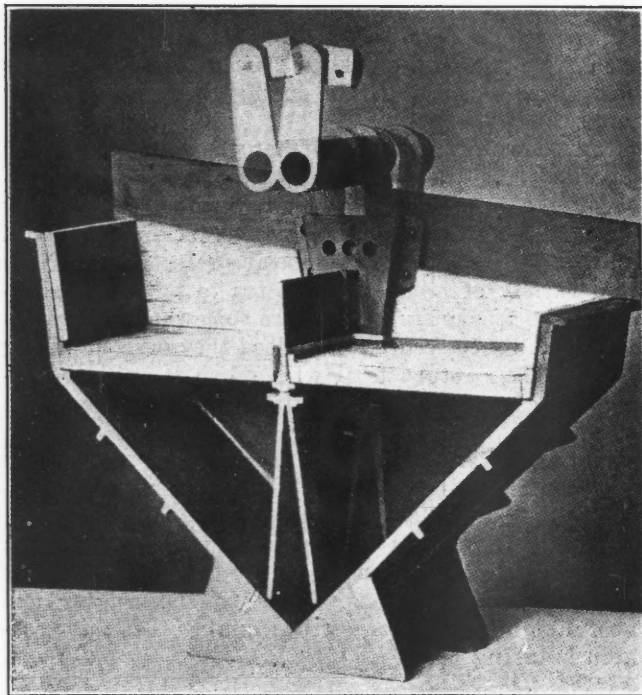
We hope that Mr. Morley will continue his experiments and investigate the physical and chemical conditions controlling flotation with such thoroughness as to permit of their statement in a form immediately useful to the practical mill superintendent and other workers.

## WHAT OTHERS THINK

### Obtaining Suction in Jigs

The interesting and timely article by Edward S. Wiard covering preliminary roughing by jigs and tables calls attention to a phase of the metallurgical treatment of low-grade ores which seems to have been overlooked too often. The desire for a simple flow sheet and "one easy step" in grinding has been the primary cause for the forgetting of old-time principles and the elimination of such important steps as Mr. Wiard describes.

In Mr. Wiard's diagram to illustrate the action of the grains of gangue and mineral in a jig bed, he has assumed that the grains are of equal size. Such is generally not the fact. The grains of metallic minerals



DOUBLE EXPOSURE, NEILL JIG, SHOWING SWING OF PADDLE

usually are more friable than the gangue and are crushed finer, and hence they will be carried by the suction effect of the piston through the interstitial openings to the screen and then through into the hutch. This is particularly the tendency if the roughing jig is used for handling an unsized product, in which event the jig might discharge from its hutch a real concentrate, from its surface a real tailing, and from properly designed end or side discharges a real middling.

The loss of capacity due to suction, as mentioned by Mr. Wiard, must be considered as relative to perfect operation, the capacity of the jig being almost entirely dependent upon the quantity of transportive water fed to the machine.

In the system devised by Woodbury, and largely in use in the Lake Superior region, each compartment in the jig is followed by a dewatering compartment, and

the surplus water is carried to the nearest jiggling compartment, thus doing away with the objection noted by Mr. Wiard. For roughing and for unsized feed where the object is the simple removal of finely divided mineral particles, no such amount of water would be necessary. In a roughing jig handling an unscreened product the effect of suction aids the elimination, through the bed, of the particles which it is desired to save. Therefore, the jig which produces the greatest suction is the one to be preferred for this operation.

In the Neill jig, of which an illustration is herewith given, there is no plunger compartment. The space ordinarily used as a plunger compartment is available for jig work. Pulsion and suction in both compartments are obtained by the swing of a paddle in the hutch below the screens. This paddle does not touch either the bottom of the compartment or either side.

The cut is made from a double-exposed photograph (of a sectional model of the jig) made for the purpose of showing the extent of the swing of the paddle. The volume that is displaced by the swing of the paddle is equivalent to about a 1½-in. stroke of a plunger the same size as one screen, and as the entire paddle is submerged at all times, it is evident that the suction must be equal to the pulsion. The weight of the paddle blade below the point of its suspension, on the outside of the jig, is balanced by the two arms and a cross piece by which it is connected to the eccentric, and there is, therefore, only so much power consumed as is required by the actual raising of the water plus sand upon the screen. These jigs have been manufactured in sizes up to 18 sq.ft. of screen area, and operated with 3 to 3½ hp.

The following figures were obtained in a testing plant using these jigs wherein cassiterite mixed with river gravel, the latter screened through ¾-in. openings, was fed to two jigs set in series. The cassiterite all passed 20 mesh. Thirty per cent passed 60 mesh. Its specific gravity was 5.56. The jigs were bedded with one inch of cast iron shot. The mixture of gravel and tin-stone was fed to the jigs at a rate of 4, 6, and 8 cu.yd. per hour, an average of 5.82 cu.yd. per hour. The jigs each had 9 sq.ft. of screen area.

The concentration was at an average rate of 9½ into 1, but varied from 17.3 to 1 down to 6 to 1. The material fed to the jigs carried from 0.27 up to 0.53 per cent of tin oxide. The concentrate produced carried from 4.27 up to 6.38 per cent. The average recovery of all the tests showed 85.49 per cent saving in the first jig, and 2.25 per cent saving in the second jig, a total of 87.74 per cent for the whole plant.

The conditions prevailing in these tests were similar to those usually obtaining upon gold dredges, where these jigs have been widely used for the removal of the "black sand" and the gold or other precious metals. These conditions are, of course, different from those prevailing in concentrating mills, owing to the fact that in dredge operations the minerals are free from the gangue and no middlings are made. It was, therefore, simply a question of supplying sufficient jig area to



remove all the mineral particles through the screen into the hutch. The concentrate produced is always, and purposely, of low grade, and is always subjected to further treatment, either by concentration, regrinding, amalgamation, tabling, or other suitable metallurgical method.

Using an 8-mesh screen, these jigs deliver a practically perfect 20-mesh product.

It has been suggested that this jig might profitably be placed in the crushing circuit ahead of the ball mills, with the object of removing from the circuit at this point all mineral particles of sufficient fineness to pass through the bed and screen, and handling this concentrate directly in the finishing plant, thus giving to the smelter the much-desired coarser material. Whether it would be advisable also to attempt to make a clean tailing in this same operation would depend entirely upon the character of the ore, but I believe that in many cases a tailing could be discarded and a further saving in crushing costs thereby attained.

San Francisco, Cal.

JAS. W. NEILL.

### Fundamentals of Exploration

The dictionary says "explore" means "to search or examine thoroughly." That being the correct definition of the term, present-day exploration companies are properly named and are logically doing their duty; but are they finding anything? It has been a long time since any new mineral discoveries of importance have been made in North America. It would be hard to name any notable strike in recent years, excepting the Premier mine, in British Columbia.

This condition, in view of the great sums that have been and are being spent by the exploration departments of many of our larger mining concerns, is becoming a matter of frequent comment, especially among Western mining engineers. These same Westerners are the witnesses of great *duplication of effort*, in that they are the nearest observers of the successive examinations of the same property, of the same district, by a dozen or more different engineers, representing as many different exploration companies, presumably in search of new mines, and profitable ones.

An engineer's diagnosis of a newly discovered mineral outcrop, or of an abandoned mine, or of a partially developed "prospect," is influenced by three fundamental factors:

First, the extent and *variety* of his mining, metallurgical, and geological experience.

Second, the requirements of his clients or backers.

Third, his courage.

In considering the first factor, we submit that many of the field engineers of these large exploration companies are able men who have made a notable success in the exploration and management of some particular mine, and have been closely associated therewith over a considerable period of years without the valuable background of variety and diversity of employment in many fields at many mines.

A successful finder of mines must have in the back of his head the record of multitudinous past experiences (both successes and failures) to draw upon and bring into play as soon as he comes on to a new piece of ground.

If he has been merely a successful operator of one or two mines he has not the requisite background to make him a *safe* diagnostician of all prospects and

rebellious mines. By *safe* I do not mean conservatism alone, but also I refer to an elimination of the danger of condemning something because it is unfamiliar.

In a consideration of the second factor, i.e. the requirements of an engineer's clients and backers, it would seem to me that in three-fourths of the cases under my observation these requirements were impossible because they either called for an elimination of chance altogether by demanding an assemblage of all essentials before spending a dollar in actual digging, or else their desire for something fashionably big in the way of tonnage obscured the real issue of finding something profitable. Although the element of *chance* is omnipresent and is what makes metals of commercial value in ordinary times, it can be reduced to a rational minimum in the hands of a field engineer possessed of a background of diversified successes and failures.

The third element—courage—has to do entirely with the ability of the field engineer to recommend to his employers something he absolutely believes in, the possible subsequent failure of which might endanger the tenure of his job. *Conservatism* in this field of endeavor means to decide for or against any enterprise accordingly as the preponderating evidence, comprising statistics and data and judgment (based on background of past experiences), is favorable or unfavorable. Any other form of conservatism is simply cowardice—a fear of risking one's personal future by indorsing something that "might not pan out all right."

If my analysis of these fundamentals is as sound as I believe it to be, would a little retrospection upon the part of our great exploration companies do any harm? For instance, how would it do to send an engineer (equipped with the requisite background) into the field, and instead of telling him we want this or that kind of an orebody in this or that stage of development, tell him: "John, we want to make some money in mining. Now go out and dig up something."

At the same time make sure that "John" heretofore has been something more than the successful superintendent or manager of some particular mine.

I venture the prediction that the successful field man and ore finder of the near future will be possessed of a long record of divers successes and failures in many fields and will have authority to spend ten or twenty thousand dollars in demonstrative preliminary digging at any place his judgment dictates. In the long run such a policy would result in finding more mines, and its cost would be no greater than the ultra-meticulous circumscribed procedure that is now usually followed without finding new mines or rejuvenating old ones.

The North American mining districts *have been* liberally scratched and the more self-evident mines have been discovered. New discoveries will be made at more obscure horizons by widely experienced field engineers with a digging account to draw upon when necessary to penetrate the veil of obscurity that has caused other engineers to become conservative.

Silverbell, Ariz.

PERCY WILLIAMS.

### Transportation of Diamonds by Aircraft

To establish a quick way of transportation for the diamonds mined in the Province of Kasai, in the Congo State, the company owning and operating these fields has acquired a number of airplanes, by means of which the stones are now being sent to their nearest destination, the town of Kinshassa.

## Drilling Results and Dredging Returns—I

Accuracy of Churn Drilling of Placer Deposits Limited by the Irregular Distribution of the Gold, the Relatively Small Samples Taken, the Skill Of the Operator, and Many Other Factors—Work Difficult To Check

BY CHARLES W. GARDNER

Published exclusively in *Engineering and Mining Journal*\*

IT IS ASSUMED by many that prospecting with a churn drill has become an exact procedure, and that from the results obtained the gold content in the tract of ground drilled can be determined accurately. An exact comparison between drilling results and dredge returns cannot be made until the area originally drilled and estimated has been completely mined, and it is the purpose of this article to show comparative results obtained from different fields and to demonstrate that drilling is not an exact procedure and that the results obtained cannot by any mathematical process be used to estimate absolutely the gold content in the prospected area. The churn drill is, however, the best device known for prospecting ground having the necessary qualifications for gold dredging, and the facts concerning its first use for that purpose may be of interest.

### CHURN DRILL USED IN PLACER WORK ABOUT TWENTY-THREE YEARS

In 1897, C. H. Souther, of Boston, then president of the New England Dredging Co., became interested in the future possibilities of gold dredging and obtained an option on a tract of ground in Boise Basin, adjacent to Idaho City, Idaho. This property was later transferred to the Boston & Idaho Gold Dredging Co. and profitably mined. I went to Idaho in November, 1897, to take charge of prospecting this ground. After successfully sinking one shaft to bedrock, a second shaft was started, but owing to the equipment being inadequate to handle the large volume of water encountered, the shaft was abandoned and the difficulties and conditions were described to Mr. Souther. He had just seen a Keystone drill at work on a site for a proposed dam in Massachusetts, and he conceived the idea that it might perhaps be successfully used in prospecting for gold.

Mr. Souther at once communicated with the Keystone Drill Co., and Mr. Downie, its general manager, went to Boston and obtained an order from Mr. Souther for a No. 2 traction drill and guaranteed that it would do the required work, and as necessary to this accomplishment designed the vacuum sand pump now in common use. This drill was shipped on Jan. 1, 1898, and placed in use near Idaho City the first of February of that year. In March Mr. Souther ordered a second drill for shipment to Yreka, Cal. About a month later Messrs. R. G. Hanford and R. H. Postelwaite visited Beaver Falls, Pa., and, after seeing a demonstration of the drill, ordered one. A little later W. P. Hammon used the same type of drills in his extensive operations, and now they are in use all over the world.

Later, the Empire hand drill was placed on the market, and it has met a satisfactory acceptance and application, principally in places where the conditions and its light weight make it adaptable. Still later, the

Union Construction Co., of San Francisco, designed a light, portable power drill which has been extensively adopted.

### IRREGULAR DISTRIBUTION OF GOLD INFLUENCES DRILLING RESULTS

As these various types of churn drills are now in common use for prospecting, I shall consider the various conditions and causes affecting the accuracy of the results obtained. The first and most important of these is the uneven distribution of gold and the smallness of the sample taken. If the gold content in placer ground existed in the form of a sheet of uniform thickness covering a certain defined area, a sample from this sheet at one point would enable one to determine accurately its value as a whole. The distribution of gold, however, in the larger dredging fields of California, such as those on the Feather, Yuba, and American rivers, is very uneven, owing to its deposition and distribution by devious and changing currents of water and to its being changed and shifted by the action of later currents before finding its final resting place.

In smaller streams, narrowly confined between elevated boundaries, the gold is often deposited in a well-defined channel, and such conditions are frequent in Alaska and sometimes in the small deposits of the Pacific slope. It is the common experience of dredge operators that the amount of gold recovered by any one dredge varies noticeably from day to day and from week to week. Gold recovered from one cut will often vary by a large amount from that taken from an adjoining cut, and well-defined pay channels are comparatively limited in area.

Some interesting tests were made by J. J. Martin, while superintendent of the Chicksan Mines, in Korea, to determine the gold content in a tract of dredging ground, and these tests show both the uneven distribution of gold within limited areas and also the misleading deductions which may be made from the results obtained from any one drill hole.

### MARTIN'S TEST SHOWED WIDELY VARYING RESULTS

An Empire drill with a 4-in. casing was used to drill a hole to bedrock, and results obtained indicated ground having an average value per cubic yard of 17.59c. Around this hole was then sunk a steel casing having a diameter of 3 ft. 3 in. The gravel content was taken out and washed, and the returns indicated a value per cubic yard of 37.33c. Around this casing the ground was laid off in a square 30 x 30 ft. This area was then subdivided into sections 10 x 10 ft., and at a corner of each section a drill hole was put down, making sixteen holes in all, which is proportionate to a little over twenty-seven holes per acre. The average of the assay results obtained from these holes was 15.22c. per cubic yard. The whole area was then excavated by hand to bedrock, the gravel was

\*Read at the Meeting of California Dredge Operators, Natoma, Sept. 27, 1921.



washed in a sluice box, and the content of the whole pit found to average 29c. per cubic yard.

The value per cubic yard as indicated by the first drill hole was 47.2 per cent of the casing value, 60.6 per cent of the pit value and 115.6 per cent of the average value indicated by the sixteen holes. The average from all of the holes was 52.5 per cent of the pit value. This disparity was due in some measure to the existence of small nuggets, because the gold was not uniform in size.

Five other 30-ft. squares were laid out in other places on the property, and in each sixteen holes were drilled at the same relative points as in the first square. The difference in results obtained from separate holes in each of the squares is startling. The range obtained was as follows:

DRILL RESULTS FROM SIXTEEN DRILL HOLES IN EACH PIT  
Range in Values Indicated in Separate Holes

Pit No.	Highest Value, Cents	Lowest Value, Cents	Average Value, Cents	Depth, Feet
1	76.14	0.19	15.22	19.8
2	41.03	0.45	8.51	13.8
3	44.36	1.11	10.28	19.6
4	30.72	0.93	6.33	18.0
5	30.13	2.20	7.31	19.3
6	51.51	0.72	6.85	20.0

In common practice any of these drill holes in any one of the squares would, with the possible exception of some of those highest in value, have been accepted as fairly representing not only the square in which it was placed but also an additional area of from one to three acres. Further tests were made by Mr. Martin in an endeavor to test the values obtained from certain drill holes by sinking casings 3 ft. 3 in. in diameter around them, and the comparative results obtained were as follows:

Test No.	Value from Drill, Cents per Cu.Yd.	Value from Casing, Cents per Cu.Yd.	Per Cent of Casing Recovery Obtained by Drill	Depth, Feet
A	4.69	9.42	49.8	19
B	36.87	97.83	37.6	18
C	4.86	15.12	32.1	14
D	25.42	112.00	22.7	19
E	17.59	37.33	47.1	19

All of the drill holes were put down with an Empire drill, using 4-in. pipe, and the calculations were based on 239 ft. in depth as representing one cubic yard of material.

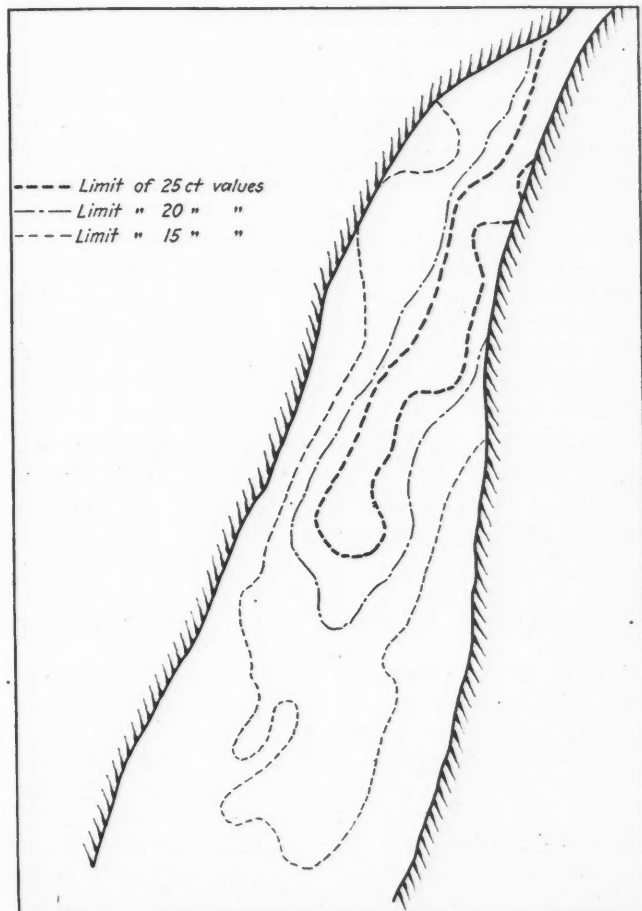
About a year ago a test was made on another placer property in Korea by dividing an area 20 ft. square into four 10-ft. square sections and drilling a hole at the corner of each, making nine drill holes in all. The range indicated by the separate holes was from 0.2c. to 34.1c. per cubic yard, and the average indicated by the nine holes was 11.33c. The whole square was then excavated to bedrock (about 23 ft.), the contents were washed, and the recovery was 12.9c. per cubic yard, the drill returns indicating 87.8 per cent of those actually obtained from the pit. The grains of gold in this ground were fine, without nuggets.

OTHER EXAMPLES ILLUSTRATE INACCURACY OF RETURNS

On a property in Colombia, tests were made at several places to determine the results indicated by single drill holes, and this was done, first, by drilling check holes, and then by sinking a shaft around them. The values found in cents per cubic yard were as follows: At the first point two drill holes gave 17.7c. and 22.6c.;

shaft, 25.0c. Second point, one drill hole, 12.2c.; shaft, 20.0c. Third point, two drill holes, 17.0c. and 68.2c.; shaft, 151.5c. Fourth point, three drill holes, 25.7c., 30.6c., and 34.4c.; shaft, 56.7c.

On a California property a drill hole was put down which gave a return per cubic yard of \$1.56. To check this a hole was put down on each side of it and 15 ft. distant. These holes showed 46c. and 25c. respectively. In the same line two more holes were put down, each being 50 ft. from the center hole. These holes returned 30c. and 14c. respectively. When the ground was mined, the dredge cut across this line of holes and included them all. The dredge return for two weeks' operation in an area having these drill holes about in its center was 5c. per cubic yard. There was a great deal of clay,



SKETCH SHOWING DISTRIBUTION OF GOLD CONTENTS OF A PLACER DEPOSIT

and the washing devices on the dredge were very inefficient, which accounts for some of the discrepancies.

On the same property, a drill hole, which indicated a value of 2.7c. per yard., was checked by means of a shaft sunk around it, which gave 3.93c. per yard. At another point a similar test was made, and the results indicated were 1.9c. per cubic yard from the drill and 5.8c. from the shaft.

One dredging company operating in California checked the results obtained from a number of drill holes by sinking shafts around them. The ground contained no water and was so firm that the shafts required no timbering. The comparative results obtained in cents per cubic yard are as follows, in which A shows the value per cubic yard indicated by drill, B

shows the value per cubic yard obtained from shaft, and C shows the percentage of drill values obtained from shaft:

Test No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	4.8	3.6	4.7	5.4	5.2	12.3	14.6	11.6	6.8	5.7	6.1	7.4	10.3	20.5	20.6
B	4.6	4.0	7.5	10.3	7.4	16.6	16.6	21.2	8.0	6.7	8.0	10.5	15.7	27.8	25.0
C	96	111	160	191	142	135	114	182	118	118	131	142	152	136	121

The average of all the drill values is 8.63c., of all the the shaft values 12.03c., the drill values being 71.7 per cent of those obtained from the shafts. The constant used in the drill calculations was 0.30.

An Alaska property was prospected by means of a hand drill using 6-in. casing. Holes were put down in pairs one and one-half to two feet apart. As the gold was deposited on or near bedrock, returns were figured on the square-foot basis. The results follow:

TESTS OF BEDROCK DEPOSITS

Holes	1-2	3-4	5-6	7-8	9-10	11-12
Depth in feet.....	6.0	5.00	8.0	8.0	4.0	5.00
Value per square foot, cents..	2.5	2.9	Tr.	5.5	18.2	5.5
Average value per square foot, cents.....	1.3	1.5	24.7	3.7	10.5	3.0

Holes assaying highest of each pair averaged 14.0c. or 187 per cent of the average value. Holes assaying lowest of each pair averaged 1.1c. or 15 per cent of the average value.

LINE 300 FEET ABOVE THE FIRST LINE

Holes	1-2	3-4	5-6	7-8	9-10
Depth in feet.....	6.3	7.5	9.8	8.0	9.5
Value per square foot, cents.....	7.5	9.0	9.5	8.0	9.0
Average value per square foot, cents.....	15.6	2.3	74.7	3.5	7.5

Holes assaying highest in each pair averaged 28.1c. or 136 per cent of average value. Holes assaying lowest in each pair averaged 13.7c., or 66 per cent of average value.

It is the common belief that in a gravel deposit the gold found in a small section of any one distinct horizontal stratum is fairly representative of that stratum for some distance from the point where the sample was taken. To disprove this I am further indebted to Mr. Martin for information concerning the results which he obtained in a recent examination of a placer property in Oregon.

A part of the property had been mined, leaving a bank, with an exposed and almost perpendicular face, having a height from bedrock to surface of 123 ft. The overburden had a depth of 54 ft. and the gravel a depth of 69 ft. This face was prospected by first removing all loose and weathered material, and a channel, 2 ft. wide and 6 in. deep, was then cut down the face of the solid and undisturbed gravel. Cutting was made from stratum to stratum and the gravel from each separately washed. To test the evenness of the values in each stratum, check samples were taken by cutting the channel 6 in. deeper, and the comparative results obtained are as follows:

VALUES IN CENTS PER CUBIC YARD AS INDICATED BY SAMPLES FROM DIFFERENT STRATA

Test No.	A	B	C	D	E	F	G	H
First cut.....	0.94	5.5	13.8	5.4	16.6	10.2	75.3	74.2
Check cut.....	0.31	10.9	48.0	151.3	158.5	18.3	77.0	82.1

This indicates that it would have been necessary to have sampled a much larger area to obtain an average value and also indicates why two drill holes, if put down only a foot apart, would give entirely different results. Under some conditions placer gravels may be laid down so as to give a fairly uniform distribution of the gold when the deposit is considered as a whole, but with gold content so varying within short distances that it is impossible to outline areas carrying definite average values by the use of a drill.

A good illustration of this is found in a property which has now been dredged. The deposit is the result of stream action having a direct flow. The portion of it under consideration was originally crosscut with six lines of drill holes, some holes being spaced 100 ft. and others 200 ft. apart. The natural conditions indicated the existence of a well-defined pay channel, but the results obtained from adjacent drill holes on the same line were so variable and had such a wide divergence that it was impossible to define an area carrying any specific average value. After the property was dredged it was easy to outline the deposition of the gold and to define the limit of any certain average value, and this is illustrated in the accompanying sketch.

RELATIVELY SMALL AMOUNTS OF PLACER GROUND ACTUALLY TESTED

The above examples are sufficient to prove the uneven distribution of gold in placer fields having average conditions, and when it is considered that some dredging properties have been prospected with one drill hole to every ten acres, and that it is common to assume one drill hole to every one to four acres sufficient to enable close estimates to be made of the gold content, it is remarkable that drill results can so often be interpreted as closely approximating the dredging returns. A few properties have been prospected with an average of one hole to an acre, but this is unusual, and even on such a basis the proportion of the sample taken to the area represented is extremely small.

The external diameter of the cutting shoe used on the end of a 6-in. Keystone drill pipe is 7½ in., and its area 0.3068 sq.ft., which is  $\frac{1}{141,982}$  of an acre.

In a quartz mine where the vein has been exposed by a drift, it is common practice to cut a sample at right angles to the strike of the vein the width of the ore exposed, and to repeat this at frequent intervals. If one imagines an orebody having an exposed width of 9.86 ft. and a length of 100 ft., as developed by a drift, and an attempt made to sample the whole by taking from some random place on the exposed back a piece of ore one inch square, it would be considered the extreme of absurdity, but such a sample would be in exact proportion in area, but not in volume, to that taken from one drill hole in an acre of ground.

If an Empire drill is used with a cutting shoe having an area of 0.1134 sq.ft., the portion of an acre sampled is  $\frac{1}{384,093}$ .

The second cause, which may be considered as having an important bearing on the accuracy of the results obtained by the use of a drill, is that of the personal equation. The average operator of a drill used in prospecting is a man of some experience in that line of work, one who can keep his machine in repair, successfully cope with such mishaps and accidents as frequently occur, and who is familiar with the common method of procedure. It is essential that he make such measurements as will enable him to know at all times the length of the pipe driven, the distance drilled below the cutting shoe, and the amount of core left in the pipe after pumping. Laxity on his part concerning any of these details will produce serious errors.

The panner must be skillful in the use of a pan and a rocker. It devolves upon him to keep a record of the details of the work as it progresses, to count the colors



found in each pumping, measure the volume of tailing pumped, and collect by amalgamation all of the gold coming from the hole. Lack of skill, inattention or inefficiency on his part will be fatal to accuracy.

On some properties where dredging operations are being conducted, and where further prospecting by a drill is a necessity, the drill operations are frequently left entirely to a crew of inexperienced men, as the general conditions are well known and no close supervision is given to the work. The record of each hole, together with the gold recovered, is turned in by the panner to the office of the company. The amalgam is then cut by acid and weighed, and the value per cubic yard of the ground drilled is figured by the use of a standard formula. I question if the results thus obtained are not as fairly representative of the gold content of the ground as if an engineer were employed to give to the work his entire attention and to estimate results by more elaborate and theoretical methods.

In the examination and prospecting of new fields it is customary to employ an engineer to take full charge, and it is usual for him to find conditions different from those he has encountered in any previous examinations. He relies on the services of an experienced drill crew, and, if all of the mechanical operations are performed by the most approved method, the responsibility then devolves upon him intelligently to interpret the results obtained. In doing this he has to rely upon preconceived and imaginative ideas as to the effects produced by certain causes. He must consider the nature of the material, the amount of water found, the effect upon the result if boulders are encountered, make due allowance for any excessive flow of material into the pipe at any depth, and take into consideration the measured tailing when it is in excess or materially less than the theoretical volume displaced by the cutting shoe. In solving his problems he has no recourse to printed formulas and no established precedents. He may have made deductions from similar conditions in other fields without knowing to what extent they were verified by subsequent dredging returns.

Even if possessed of such information he realizes that conditions in the present field vary materially from those in the others, and that he has new problems. His position is like that of one called upon to estimate the distance between two points. His estimate is placed on record, but if he is not informed as to the actual distance, his first guess is no guide or help to him when called upon to estimate the distance between two other points. It is unfortunate that so few engineers are conversant with the dredging returns from ground which they have previously prospected, and in the absence of such information they adhere to their theoretical conceptions and ideas, with no concrete facts to either prove or disprove them. The uncertainty as to the results obtained is fully recognized by Mr. Prichard in his report to the Oroville Dredging Co. and published in *Engineering and Mining Journal* of Jan. 30, 1915, and expressed by him as follows:

"Where gravel deposits extend several feet below the permanent water level, as those of the dredging areas of Pato, there is no method commercially available for accurately determining their gold content. Drilling, which under these circumstances is the most accurate, gives only approximate results that are subject to wide variations owing to the personal variation of method, carelessness in drilling and panning, varying physical properties of the deposit, and to the economic impracticability of drilling holes sufficiently close together.

"Having driven a tube and pumped the gravel out of it foot by foot to bedrock and panned the gravel so extracted, and weighed its gold contents, we desire to know just what proportion of the displaced gravel and gold entered the tube and subsequently the pump, and what proportion was pushed aside by the tube in entering the ground and how much was pushed out of the tube in pumping. This proportion varies in different sections of the hole and also in the different holes, more especially where the physical character of the deposit is different. Many other variable quantities common to all types of drills enter into the process, but suffice it to say that we can only assume an average factor or proportion which is reliable to within perhaps 50 per cent of the true average figure on any individual drill hole."

It is with these facts in mind that I state that estimates of the gold content in placer ground are dependent to a great extent upon the personal factor, both as applying to the care and skill employed in the actual drilling operations as well as to the interpretation of the results on which the final estimate is based.

As indicating the difference in results which may be obtained, I may cite as an example work done on a certain property where an engineer crossed the gravel deposit with five drill holes spaced 200 ft. apart. The average value per cubic yard of the section between the end drill holes was estimated to be 10.29c. Another engineer, working independently of the first, at a different time, drilled four holes midway between those originally put down, and the results from these holes applied to the whole section, as first estimated, gave a value of 18.20c. per yard, or an increase of 71 per cent.

It is an established fact that the same engineer with the same drill crew cannot redrill a piece of ground, even with holes placed a few feet from the original ones, and get the same results, and there will be a material difference should the holes in redrilling be laid out on different lines. The best illustration which we have of this is that given by James W. Neill and published in *Mining & Scientific Press* of Aug. 8, 1914.

In the property of the Yosemite Dredging & Mining Co. there was a tract thirty acres in area which was drilled with holes 400 ft. apart up and down stream, by 200 ft. across the flow, making twenty holes in all. The average value of all of these holes figured with a constant of 0.27 was 5.29c. per cubic yard. Three of the drill holes were high in value—25c., 14c., and 20c. If the value of these was cut in half, the average value of all the holes would then be 3.63c.

This tract was then redrilled by lines of holes across the flow and between the lines as first drilled. Twenty-five holes were put down, which gave an average value of 4c. per cubic yard. Two of these holes, having a value of 33c. and 13c. respectively, were considered high and were cut in two, giving an average value for all the holes of 3.27c.

Comparing the results of the two operations it appears that, if the full value of the holes be taken, the second drilling shows an average value per cubic yard of 75.6 per cent of the first. If the revised values, obtained by an allowance for the high holes, are used, the results from the second drilling are 90.1 per cent of the first.

This example also brings up the interesting question as to how other engineers would have considered the high holes and what allowance they would have made for them, as such a decision has a material effect upon the average result.

*To be concluded.*

## Cobalt in Jackson County, Ore.

Found Associated With Gold-Copper Ore in Gold Hill District—30,000 Tons of Ore Blocked Out In Chisholm Property Estimated to Run 4 1-2 Per Cent

By A. E. KELLOGG

Written for *Engineering and Mining Journal*

ABOUT twenty years ago cobalt was discovered in Jackson County, Ore., by Dr. W. P. Chisholm, of Gold Hill, Ore., the pioneer of the quicksilver industry in that district, while he was developing his gold-copper mine in the "Meadows," twelve miles north of Gold Hill. This property, known as the Chisholm group, is still owned and under development by the doctor. It is situated not far from Chisholm's quicksilver properties, also in the "Meadows." Early in the development of the gold-copper property, large ore-bodies were opened up, which, besides producing gold and copper, also carried from 4 to 4½ per cent of cobalt. This work extended over a period of several years and it is estimated that at least 30,000 tons of this ore will produce not less than 4½ per cent cobalt.

The discovery attracted considerable attention at the time among those seeking new deposits of cobalt. But owing to the low price and less extensive use of the metal at that time, investors were seeking deposits that would produce at least 6 per cent cobalt. Recently, however, operators have been urged to search for new deposits of cobalt, and the deposits of this region have been investigated. Development of the quicksilver properties shows that the cinnabar ore, besides producing gold, silver, nickel, zinc, and arsenic as by-products, also gives evidence of cobalt values. Other localities in this region are believed to contain cobalt in commercial quantities, but the Chisholm mine is the only property in the district which has been reliably and systematically tested for cobalt.

The Chisholm mine is in a heavily timbered district, at an elevation of 1,760 ft. About \$45,000 has been spent in its development. In part, the ore is a primary constituent of the norite country rock, and the vein deposits were probably derived from the same source. That is, magmatic waters, after concentration through crystallization of the main magma, probably carried the ores, simultaneously concentrated, into fissures and there deposited them with other vein-forming matter. At this mine there is no evidence that surface waters have produced any important effects; the veins are not leached nor oxidized, and there is no indication of secondary enrichment by meteoric waters.

A crosscut entry extends S 45 deg E about 30 ft. and is being driven thence S 63 deg. E about 300 ft. through quartzitic rock, but has not yet struck the main body of ore at the fault. About 150 ft. from the portal a fault strikes N 31 deg. W and dips 55 deg. northeast. It has a maximum thickness of 18 in. and contains fragments of quartzite. Near the fault the country rock changes from a micaceous to an ordinary quartzite. There are two other older adits which show large bodies of ore. The lower and southern entry is in micaceous quartzite banded and locally contorted. The upper adit is about 100 ft. higher. It disclosed ore which consists of chalcopyrite and arsenopyrite. Surface waters have formed some gypsum and melanterite by oxidation of the sulphides.

The ore at this mine is very interesting, as it occurs

in part as a primary constituent of a basic igneous rock, and in part as a vein filling. The rock is a norite containing abundant hypersthene partly poikilitically inclosed by plagioclase, both minerals intergrown with pyrrhotite and chalcopyrite as well as a little brown biotite, hornblende, and magnetite. Some secondary chlorite and calcite are also present. As a vein filling the sulphides occur intergrown with quartz, which may fill fissures or serve as a cement of broken material consisting of pegmatitic andesite with some quartz. The vein filling has been sheared since formation. It seems clear that the ore was derived from the norite magma.

The Gold Hill district is a mountainous region cut by one narrow east-west valley and its tributaries from the north and south. The elevation varies from less than 1,000 to 4,000 ft. The district is occupied chiefly by old Paleozoic sediments interbedded with stills or flows of andesite and greenstone. Everywhere the sedimentary rocks strike northerly, usually about N 15 deg. E and dip eastward at angles ranging from 65 deg. to nearly 90 deg. Diller has shown that Jurassic beds west of the district have been overturned so that the oldest strata now overlie the younger formations. It is probable that the Paleozoic sediments are also overturned, and that limestone found in the district is probably of early Paleozoic age, and fossils found in limestone lenses indicate that they are not Devonian; Diller would suggest that they are Silurian rather than Carboniferous in age.

Long after the formation of these Paleozoic sedimentary rocks, the region was intruded from below by a mass of molten igneous rock; at about the time and perhaps by the same agency the bedded rocks were closely folded and overthrust to the westward. The intrusive rock solidified beneath a considerable thickness of sediments or other rocks, which has since been removed in some places. Thus the igneous mass is now exposed to view in the south part of the district, and extends thence northeastward past the Chisholm mine, and it seems probable to Diller that it underlies at considerable depth a large part of the Gold Hill district.

This igneous intrusion and intense folding seem to have elevated the region enough to cause a new erosion and the formation of coarse sediments which could not be transported far by ordinary agencies. Therefore conglomerates were produced, and these were succeeded by feldspathic sandstones during part of Cretaceous times. Rocks produced in this way are now found in the south part of the "Meadows." Along Evans Creek from the "Meadows" northward these Cretaceous sandstones are overlain by a considerable thickness of Tertiary sandstones which contain some thin beds of coal.

The latest rock formation in the district consists of stream deposits, some of which are valuable on account of the gold and platinum they contain. They are formed along all the streams of the district, but are not abundant along Rogue River in this region because the latter is here in a narrow rock-cut portion of its course to the sea.



## War Minerals Problems

### III—The War Minerals Investigations of the Bureau of Mines

By J. E. SPURR

IT IS NOT GENERALLY KNOWN, but it deserves to be known, that the program of restriction of mineral importation which was worked out by the Committee on Mineral Imports in collaboration with other branches of the Government and through conference with the industries involved would have turned out to be unusually close had it not been interfered with. The one way to reduce shipping use in transoceanic ore-haulage was to reduce the maximum tonnage allowed to be imported; and at once it became necessary to provide for a program for increasing the domestic supply sufficiently to make up the tonnage barred. The advice and support of domestic producers was asked in carrying out this program. I refer, of course, to high-grade manganese ore, chrome, and pyrites; and it was pointed out to them that, with the restricted imports and surely far larger consumption, a certain large tonnage of domestic ore could be marketed promptly if produced.

The committee was justified in making these statements and in assuming its ability to carry its program through. It was so organized that it had behind it the administrative powers of the Shipping Board, the War Trade Board, and the War Industries Board; and its program had been accepted by all the boards. But it realized from the first that any laxity in restricting importations to the agreed figure would tend to overstock the market, and thereby leave the domestic producer of what was on the whole less desirable ore with some of his stock hanging on his hands. It, therefore, pointed out at the start that no infringement of the program restriction should be allowed on any excuse, especially on the specious "ballast and back haul" basis. This was a form of exception which always looked good to the shipping men, who, indeed, always fought for it. Some ship turned up with the plea that she had taken a cargo from the United States to New Caledonia, and unless she were allowed chrome ore as a back haul, or ballast, she would not be fit to put to sea.

There were a number of reasons, which the committee had fully investigated, which made it deaf to these emergency pleas. They were without exception the pressing devices of importers, and were promptly refused as fast as they came up. But our citizens have found that there are many departments to our Government; and their excellent story found sympathetic hearers elsewhere. One of these was in the office of the branch of the Shipping Board in New York, which controlled actual sailings and cargoes of ships—subject, of course, to the importation restriction schedules such as those which we had drawn up. This department assumed that "ballast and back haul" exceptions were not infringements of the restrictions; in fact, that the shipping efficiency would be thereby increased. A real conflict of authority grew up between the two departments of the Shipping Board, our committee (through Mr. E. F. Gay, member of the War Trade and Shipping Boards, our immediate chief,) insisting on a literal interpretation of the restrictions, and the New York department insisting on its interpretation of shipping

efficiency. For a ship to clear, however, the approval of both branches of the Shipping Board was necessary. Therefore, it happened at that time that a ship might be released and stopped again by the same board; and in one pivotal case, that of the "Betsy Ross," her clearance orders were granted and countermanded many times over a period of several weeks.

Of course, this situation could not last indefinitely. The importers found an additional backer in the powerful person of B. M. Baruch, chairman of the War Industries Board. It was Mr. Baruch's job to see that the war industries got all the raw materials they needed. He felt that these restrictions on the ore importations threatened the abundance of these supplies, and believed that the whole matter should have been and should be under his own control. He undertook promptly to aid those importers who were trying to import chrome ore as "ballast and back haul." He took part in the "Betsy Ross" controversy, which precipitated the show-down, in which he finally carried his point.

Mr. Baruch's sources of advice were opportunistic rather than scientific. At any rate, the hotly fought-over chrome-laden ships sailed for the United States; and the Committee on Mineral Imports, consisting of Messrs. Leith and Spurr, promptly resigned, for it was at once evident to them that the importations plus the domestic production would mean a congestion of the market which would be bitterly resented by the American producer, who had been told the settled program would be adhered to. The War Industries Board member of the committee, Mr. Pope Yeatman, had already withdrawn from it on Mr. Baruch's request. The organization of the committee continued to function as before, as a part of Mr. Gay's organization, and under the efficient direction of Mr. F. W. Paine, who had been active in its work nearly from the first.

In making war it is better to have too much in the way of supplies than too little; far better than either is it to have the right amount. In this war, we had too much of many things; almost nothing of many essentials; often, apparently, no calculations were made in giving orders for material. A certain ornamental button was used on a part of the regular army overcoat. Enough orders were placed so that there were several dozen extras on hand for every overcoat in existence. Saddles were ordered out of all proportion to the horses in the army. It was not scientific or economical: and, therefore, it was fortunate for us that our participation in the war was not long. In the case of the necessary war minerals, however, a careful program had been worked out; and when it was in full operation, it was scrapped in favor of opportunism.

Mr. Baruch was a good provider. What he provided for in the way of copper still hangs over the world's copper markets as the surplus stocks. From the time he broke the Mineral Importation Committee's stand as to chrome importations he had plenty of chrome also, for importers crowded the ore in, and domestic producers on either side were already accomplishing wonders even before the barriers were let down. It was

this breach of the stated program that caused the domestic producers to believe (properly) that they had been misled, and was the basis of reasons for the passage of the War Minerals Relief Act later. Except in the case of chromite, however, there was no very serious breach in the enforcement of the importation and production programs covering the numerous war minerals.

We must remember, as an excuse for all errors of judgment in the war—none were of the heart—the vast confusion of feverish action into which we were hurled through President Wilson's refusal to prepare before the war. When the War Minerals problem was presented as a serious one by the War Minerals Committee, headed by Mr. Westervelt, the Director of the Bureau of Mines saw his opportunity to assist in the regulation of the domestic supply, and was granted by Congress a special appropriation of \$150,000 for the purpose. This became available just before the time of the sudden resignation of Dr. Leith and myself as members of the Committee on Mineral Importation, and I accepted the invitation of Director Manning and Assistant Director Bain, and took charge of this work on June 6. Dr. Leith believed he could be most useful in representing the Shipping Board restrictions in the War Industries Board.

The War Minerals Investigation of the Bureau of Mines covered war minerals, their production and utilization. Its field touched that of the Geological Survey on the one hand and that of the War Industries Board on the other; the Geological Survey covering the field of the geologist, the War Minerals Investigation that of the mining and metallurgical engineer, the War Industries Board that of the manufacturer and merchant. The program covered all the "war minerals."

To handle each of the war minerals adequately, an organization of specialists was developed in Washington, and each mineral or metal was placed in special hands. The patriotism of the period had made available in some cases at little or no cost some of the best mining engineering talent of the country. The first draft of organization showed on the section of the staff covering mineral groups in Washington F. W. Paine, J. H. Mackenzie, D. A. Lyon, H. Foster Bain, Harvey S. Mudd, A. G. White, Hennen Jennings, Henry C. Morris, A. W. Stockett, Oliver Bowles, R. W. Gannett, and D. A. Hall. Another group handled general mining, transportation, and marketing problems: H. H. Porter, a volunteer, serving as railway transportation expert for both the Shipping Board group and the Bureau of Mines; and Mr. Paine handling the shipping problems when they became a factor of the mining problems, and so on.

A number of mining engineers were in the field, studying the mineral production. For manganese, these included Messrs. Newton, Van Barneveld, Eaton, Crane, Louderback, and Jones, and also, as volunteer experts, E. G. Spillsbury, H. W. Hardinge, and C. W. Van Law; for chrome, Albert Burch, J. E. McGuire, Frank C. Probert, and others; for tungsten, J. H. Mackenzie and J. H. Means; for pyrite, H. A. Buehler and C. E. Julihn; for sulphur, Otto Lindberg; for sulphuric acid, A. E. Wells; for mercury, L. H. Duschak; for graphite, George D. Dub and others. Some of these were regular Bureau of Mines men, but most were engineers who enlisted especially in the Bureau of Mines work for the war.

An executive staff in Washington was developed,

ready to handle expeditiously and promptly any matter which arose or was referred to the Bureau of Mines for decision. C. M. Weld was appointed assistant executive, and A. G. White administrative assistant. Mr. Weld was also in special charge of manganese, both in the field and at headquarters; metallurgical problems relating to conservation being handled through a committee consisting of Dr. H. M. Howe, J. E. Johnson, Jr., Bradley Stoughton, and himself, with a special staff including P. H. Royster, S. L. Hoyt, and others. J. E. McGuire had charge of chrome, H. C. Morris of tungsten, W. C. Phalen of magnesite, A. W. Stockett of potash, and so on through the list. Upon each subject there was a representative or a committee. Corresponding committees having been appointed on the Geological Survey, there were frequent consultations, and also numerous joint committees formed on each subject, so that the knowledge and judgment of the mining bureaus of the Interior Department as a whole was constantly ready on all current problems.

The necessity for interlocking this organization with that of the War Industries Board, to insure full advice on every problem and a consistent program, soon became apparent. After some delay, closer co-ordination was effected by arranging to have certain members of the War Minerals Investigations sit upon committees of the War Industries Board in a consulting and advisory capacity. Unfortunately, the smooth and effective working of this plan came too late to accomplish much toward adjustment of supply and demand. In accordance with this plan, Mr. Weld served on the manganese and chrome committees of the War Industries Board, which were in charge of Hugh Sanford, and the unanimous approval of the most vitally interested Government organizations was thus facilitated on any important decision. J. H. Mackenzie, of the Bureau of Mines, took charge of the War Industries Board tungsten problems when emergencies arose, and A. E. Wells, of the Bureau, co-operated with the War Industries Board on matters regarding the sulphuric-acid supply, and served on the committee of the board appointed for that purpose. Hennen Jennings, of the Bureau of Mines, in charge of platinum for the Bureau, served on the platinum committee of the War Industries Board also, and so on.

Co-operation was effected with the Department of Labor, in regard to the allocation of unskilled labor, and with regard to exemption of skilled men essential for the operation of approved and necessary war mines. The Director of the Bureau of Mines was given charge of this matter, and local volunteer representatives were appointed in the different mining fields, to take up these matters with the local draft boards. Even the mining section of the Capital Issues Committee, which controlled the issue of securities during the war, was entirely referred to a special section of the War Minerals Investigations, and in some cases the decisions required field examinations. Matters pertaining to the War Finance Corporation that involved mineral problems were also referred from all quarters to us for final report. Everything was produced or moved during the period, under the War Industries Board, on a "priority" basis, and priority lists were given out to railroads and others for their guidance.

To show the unorganized nature of war board work, the War Industries Board got out in September a new priority list, which failed to include smelters, mills, or mines of the non-metallic minerals; and it became



our duty to see that this omission was promptly remedied. Questions of priorities for fuel for mines were referred to the War Minerals Investigations by the Priorities Committee of the War Industries Board. Indeed, the regulation of production of necessary war minerals was taken into consideration in all its phases by this organization, both in regard to matters initiated by the Bureau of Mines, and those referred to it by other branches of the Government, in the numerous cases where office or field reports of mining or metallurgical engineers was necessary. I am sorry (and glad) to say also that from time to time it was our duty and pleasure to circumvent the plans of promoters who, in the confusion of our war troubles, sought to put over some mineral-producing scheme for their own financial betterment. It sometimes happened that they sought to use the Government as their tool, and had secured political backing in high places.

Another activity in which the War Minerals Investigations was active was the completion of the series of summaries of the situation in regard to the political and commercial control of the different important war minerals. For the first time the Government awoke to the necessity of knowing what capital controlled key mineral industries, both in this country and abroad, and what political control lay back of this capital. These papers, each written by a specialist who contributed his work as a patriotic offering, were the first systematic efforts to state the problem; and they were got out one by one in mimeograph form and furnished confidentially to the interested officials of the Government only. They were highly appreciated. Among others, I was told that Secretary Lansing took a full set in his trunk when he went to Paris. At the close of the war, the remaining mimeograph copies were distributed to the public. Unwilling that this work should be lost, I suggested that they be published by the Interior Department, but not receiving approval of this, I received permission to publish the papers outside, which, after drastic editing, I did, in one volume, the royalties being devoted to further work along the same line.

The problem of increasing the domestic and near-by foreign production of high-grade manganese, of chrome, and of pyrite, near the Atlantic seaboard, enlisted the special efforts of the field force during the early weeks of the War Minerals Investigations. This work had been initiated before the decision against the Mineral Importation Committee's stand on importing minerals as ballast in excess of the amount allowed in its program, which led to the committee's resignation as a protest against possible consequences; and though this situation led to anxious uncertainty, it was some little time before it was demonstrated to be the case that the domestic supply of war minerals would reach the necessary figures; and in the meantime it was necessary to continue the production stimulation program already entered upon. By the first of August, 1918, however, less than two months after I had undertaken the War Minerals Investigations work, I was able to report to the Director that the situation in the chief war minerals was "very easy"; that both the domestic production campaign, and the efforts put forth for conservation and economy in the use of these materials, had been effective past all anticipation and prophecy; so that the restricted import program which had been laid down by the Committee on Mineral Imports, and which had been condemned as too drastic by many, was already proved to be sufficient and even superfluous.

There began to be, at this period, an oversupplied market for chromite, thanks largely to the "ballast and back haul" importations. By the first of September, it was still more plain that there was a superabundance of this mineral. Those best acquainted with the situation, when we canvassed it before determining upon a program, were of the opinion that the maximum production which could be secured for the United States in 1918 would be 60,000 tons; but by Sept. 1 it was estimated that the actual production would be 75,000 tons. In the meantime, the result of the programs of conservation and economy in the use of chromite had been so effective that, whereas in 1917 the domestic consumption amounted to 150,000 tons, of the equivalent of 50 per cent chromic oxide, in 1918 the consumption promised to be less than 100,000 tons. To meet this domestic oversupply question, conferences were held with the Shipping Board, the Geological Survey, and the War Industries Board. In these conferences, the Interior Department made firm representations as to the rights of producers who had been stimulated by the Government program.

On Nov. 9 I wrote the Director concerning the chromite industry:

"It is true that this industry was advised by the consumers and by the Government that all the ore which they could produce would be absorbed, but this encouragement was based upon the almost universal testimony of the California chrome producers themselves that the Pacific Coast production could not be stimulated beyond a production of about 60,000 tons for 1918, so that the moral responsibility really does not go beyond that figure. In the conference which was summoned by the War Industries Board and the Shipping Board, and at which I presided, we had a score or more of representatives of the California chromite industry, and the above was practically their universal testimony. The tonnage which we estimated as the possible maximum has already been produced and marketed, so that in one way it might be considered that there is no moral obligation on the part of the Government to further sustain the domestic chromite industry. On the other hand, it is true that actual importations of chromite in 1918 were largely in excess of those recommended by the Committee on Mineral Imports and approved by the War Trade Board, the Shipping Board, and the War Industries Board, and that producers had been advised of the limitations which had been placed by these boards, and which, as I have said, have been greatly exceeded. This was due to the fact that an exception was made by the War Trade Board to import restrictions on the basis of 'ballast and back haul,' although the Committee on Imports had definitely recommended that no such exceptions be allowed; and the discretion over this exception was placed in the hands of the Ship Control Committee in New York, which allowed such large amounts of chromite (as well as manganese) to come in that the entire program and calculations of the Committee on Mineral Imports were upset, and the present oversupply of chromite is the result. If the Government is morally liable, therefore, it is not on account of its program, but on account of the lack of co-ordination of the various branches of the Government and the lack of a strong central control."

The oversupply of chromite continued, and a plan was adopted by the War Industries Board, after conference with the Bureau of Mines and the Geological Survey, to cut off all importations for 1919. Had the war lasted, of course, this plan would probably have procured the absorption of the domestic supply; also, the program of conservation and economy of the use of chromite was rescinded.

The manganese situation was somewhat similar. As set forth above, it was stated as early as August to be "very easy." By late September there was a threatened possible oversupply. Even before this time

the War Minerals Investigations had begun to discourage all new domestic manganese undertakings except such as might give promise of being able to withstand drastic competition. An effort was also made to promptly reduce importations from Brazil to the rate of 250,000 tons annually, a figure which promised ample supplies for the continuation of the full war program, even though domestic output should show no increase over the already established 1918 rate and our conservation program should effect no marked reduction in consumption. This effort was delayed, however, on account of considerations involving State Department policies relating to Brazil.

By the middle of October, conditions of supply of war minerals were such that I advised the Director:

"As regards the general situation, the condition previously reported as to sufficiency of prospective supply of chromite, manganese, pyrite, and sulphur continues, and it is unlikely that we shall be pressed for supplies of these materials during the remainder of the war."

In the early part of November, the near prospect of peace led to a backing up of markets in general, and the situation in chromite and manganese became acute. The following general notice was sent out on Nov. 9, under the signature of the Director:

"From the Government standpoint there is no longer any need of encouraging increased production of manganese, chromite, and pyrite. Intending investors should investigate very carefully before embarking in mining ventures involving these ores. After the war, domestic mines will have to compete with foreign ores, which are situated where labor is more plentiful and cheaper."

On Nov. 9, I advised the Director as follows:

"The near prospect of peace has led to a backing up of markets in general and of these the chrome and manganese markets have been brought very specifically to our attention. The War Industries Board, which had handled the matter all through, has become subject to very sharp criticism, and it is largely for this reason that the War Industries Board has turned over the entire problem to the Interior Department. Unfortunately, however, it is, in my opinion, too late to correct any errors in judgment which may have been made. The great trouble has been in the lack of co-ordination of Government departments. They have attained our major object, namely, the procuring of abundant manganese, chromite, and other war minerals, for the carrying on of the war, but have failed utterly in the accurate adjustment of supply and demand."

During all this period, there had been pending tardy legislation in Congress to pass a bill creating a Minerals Administration, similar in authoritative scope to the Fuel and Food Administrations. This had been recommended by the War Minerals Committee, of which Mr. Westervelt was chairman, as told in his article, which precedes this. The matter had dragged on in Congress while the war was being fought and decided, and we had no time to pay much attention to this deliberation in the necessity for action, which fortunately was secured in some fashion by the working together of various boards and bureaus and the formation of our own interdepartmental committees to decide and handle emergency questions.

The bill was passed by both houses of Congress late in September and went to the President for signature. It put the responsibility of selecting the Administration on the President, and the President's signature was delayed while he conferred with Mr. Baruch on the subject. In the latter part of October, it was agreed between Mr. Baruch and Secretary Lane that Mr. Baruch was to designate to the Secretary any war mineral of which there was a shortage (the bill re-

stricted the authority of the act to minerals of which there was a shortage for war purposes), and in this case, the Interior Department would become responsible for its production. Mr. Baruch further specified that at that time, Oct. 28, the only articles of which there was a shortage were potash, zircon, and arsenic. He held that other minerals mentioned in the bill, of which there had once been a shortage, were no longer within the field of the bill, since the shortage had been relieved. Under this category, he placed the chief "war minerals," like chromite, manganese, and pyrite.

Acting on these instructions, I appointed A. E. Wells in charge of the arsenic situation, which was the only one which required immediate action, the zircon problem being really inactive; and I appointed a special new committee to supplement the former committee in a more vigorous handling of the potash situation. A first allotment of \$100,000 out of the administration fund of the Mineral Control Act was made to the War Minerals Investigations, subject to my expenditure. This money was subsequently turned back into the fund.

On Nov. 1, however, Mr. Baruch advised Secretary Lane that the chromite situation was in a precarious condition, and asked him to *keep up the production* under the Mineral Act, thereby "passing the buck" of the oversupply problem, after having tenaciously held the mineral control up to that period.

It so happened, however, that the powers of the Minerals Administration were destined not to extend further than the arsenic question, and did not go far in that. A contract with the Government to supply arsenic was being sought for a mine in New England. This contract was sought by an officer who was in the Chemical Service of the War Department, but on investigation it was found that the enterprise did not warrant making any contract; it was also found that the reported shortage of arsenic was not threatening, and that it was very likely to disappear, which it shortly did.

The pressing mineral problems at the time were, however, not shortage, but overproduction, so did not come under the terms of the Minerals Control Act, which, moreover, was not signed by the President till about the time of the Armistice. Nevertheless, as soon as the news was wired by the American Mining Congress to the mining world that Secretary Lane had been appointed administrator under the act, telegrams and letters began to come in to the Bureau and to Secretary Lane, the President and members of Congress, urging that the Government relieve the chromite and manganese situation by purchasing producers' ore at the market price and supporting the market. Representatives of the industry also arrived in Washington to press the matter. Possible remedies were drawn up by the chromite, manganese, and pyrite committees, which I had appointed for the War Minerals Investigations.

The Chromite Committee submitted a plan for the alteration of the situation under the War Minerals Control Act. I stated, however, at this time in my report to the Director (on Nov. 23), "I do not think it possible to secure proper and adequate relief for the chromite, manganese, and pyrite situations under the Minerals Control Act, and I recommend that these problems be investigated by special commissions who shall report to Congress." And on Nov. 19 I wrote:

"I am of the opinion that we shall find on mature reflec-



tion that the present situation regarding manganese, chromite, and pyrite cannot properly or safely be dealt with under the Mineral Act, and that it would be a great mistake for the Bureau to undertake them under this act, and one which would bring finally much criticism upon it. Aside from the propriety, the logical methods for carrying out a plan of reparation for producers of chromite, manganese, and pyrite, including the establishment of a protective tariff in each case, and the control of vast and complex industries for the sake of supporting single minor industries, would lead the Bureau into an impossible position and one which would bring upon it an immense amount of criticism and would be foredoomed to failure. The recommendation is that a commission be appointed by the President, at the suggestion of the Secretary of the Interior, outside of the Bureau of Mines, or including a representation from the Bureau, to determine the moral obligations incurred by the Government during the war to the domestic producers of chromite and manganese, and that this commission or commissions report their findings to the President and recommend that he ask Congress to appropriate the necessary amount determined upon as damages, and reimburse the producers by a flat cash payment."

The plan of the Chromite Committee was transmitted for his opinion to Secretary Lane, who called a conference to consider the action of the Government and the consumers in the event of his taking action according to the Minerals Control Act. To this conference he invited representatives of the principal Government departments and of the Mining Committees of Congress, one representative of the producers, and about twenty-three representatives of the consumers. It was the Secretary's plan to see whether the chrome consumers could not be induced to buy sufficient chromite so that the domestic chrome industry should be enabled to avoid the losses with which it was threatened. The plan was not successful. Only about four of the twenty-three consumers invited responded, and these refused to admit a responsibility. The steel industry was not represented at all. Except that the Secretary indicated his sympathy with the producers of chrome in their difficulty, the conference was without result.

Subsequent to the conference, a tentative plan was suggested for the Bureau of Mines to proceed with the further investigation of the mooted problems of oversupply and failing markets for war minerals, such as chromite, manganese, tungsten, and pyrite, and that the administration funds carried in the Mineral Control Act should be used for that purpose; and I was asked by the Director to formulate plans for undertaking this investigation.

I reported on Dec. 7 that, in the opinion of the War Minerals Investigations Staff, we could not properly undertake investigation of the existing war minerals situation with the administration funds of the Mineral Control Act, since the Secretary had decided not to act under this authority, for the double reason that the war was virtually over, as President Wilson had announced, and that there was no shortage. In fact, it was not war problems, but post-war problems, that must be dealt with. However, a conference of producers about the middle of December secured the statement from Secretary Lane that he would exercise the powers of the Mineral Control Act, if he were authorized to do so by Congress. Concerning this conference, I reported:

"A plan was therefore formulated to have Congress authorize the application of this act to cover the present emergency. Although this plan was approved by the senators present, personally I do not think there is any chance what-

ever of its succeeding, and, therefore, I am not counting on funds from that source."

What Congress actually decided to do was the obvious course of meeting the situation by new legislation, affording relief by the payment of claims; and the administration of this relief fund of \$8,000,000 was turned over to the Interior Department. I was asked by the Director to handle this work, but I advised him that, the war being over, I desired to be relieved as soon as possible; and that I should advise in any case putting the adjudication of the claims into the hands of a commission of three men of recognized standing who had not been connected, as I had been, with the war minerals problem and the events which led up to the existing situation. This suggestion was adopted by the Director and the Secretary, and a commission, consisting of former Senator John Shafroth, of Colorado, chairman; Dr. Martin Foster, former chairman of the Committee on Mines and Mining in the House of Representatives, and Philip N. Moore, former president of the American Institute of Mining and Metallurgical Engineers, was appointed. On the urgent request of the Director, however, I undertook to organize, with the title of chief engineer, the investigating force of the Bureau, which it was planned by the Director to conduct separately from the commission.

Accordingly, a competent staff of engineers and auditors was assembled. C. B. Holmes, formerly with the Chile Copper Co., was engaged as chief accountant, and the selection proved a wise one. On July 8, 1919, nineteen engineers were at work—Messrs. Cameron, Toll, Shonts, Sheafe, Locklin, Williams, Sears, Eddingfield, Wormser, Van Siclen, Tucker, Harrison, Dub, Means, Henry, Hyder, Harder, Crane and Battle; and eight auditors—Messrs. Holmes, Trelawney, Langton, Hay, Evans, Dunn, Roosa, and Fleming. The staff being ready, I had all claims analyzed, abstracted, and classified, and annotated with whatever knowledge there existed in the Government departments concerning the particular enterprise in question.

The War Minerals Relief Bill as passed by Congress was not a skilful piece of legislation; after being trimmed here and compromised there, it required a lawyer to determine what it really provided for. Therefore, the decision as to its meaning was secured from the Attorney General and from the Solicitor of the Interior Department. The most perplexing and unsatisfactory provision was for the payment only of those losses made in the production of minerals "at request or demand" of the Government. Congress had, of course, no very clear idea what it meant by this. It was a cloudy and inequitable piece of legislation, giving awards to some who did not merit them, and withholding, by its provisions, awards from some better entitled, but it did not lie within the function of the Interior Department to make awards or disburse moneys from the \$8,000,000 set aside by Congress for that purpose, except as directed by the law; so our job was simply to have that law interpreted by the highest authority, and act promptly in accordance.

Subsequently, in order to facilitate and expedite handling and disposing of the claims, and at the special request of the Director and the Secretary, I devised a plan of having the claims, after having been reported on by engineer and auditor, go to "examiners" (whom I selected and started out), who would go over the evidence, make additional necessary researches, and submit the whole case, with recommendations, to the

commission, for their approval, disapproval, or further investigation. After the commission's finding the only final formality was the Secretary's approval. That the entire plan devised, of a commission, force of auditors and engineers, and intermediary examiners, has worked smoothly, is shown by the handling of 1,400 claims in about two years.

This sketchy record of the activities of the War Minerals Investigations has been prepared with the same object with which I have secured the other papers of this series—namely, the presenting of a true, unvarnished report as to how the mineral problems of the war were handled in Washington. It is not that we can point to the record with pride: we cannot. But we need the record to preserve an event in the history of American mineral production which otherwise would be unrecorded, and its lesson lost.

The striking feature to the reader will be the total unpreparedness: the swiftness of events which swept past a tardy and confused Government, and found us at the end of the war with knowledge and methods just emerging from something very near bewilderment, but still hopelessly hampered by internal politics and jockeying for power and for preferment within the Government.

The lesson to be learned and acted on is preparedness at leisure. There is no question more important than the supply of raw materials during crises: it should be taken up now, in the light of our war-time experience, and a careful survey made of the field, and detailed plans made for the effective putting into action of those plans in case of emergency. Our Navy at least, and some of our Army, is maintained ready for any surprise. What a lack of foresight if we do not have the other details for any eventuality planned and ready to put into smooth and effective action at a day's notice!

In the case of breaking out of a sudden war again, how would the mineral supply problem be handled? Nobody knows—there would be the same "doubt, hesitation, and pain." The agency would be squabbled over, and dallied over; and, if ever decided on, the necessary surveys and plans would still be lacking. So far as possible, the lesson teaches us, this should be remedied. The matter should be taken up by the War Department, co-operating with the mineral bureaus of our Government. At any rate, a conscious, intelligent, and far-sighted mineral policy, both foreign and domestic, should be reached as soon as may be by our Government.

We have certain reserves of certain ores: shall we mine haphazard; shall we exhaust at unnatural speed by the forced pressure of tariffs or other devices; shall we conserve? The country needs a wise business policy for its natural resources; and for its mineral supplies an intelligent program for the future, for peace or for possible war, is quite necessary. Tariffs should not be based on present-day individual desire for profit, but on a sane national policy of using its resources most efficiently and to the best advantage.

#### Mills in Tri-State Field Inspected

An inspection of the mills in the Missouri-Kansas-Oklahoma lead and zinc district is being made by engineers of the U. S. Bureau of Mines, with a view to determining their general procedure and gathering data as to different phases of the milling practice that may be most amenable to improvement.

#### Manganese Ore in the Western States Described in Survey Bulletin

In 1917 and 1918 there was a shortage of manganese ore in the United States owing to the impossibility of obtaining shipments from abroad. Because of the necessity of discovering further domestic supplies, a group of ten geologists of the U. S. Geological Survey made a rather careful examination of districts throughout the country in which manganese ore was known or supposed to be present. The results of these examinations have now been published, including reports that describe the deposits in most of Virginia, Tennessee, Georgia, Arkansas, Oklahoma, Colorado, Wyoming, New Mexico, Arizona, Nevada, and Southern California. One of the last of these reports, which describes the deposits of Montana, Utah, Oregon, and Washington, has just been issued as Bulletin 725-C, "Deposits of Manganese Ore in Montana, Utah, Oregon, and Washington," by J. T. Pardee.

The deposits in Montana include those near Philipsburg, where twenty-one mines have been operated; those near Butte, where a number of mines have been operated but only five have been productive; and those of eleven other districts. The most productive deposits in Utah are in the Little Grande district, Grand County, where twenty mines were operated, although those in the Tintic and Erickson districts also produced some ore. Many deposits in Oregon and Washington were explored during the war, but only a few were brought to the shipping stage. In Oregon twelve groups of deposits in the Lake Creek, Gold Hill, and Greenback districts, Jackson County, as well as scattered small deposits in three districts in Baker County, were explored. The principal deposits of Washington lie along the east side of the Olympic Mountains, in Mason and Jefferson counties, but small deposits are found in four other districts that have been under investigation and consideration.

#### Finland Iron-Ore Deposits

According to expert opinions obtained by the Geological Commission of Finland, the deposits of iron ore in the Porkonen-Pahtavaara region of Kittilä, in Finnish Lapland, estimated to contain 100,000,000 tons of ore, cannot be utilized for the next ten years, because of the high percentage of phosphorus and the difficulty of separating it from the ore, and owing to the inaccessibility of the mines, reports Leslie A. Davis, consul at Helsingfors. It is thought that these ore fields can be worked profitably if the proposed railroad to the Arctic Ocean is constructed within convenient access to them.

During the last three years the O/Y Pitkaranta Bruks A/B has been engaged in making preparations for the mining of iron ore and has been completing its foundry. Considerable money has been expended for this purpose, and conferences have been held with both native and foreign experts. Smelting experiments in electrical ovens have proved that a good cast steel and also a first-class steel for making tools and implements can be produced. Forests have been purchased to insure fuel for the coming smelting operations. Other improvements and extensions of the plant are said to be under consideration, and investigation warrants the conclusion that development will probably be initiated soon.



## Government Officials Prominent in Mining

### Albert H. Fay

BY PAUL WOOTON

Written for *Engineering and Mining Journal*

**A**. H. FAY has been made chief of the Natural Resources Division of the Income Tax Unit of the Bureau of Internal Revenue. Mr. Fay is a widely known mining engineer. It is this subdivision of the Bureau of Internal Revenue with which the mining industry has largely to deal on taxation matters. The appointment of a mining engineer to that place follows many urgent appeals from the industry, as the valuation of mines is a highly technical procedure and one which best can be directed by an engineer, it is believed. For several months Mr. Fay has been the acting head of the division and has already undertaken to reorganize the units handling matters pertaining to natural resources. This is being done with the purpose of speeding up the work on valuations. A revised manual on oil and gas will soon be issued, which will be of great assistance in the valuation of oil properties. In his new position Mr. Fay is at the head of an organization comprising a large technical personnel. His staff includes fifty engineers and seventy-five auditors, besides clerks and other assistants. More than \$250,000,000 in taxes are based on valuations made in the Natural Resources Division.

Complaints have been frequent that it requires too long a time for tax collectors of this division to handle the data furnished them. It is admitted by Mr. Fay that the work has been handicapped by lack of funds with which to hire a sufficient number of engineers. He is not willing, however, to allow the Government to take all the blame, as his records show that many taxpayers are slow in filing valuation data. He has figured out a plan which he believes will make possible a gain of from two to six months in the readjustment of taxes when the taxpayer proves his case.

Valuations of natural resources were necessarily slow at first, Mr. Fay points out, because the division was called upon to pioneer the entire field. During the period of organization and of preliminary work delays were unavoidable. This has had the effect of bringing the work of the division into some disrepute. It has been

hard to live down that reputation, but Mr. Fay believes that there will be little cause for such complaints in the future. One thing is certain, he says—every taxpayer is going to be given every consideration that it is possible to extend. Mr. Fay is a native of Missouri. He

was graduated from the Missouri School of Mines in 1902. He took post-graduate work at Columbia in geology, mineralogy, and ore dressing. Early in his career he became acquainted with a large number of mining engineers through his service as assistant to the secretary of the A. I. M. E. He resigned this position in 1903 to enter the employ of the Cananea Consolidated Copper Co. in Mexico. After more than two years with the Cananea company Mr. Fay became superintendent for the Bartels Tin Mining Co., which was operating in the Cape Prince of Wales district of Alaska. Two years later he accepted a position as mining engineer for the John T. Williams Co. at Bristol, Tenn., where he was in charge of the barytes operations of that company. From December, 1908, to August, 1911, Mr. Fay was a member of the editorial staff of the



ALBERT H. FAY

*Engineering and Mining Journal*. He edited the 1910 volume of *Mineral Industry*. In connection with his work for the *Journal*, he traveled widely, gathering data on numerous mining districts.

In August, 1911, Mr. Fay assumed the position of mining engineer in direct charge of statistics for the U. S. Bureau of Mines, in which position he continued for nine years. During that time, in addition to maintaining the statistical records of the Bureau, he prepared thirty-five technical papers, aggregating 4,000 pages in all, of statistical data on mine accidents. He is the author of a special bulletin analyzing coal mine fatalities in the United States between 1870 and 1914, the preparation of which involved the detailed study of 55,000 fatalities.

Mr. Fay is perhaps best known by his last publication, which bears the title "A Glossary of the Mining and Mineral Industry." Soon after leaving the service of the Bureau of Mines he accepted the position with the Bureau of Internal Revenue.

## CONSULTATION

### The Uses and Associations of Monazite Sand

"I am interested in monazite sand, and desire the following information regarding it: Where is it found? What are the minerals or metals usually associated with it? For what purpose is it used? Is there a considerable demand for it? What is it worth? I presume the sand is concentrated."

Monazite is a phosphate of the cerium metals (cerium, didymium, and lanthanum) and other rare-earth metals such as neodymium, and praseodymium, including thorium, the metal for which it is chiefly mined. The thorium content varies widely, and commercially ranges from 2½ to 6 per cent, but some monazite carries as much as 18 per cent thorium oxide. The best Brazilian concentrates carry about 6 per cent thorium oxide, or thoria, whereas those of India and Ceylon have about 9 per cent. The mineral is commonly associated with magnetite, zircon, gold, chromite, ilmenite, garnet and occasionally the diamond. Monazite sand consists of well-rounded grains of a resinous lustre which may be brownish, gray, yellow, or reddish in color. It is weakly magnetic but of high specific gravity. It gives a phosphate reaction.

Monazite, being heavier than ordinary minerals, has made many a prospector attach undue importance to the value of his find. The value of monazite depends upon its content of thorium oxide, and if this be too low the mineral is worthless. The domestic monazite-sand industry flourished at the beginning of the present century, but after 1910 production ceased entirely, owing to the development of strong competition by foreign producers.

Monazite is widespread in occurrence, but forms only a small fraction of 1 per cent of the rock contained in the earth's crust, according to W. T. Schaller. On decomposition of the rock, the monazite and other resistant minerals are not attacked chemically, remaining behind unaltered, and, being much heavier than the products of decomposition, are gradually but slowly concentrated in the residue from the broken-down rock. Locally, river waters will effect a concentration of the heavy minerals into monazite-bearing sands and gravels. If the ocean encroaches on an area of such decomposed rock, the selective action of the sea waves will still further concentrate the heavier minerals. Sea-coast deposits of sand, therefore, contain monazite in higher natural concentration and cover larger areas than river-bed deposits. Even if the percentage of thoria in monazite were constant, sea-coast monazite sand would contain more thoria than river-bed sands, on account of their greater content of monazite.

The world's monazite supplies are obtained principally from deposits in Brazil and India, although it has been found and mined in other countries. In the United States, it has been produced in the Carolinas and in Idaho. The counties of Cleveland, Burke, Alexander, Catawba, Caldwell, Rutherford, Gaston, Iredell, McDowell, Polk, and Lincoln of North Carolina, and Cherokee, Anderson, Laurens, Oconee, Pickens, Spar-

tanburg, and Greenville counties in South Carolina, contain the most productive localities. The monazite is found in stream and bottom lands, and the mineral-bearing gravels are reported to range between 1½ ft. and 2½ ft. thick. In Idaho, the deposits are in Centerville and Idaho City, and are associated with gold-bearing gravels. Monazite is also reported to have been found in Colorado, in the Newland Gulch district.

Monazite was found in the Carolinas in 1879, and the placer deposits there, according to the U. S. Geological Survey, were first worked about 1886. The next year the mineral was shipped, and more or less has been mined and shipped ever since.

The quantity produced in the United States reached its maximum in 1895. In that year Brazilian monazite entered the market and caused the domestic production to fall to almost negligible proportions. Increased demand soon created a revival in the domestic output, which in 1905 again approached the maximum. From 1893 to 1910, inclusive, there was a large production of monazite in this country, but from 1911 to date the output has varied from nothing to 38,000 lb. annually.

The world's production of monazite is small, and fluctuates widely, averaging about 2,500 tons annually. Although Brazil formerly was the most important producing country, Indian monazite is now produced in greater quantities, and it is reported by the Imperial Mineral Resources Bureau to be richer in thoria than the Brazilian grades.

Monazite is used as a source of thorium salts and by-product rare earths, such as cerium and lanthanum. Thorium oxide glows intensely when heated, and is therefore used in making incandescent mantles for gas lights (the Welsbach mantle). It is obtained by heating nitrate of thorium. According to the U. S. Geological Survey, from 250 to 500 mantles are produced from one pound of thorium nitrate. The world's annual consumption of incandescent gas mantles is about one-third of a billion. Thorium compounds are also used in magnesium flashlight powders, and the metal thorium, with other rare-earth metals, is alloyed with tungsten, making very ductile filaments for electric lamps. Only a slight use has been found for the rare-earth salts byproducts obtained from monazite sand.

Cerium residues may be used in the manufacture of ferrocerium, an alloy used in sparking devices, and cerium salts are used in the flaming arc. Mesothorium, a radio-active element found in thorium minerals, is recovered and used as a substitute for radium in luminous paint. Although the percentage of mesothorium in monazite is exceedingly small, its great value makes it one of the most desirable byproducts of the mineral. A ton of monazite containing 5 per cent of thoria has been estimated to yield about 2.5 mg. of mesothorium.

Monazite is quoted by *Engineering and Mining Journal* as being worth \$30 per unit for material containing at least 6 per cent thorium oxide.

The sand is usually concentrated before being shipped. The deposits in the United States especially require concentration.

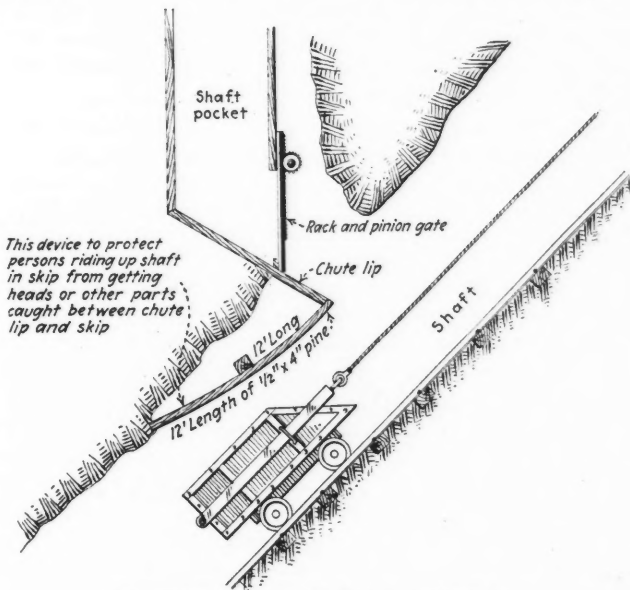


# HANDY KNOWLEDGE

## Guarding Chute Lips of Shaft Pockets

Written for *Engineering and Mining Journal*

The main shaft at the French Creek Mines of the E. & G. Brooke Iron Co., at St. Peters, Pa., is a 43-deg. incline to the 7th level, below which point it flattens to 33 deg. Shaft pockets or ore bins are provided at every level, the chute lips of which project into the shaft, clearing the skip by only about 2 in. to avoid spillage. If left unguarded, these lips would be a source of danger to men riding in the skip. Full protection is afforded, however, at each chute by nailing 12-ft. lengths of  $\frac{1}{2}$  x 4-in. pine lengthwise in the shaft over the full width of the skipway, one end of each length meeting; the lip and the other end being nailed to a timber across the hanging wall of the shaft. This makes it impossible for a person riding in the skip to let his head be caught between skip and chute lip. Any part of the body projecting outside of the skip is



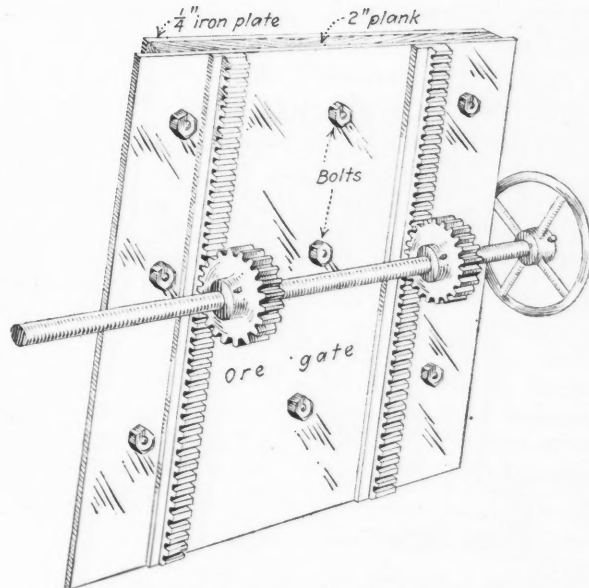
MANNER OF GUARDING CHUTE LIP

slowly pushed back without injury so as to clear the lip. This arrangement was devised at the mine and has been approved by the state mine inspector. The same device is used at the collar of the shaft. M. T. Hoster is superintendent in charge.

## A Reinforced Gate for Ore Bins

Written for *Engineering and Mining Journal*

The rack-and-pinion gate commonly used on ore bins is often required to withstand severe battering. The impact of the heavy pieces of ore frequently breaks the racks, which are of cast iron, bends the pinion shaft as well as the plate of which the gate is made, and springs the plate out of the groove in which it runs. This difficulty is avoided at the French Creek mines of the E. & G. Brooke Iron Co. at St. Peters, Pa., by reinforcing the gate, as shown in the sketch, with 2-in. planks of soft wood backed by a  $\frac{1}{4}$ -in. iron plate. This



REINFORCED RACK AND PINION GATE

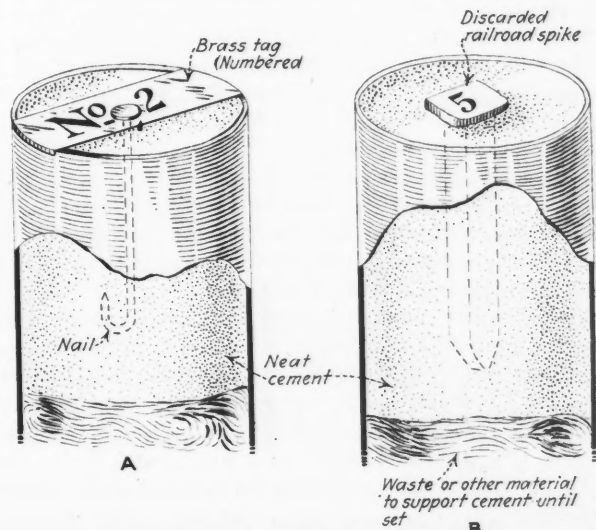
extra plate and the planks are bolted to the gate. Gates thus reinforced have lasted three years without breakage at the mines mentioned, and are still in good condition.

## Tagging Diamond-Drill Holes

By ROY H. POSTON

Written for *Engineering and Mining Journal*

Every diamond-drill hole should be tagged—that is, designated—by some number or symbol in a permanent way, to establish its identity beyond question at any time. Different ways of doing this are in use, such as center punching the number on the sleeve, bradding the number plate on the sleeve or filling the top of the sleeve with cement and embedding the number tag in it. The method depicted in B in the accompanying sketch seems better than others. That illustrated in A was



METHOD OF TAGGING DRILL HOLE

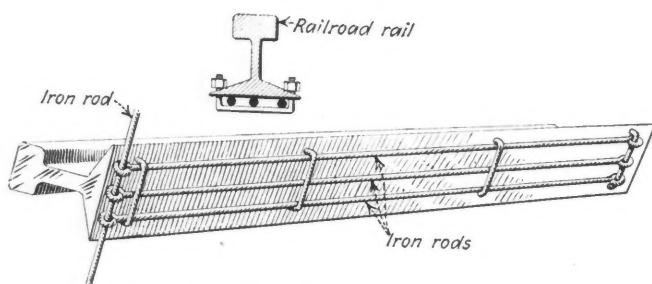
used for several years at one Missouri mine, but small boys pulled off the tags as fast as they were put in place.

To obviate this annoyance and difficulty, discarded railroad spikes, with the number punched in the top of the head, were substituted for the tags, and the trouble ceased. A coat of waterproof paint was applied to the top of the spike after it was placed in position in the drill hole. The top of the spike was faced on an emery wheel before punching the number.

### Ore-Chute Device

Written for *Engineering and Mining Journal*

It may be desirable to lessen the impact of the feed flowing to a coarse crusher. At one plant chains were hung in the feed chute and, these failing, 3-ft. lengths of rail were suspended by one end. Both of these were unsatisfactory, as the breaking of either chain or rail



CRUSHER PROTECTOR FOR ORE CHUTE

permitted iron to enter the crusher, with consequent damage to the latter. Finally three rods were attached to each section of rail, as shown in the sketch. The device will hold the rail together, in case it breaks, thus protecting the crusher.

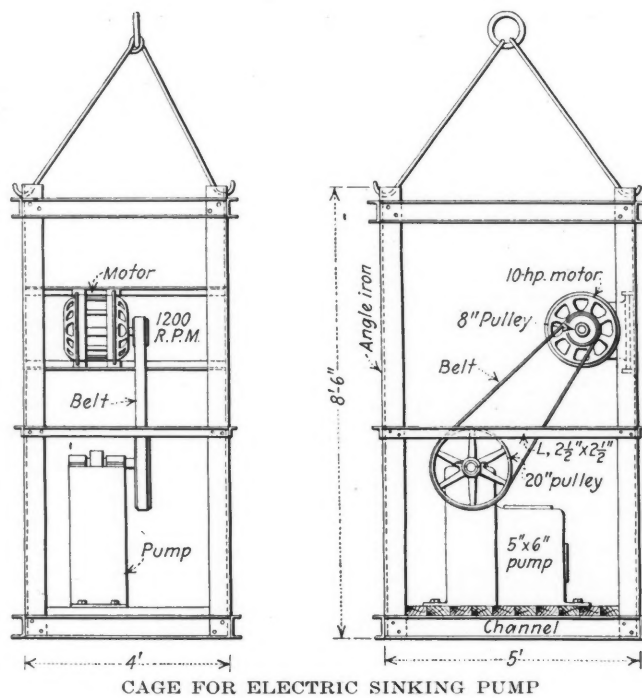
### Substitute for Sinking Pump

Written for *Engineering and Mining Journal*

The necessity of purchasing an electric sinking pump to unwater an old shaft for preliminary examination, at the French Creek mines of the E. & G. Brooke Iron Co., at St. Peters, Pa., was avoided by mounting a small Dean triplex pump of a capacity of 130 gal. per minute and a belt-connected 15-hp. motor on a cage built for the purpose. The cage was lowered by a block and tackle as unwatering progressed. A standard 4-in. suction 20 ft. long was used, which permitted the cage to be lowered 20 ft. at a time. The horizontal members of the cage were of 3-in. channel iron and the vertical members of 3 x 1/4 in. angle iron. The platform of the cage on which the pump sat was 5 x 4 ft. A sketch of the cage is shown herewith.

A 20-ft. length was added to the 3-in. column pipe each time the pump was lowered to a new position. To reduce to a minimum the time required to connect the pump to the column pipe, a flexible connection of fire hose was employed. Here a slight difficulty was encountered. The pump discharge and the column pipe were both of 3-in. diameter, but it was impossible to buy fire hose larger than 2 1/2 in. in diameter. This was overcome by fitting both the pump discharge and the column pipe with a standard 3 x 2 1/2-in. Y and connecting the two Y's with two 5-ft. lengths of 2 1/2-in. fire hose. The fire hose was fitted with standard pipe-thread couplings.

An electric sinking pump was preferred to one oper-



ated by air for the reason that it was much cheaper and because, had the mine closed down, it would have been very inefficient practice to operate a large compressor for one or two small pumps.

### Suggested Changes in Low's Methods Of Analysis

By ALBERT H. LOW

Written for *Engineering and Mining Journal*

The above caption appears in the Sept. 3, 1921, issue of *Engineering and Mining Journal*. I am glad to note the changes suggested. The first relates to the necessity of a provision being made for the presence of arsenic in the nickel and cobalt determinations. Unless arsenic is present in large amount relatively to the iron, it does no harm, and my inadvertence in the matter was due to the fact that I had not happened to encounter such ores. The decomposition in the zinc assay is similar, and arsenic has sometimes given trouble from the cause indicated. Reference to my "Methods" will show that provision was made for this contingency in a simple manner, which can easily be adapted to the nickel determination.

The suggestion relative to the determination of chromium in chromite does not impress me, as my personal experience with the method has failed to show the loss indicated. I am glad of the suggestion, however, and will as soon as practicable investigate the matter further.

The figure 4.74 in the molybdate method for lead is evidently a misprint for 4.24, the figure being qualified by the word "about." A more nearly correct figure is 4.26.

### Investigating Use of Guniting

The U. S. Bureau of Mines is conducting an investigation in the Nevada gold-mining fields of the use of guniting in metal mines. The possibility of the cement gun being used in the preventing or minimizing of rock burst in deep metal mines is being given especial attention.



# THE PETROLEUM INDUSTRY

## Oil Prospects in Mackenzie River District

SPECIAL CORRESPONDENCE

A. H. Low, geologist for the Mackenzie River Oil Co., has returned from field operations in the Northwest. He states that the results of the summer's work at and around Fort Norman are disappointing, no additional strikes having been made and the original discovery well not having yet been proved a commercial producer. Several years, in his opinion, may be necessary to locate the oil supply in the Mackenzie region, and Mr. Low is inclined to think that the greatest possibilities will be inland at a distance of perhaps fifteen miles from the river. This will increase the difficulties of operation, but the indications at several points at that distance inland are more favorable than along the shore.

It is also Mr. Low's opinion that the potential oil field does not extend far north of Fort Norman and that strikes are more likely to be made south than north. He considers that the Hay River field and some of the inland areas around Great Slave Lake are among the most probable prospects. His investigations showed many possibilities, but only a well could prove them and the only way was to keep on drilling until oil would be struck. No machinery having been taken in for the Mackenzie River Co., its operations were confined to the geological field work conducted by Mr. Low and his party.

When Mr. Low left Fort Norman on Sept. 13 the Imperial Oil Co.'s well on Bear Island was understood to be just beginning to drill, and the other rigs at Bluefish Creek, and the opposite side of the river, were getting under way. It will be possible to continue drilling at these points well into the winter, and the crews left at each of the camps will probably keep at work for some time.

## Petroleum Conference Proposed

WASHINGTON CORRESPONDENCE

A conference of men representing the various branches of the petroleum industry may be held in Washington in December. The matter is being discussed, and it is believed that the plan will be carried out. A gathering of oil men in Washington last winter was productive of much constructive work. Conditions have changed materially since that conference, and it is believed that mutual good will come from a discussion of the present-day problems which the industry faces. The Government officials who have been approached in this connection have expressed the desire that the conference be held.

## Montana Oil Developments

SPECIAL CORRESPONDENCE

Montana has sixty-nine wells producing and sixty-four more drilling or rigged up to drill. Of this latter number forty-eight are on wildcat structures.

The West Dome Oil Co., which is controlled by officials of the Anaconda Copper Mining Co., has brought

in its sixth producing well in the Cat Creek district. Besides this it has another well close to producing sands and will drill its Ten Spot well to the quadrant sands. It is rumored that West Dome officials have been negotiating to sell out to the Midwest Refining Co.

The Ohio Oil Co., a Standard subsidiary, has announced that it would build a seventy-two-mile pipe line to convey gas from the Elk Basin, Wyoming, fields to Billings, Mont. This will supply gas for light, heat, and fuel to Billings and points along the way. It will take ninety days to build the line, and during the construction period the company will employ 500 men and have a payroll of about \$120,000 per month, including superintendence and incidental charges and expense. Cheap gas should make Billings a center for manufacturing and possibly for refineries and smelters.

## Rumanian Oil Production

BY REUTER'S SERVICE

The production of oil in Rumania during August amounted to about 105,000 tons, compared with 80,000 in July. There was a general increase in the output of the companies, the Steaua Romana producing 22,846 tons, against 18,892 tons in July; the Astra Romana 27,013, against 22,834; the Romana Americana, 23,187, against 20,449; and nearly all the smaller concerns showing proportionate, in some cases much larger, in-show proportionate increases.

## San Joaquin Strike Unchanged

SPECIAL CORRESPONDENCE

The strike situation in the southern San Joaquin oil district continues without apparent change. Acts of violence have been reported and threats have been made of extending the strike to other oil fields in California. Operators and workers have made no changes in their relative positions, and it appears that a settlement of the strike is a long way off.

## The Alberta Oil Fields

SPECIAL CORRESPONDENCE

Vice-president A. M. McQueen, of the Imperial Oil Co., confirms the report that a strike of 2,000,000 ft. of gas has been made at Pouce Coupe at a depth of 1,650 ft. He stated that drilling operations would be carried on throughout the winter as far as weather conditions would permit at all of the company's thirteen wells in Alberta.

## Benzine Consumption in Japan Increasing

The output of oil in Japan and the import of foreign oil are alike increasing in proportion to the steady increase in consumption, comments the *Japan Gazette*. Consumption of benzine in 1920 amounted to 1,321,000 cases, against 929,000 cases for the preceding year, and the output amounted to 711,000 cases, an increase of 48,000 cases compared with the output of 1919.

## Technical Papers

**Washington Mineral Resources**—Two bulletins have recently been issued by the Washington Geological Survey, Olympia, Wash., on the mineral resources of the state. Bulletin No. 21, 155 pages, presents not only bare statistical figures for each product, but makes interpretations and discusses the factors influencing changes in production. Descriptions of many mineral deposits are given, and a large map of the state, with mineral occurrences indicated in red, is a feature. Bulletin 23, 366 pages, is devoted to the metal mines of the state, the first seventy pages covering general information on the geography, geology, and commercial development of the deposits and the remainder being a description of the mining districts and individual ore deposits, arranged by counties. A directory is appended. Either bulletin may be obtained on request to the Survey at Olympia.

**Mineral Tariffs**—The October issue of *The Mining Congress Journal* (American Mining Congress, Washington, D. C.; price, 30c.) is devoted to the Chicago convention and appears in greatly enlarged form. An interesting feature is an insert, in tabular form, which is a digest of information on mineral tariffs compiled by the tariff division of the American Mining Congress. The chart covers twenty-seven minerals and mineral products and gives briefly conditions of production in the United States contrasted with those of foreign countries; present and pre-war prices and costs of production; and present, proposed and desired tariffs.

**Alunite**—"Alunite Deposits in the United States" are discussed in a four-page illustrated article in the *Compressed Air Magazine* for October (New York, N. Y.; price, 35c.). Economic conditions in alunite production are given equal prominence with a brief sketch of the developed deposits.

**Silver**—The Imperial Institute has issued a 152-page monograph on "Silver Ores," obtainable for 6s. from John Murray, 50A Albemarle St., London, W. 1. The book contains a short chapter on the occurrence, character, and uses of silver ores, followed by a résumé of information regarding the principal deposits of the world. The information given is largely either geological or statistical.

**Mineral Resources**—Recent publications of the U. S. Geological Survey in the "Mineral Resources" series include: "Lime in 1919," thirteen pages; "Sodium Compounds in 1920," eleven pages; "Carbon Black Produced From Natural Gas in 1920," four pages; "Gold, Silver, Copper, and Lead in South Dakota and Wyoming in 1919," five pages; "Silica in 1920," two pages; "Potash in 1920," twenty-four pages; and "Lead in 1919," seventeen pages. They may be obtained on request to the Survey at Washington, D. C.

**Mine Gases**—U. S. Bureau of Mines *Reports of Investigations* No. 2275 three pages, obtainable on request to the Bureau at Washington, D. C., is entitled "Rock Strata Gases in Mines of the East Tintic Mining District, Utah." Heavy irrespirable gases at times flood the lowest workings in this district. Dilution of the inflow with large volumes of air by mechanical ventilation was found to be the best means of surmounting the difficulty.

**New Uses for Copper**—The leading article in the *Arizona Mining Journal* for Oct. 1 (Phoenix, Ariz.; price 20c., four pages) is an interesting paper on the discussion on broadening the copper market. Some purposes for which copper is suitable as well as some for which copper is not so suitable as other metals are mentioned, and an address recently made by the president of the National Brass Co. before the Copper and Brass Research Association is reprinted. The movement to extend the uses of copper seems to be earnestly pushed in the Southwest.

**Mine Ventilation Doors**—Ventilation doors which can be opened and shut mechanically by the motorman without leaving his seat or stopping his train are described in U. S. Bureau of Mines *Reports of Investigations* No. 2273, three pages, obtainable on request to the Bureau at Washington, D. C. Such doors have been widely adopted in Arizona.

**Diamond Digging**—"Alluvial Diamond Diggers in South Africa" is the title of an eleven-page article in the September issue of the *South African Journal of Industries* (Pretoria; price 6d.) The stones are mined by methods and by a class of workers unknown in America. Among the topics discussed are classes of diggers; storekeepers and credit; cost and method of digging; factors affecting earnings; profits of the diggers, and how the discovery of new pipes would affect them; and the question of nationalization of diamond mining.

**Oil in Montana**—The State School of Mines, at Butte, Mont., has issued *University of Montana Bulletin, Bureau of Mines and Metallurgy, Series No. 4*, entitled "Geology and Oil and Gas Prospects of Central and Eastern Montana," by C. H. Clapp, Arthur Bevan, and G. L. Lambert. The report is a compilation of reports already published, together with information obtained from field work done by the State Bureau. Geologic maps and sections are included.

**How Land Grows**—*The Mining Magazine* for August (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.) contains an illustrated article of thirteen pages entitled "Land Growth," which should be of interest to geophysicists and geochemists.

**Lead Poisoning in Utah**—U. S. Bureau of Mines *Reports of Investigations* No. 2274, six pages, obtainable from the Bureau at Washington, D. C., is a statistical study of the relation of lead poisoning in Utah to mining.

## Book Reviews

**Textbook of Geology.** By Amadeus W. Grabau. In two volumes. Cloth; 5½ x 8½; pp. 921; 1,980 illustrations; 1921. D. C. Heath & Co. Price, \$6 each volume.

This most excellent and valuable work is a real addition to our existing list of textbooks of geology. Outstanding characteristics are detail, accuracy, a facile, lucid, and pleasant style of instruction, and every evidence of profound research, experience, and consultation of the literature. Elucidation by example is freely used to supplement the statement of principles, and the whole result is to make unusually easy reading for a work that is not intended in any way for popular use. Even the layman may look over these volumes with far less difficulty than with the usual geologic work; and the books are, therefore, well fitted for the guidance of students; they are also very valuable for the trained geologist, containing, as they do, the most modern discoveries and views of many phases of geology.

We know that the individuality of the author enters even into a textbook of geology. Thus, Dana was quite different from Le Conte; the facts were seen and presented through glasses of different tints. The work of Chamberlain and Salisbury is far different in point of view and in general individuality from that of Pirson and Schuchert. The latter work has the unusual advantage of being the result of collaboration between a petrographer and a paleontologist and stratigrapher. The work of Grabau, which we are here reviewing, shows unavoidably the perspective of the paleontologist, stratigrapher, and student of the geology of the eastern United States. To that extent it is not perfectly balanced; to ore deposits, for example, are devoted three pages and five illustrations out of the total—less than is given, for example, to lime deposits from springs and in caves, or to foraminiferal ooze. Therefore, the student of mining geology will find nothing to interest him, as to his chosen field, except to wonder that what is so vast and complex to him is so nearly invisible to the type of geologist represented by the author. The lesson for the student is that this work should be studied along with other textbooks, which present more fully and in different proportion varying perspectives of geological science; and this is a good plan in any event.

The number of illustrations is extraordinary, and they lighten the text continuously. In the vast presentation it is perhaps not surprising that some of them have slipped in twice: for example, Numbers, 423, 425, and 521 reappear in the second volume as Numbers, 1,923, 1,924 and 1,460. The area of glacial till on Warner St., Gloucester, is not without interest, but not sufficient to warrant a second printing.

J. E. S.



# ECHOES FROM THE FRATERNITY

## SOCIETIES, ADDRESSES, AND REPORTS

### Electrolytic Zinc—Present and Future Possibilities

#### Anaconda Interested in Finding New Uses for Copper and Zinc

Dr. Frederick W. Laist, general superintendent of smelters of the Anaconda Mining Co., recently delivered an interesting address before the American Zinc Institute in which he praised the value of copper for roofing purposes, told of the success of experiments conducted at the Washoe plant and stated that the zinc producers need not consider copper producers as their competitors.

Dr. Laist does not believe that the zinc producers need fear the competition of the copper people, inasmuch as copper must necessarily command a higher price on the market than zinc. The cost of producing copper, says Dr. Laist, is seldom less than 15c. per lb., and in many cases the production cost is considerably more than this. Under ordinary conditions, copper will cost more than twice as much to produce as zinc.

#### COPPER ROOFING DURABLE

The converter building at the Anaconda reduction works afforded a difficult roofing problem, and experiments were made with many kinds of roofing. Corrugated iron was first used and had to be replaced about every eight months. About ten years ago it was decided to replace part of the roof with copper, which is still in fairly good condition, although some sheets have had to be replaced, owing chiefly to lack of physical strength rather than chemical corrosion. Thicker sheets should have been used. Later some corrugated zinc sheets were tried out on the roof of the converter building. These sheets, though they have stood up remarkably well, are not as good as copper and show the corrosive action of the sulphur gases. However, they stood the test better than might be supposed, considering the extremely severe conditions, and Dr. Laist is convinced that zinc roofing for ordinary purposes would last so long that the question of life would not be of importance as determining the choice between copper and zinc.

Last April the Anaconda company actually produced more zinc than copper in Montana. Though this is an exceptional condition, it is obvious that they are just as much interested in finding new uses for zinc as for copper.

At the present time, said Dr. Laist, the potential aggregate production of electrolytic zinc for the world amounts to approximately 125,000 tons, or 250,000,000 lb. per year. This is divided about as follows:

Anaconda Copper Mining Co., Great Falls..	Tons	55,000 to 60,000
Consolidated Mining & Smelting Co., Trail, B. C.....		20,000 to 25,000
Electrolytic Zinc Co. of Australia .....		30,000 to 40,000
Judge Mining & Smelting Co., Park City..		2,500
Brunner, Monde & Co., England .....		1,700

The experimental work upon which the modern electrolytic zinc process is based was started about the same time in 1914 by the Anaconda Copper Mining Co., at Anaconda, Mont., and the Consolidated Mining & Smelting Co., at Trail. Owing to the extraordinary high prices then prevailing for high-grade zinc, developments were unusually rapid, and in a surprisingly short space of time both Trail and Anaconda had commercial plants in successful operation.

#### ELECTROLYTIC PROCESS APPLICABLE TO ALL ZINC ORES

It may be stated that the electrolytic zinc process is applicable to a great variety of ores and concentrates. Almost any ore containing zinc can be treated, although, of course, it does not necessarily follow that the operation of extracting the zinc will be profitable.

The electrolytic zinc plant and the technique of the process at Great Falls is described fully in the *Transactions* of the American Institute of Mining and Metallurgical Engineers, and is also briefly described in a well-illustrated article in a pamphlet published for distribution by the Anaconda company. This plant represents the culmination of the experimental work and is probably the largest existing zinc plant of any kind in the world today.

#### JULY PRODUCTION RECORD

The record production for the plant was made last July, when a total of 11,801,662 lb. of cathodes were drawn. For Great Falls conditions this does not all represent marketable zinc, inasmuch as about 8 per cent of the cathode production must be blown into zinc dust for removal of copper and cadmium from the solutions. It should be borne in mind, however, that if the Great Falls plant had a copper-free concentrate to treat this would have very nearly represented net production, as on such concentrates probably not over 15 per cent as much zinc dust would have been required for purification. Though the Great Falls plant is rated at only about 110,000,000 lb. per annum, this means production from the relatively impure and cupreous concentrates on which it operates. The maximum output of the tank house has been

demonstrated to be at the rate of 140,000,000 lb. per year, or 193 tons per day, and it is probable that under favorable conditions, operating on concentrates such as are produced in the Joplin districts, the equipment at Great Falls could roast, leach and electrolyze sufficient concentrates for a production of 200 tons of zinc per day. This is quite an important point from the standpoint of plant investment in making comparison between the electrolytic and the retort process as applied to high-grade concentrates.

When the development of the electrolytic process at Anaconda for the beneficiation of complex zinc-lead-copper-silver ores and the utilization of surplus water power was undertaken there was little idea that such a process could be applied commercially except when the concentrates were low grade and water power was obtainable at low cost. Later high-grade concentrates, originating in the West in competition with retort plants, were purchased. In fact, it is probably not too much to say that the future of the zinc business in the West is going to depend to a considerable extent on the development of electrolytic zinc.

#### ELECTROLYTIC ZINC SHOWS STEADY INCREASE

With the development of the process and the extension of the Anaconda operations, optimism as to the future of electrolytic zinc has steadily grown, until now electrolytic plants operating on high-grade concentrates, and actually producing their power by the combustion of coal or oil or gas, are not an impossibility.

This statement may seem somewhat extreme, but it is based on the following general premises:

First. The fuel required for distillation and reduction of a ton of zinc in a modern retort plant will, when burned in an efficient modern power plant, generate sufficient electric energy to deposit a ton of zinc from sulphate solution.

Second. The labor required for producing a ton of zinc electrolytically from a given concentrate will be more than one-third the labor required by the furnace method.

Third. The total investment required to produce a ton of zinc electrolytically, will, in general, be little, if any, greater than by distillation—it being assumed, of course, that both plants are constructed with a view to permanence.

Fourth. The great purity of electrolytic zinc and the desirable qualities which it possesses by reason of its purity will, as they become better known, give electrolytic zinc a distinct advantage on the market.

An important advantage of the electrolytic zinc process over the retort process is better recovery. There has been a good deal of misunderstanding as to the recovery realized in existing electrolytic plants and a certain amount of disappointment has been manifested at the apparently low recovery being made. At Great Falls, for example, the recovery is approximately 80 per cent; at Trail it is lower than this. This 80 per cent recovery is, however, made up of recoveries of about 75 per cent on low-grade concentrates containing 30 per cent to 35 per cent zinc, on the one hand, and 85 per cent to 90 per cent on high-grade concentrates containing 50 to 55 per cent zinc, on the other. In other words, the possible recovery depends entirely on the grade and composition of the concentrates undergoing treatment, and the actual recovery depends as well on the design of the leaching equipment and the facilities for washing.

On pure, high-grade Joplin concentrates a well-designed roasting and leaching plant can make a recovery of 92 per cent to 95 per cent of the zinc content, and in general on any given grade a better recovery is commercially possible by distillation.

It goes without saying that a lower grade concentrate can be successfully treated, as the operating costs of the electrolytic process are more nearly proportional to zinc content than those of the distillation process and the presence of lead and iron is much less detrimental.

The recovery of zinc from low-grade and to a lesser extent from high-grade concentrates is one of the things which is receiving considerable attention at the present time, and the future will see great improvement in this direction. Experimental work is being carried on along two lines:

First. To cut down losses of insoluble zinc by more careful control of roasting, and to improve extraction and washing by better design of leaching plant equipment and flow sheet.

Second. By subjecting residues to additional treatment for recovery of both soluble and insoluble zinc.

The latter development is particularly important where the residues are to go to the lead smelter, as the presence of zinc in such residues, apart from representing an economic loss in itself, is highly detrimental to the subsequent smelting operation. Its removal and recovery would, therefore, be a very decided step in advance. Experimental work at Anaconda and Great Falls indicates that a recovery of 75 per cent of the zinc in the residue may be expected, which would bring the over-all recovery on even a low-grade (30 to 35) concentrate between 92 per cent and 94 per cent.

#### TREATMENT OF FINES ADVANTAGEOUS

Another important advantage of the electrolytic process is its ability to treat fines. The flotation process is bound to be resorted to more and more

for the production of zinc concentrates, and these are necessarily very fine. So far from being a detriment as in the firing process, this condition is a positive advantage to the new process, so that at Great Falls the company has in the past actually limited purchasers of outside material to flotation concentrates.

Where acid is to be manufactured, less complete roast required for the wet process may present certain advantages and might under favorable conditions make unnecessary the use of muffle furnaces. Obviously, from the standpoint of recovery the presence of sulphur in the form of  $SO_2$  is not detrimental. The only possible disadvantage from too much sulphate in the calcine is the building up of acid in the solution system to the point where a discard of cell acid must be made. This actually happens at Great Falls and results in the loss of a small percentage of zinc. Both the acid and the zinc could be saved by evaporation of a small portion of the cell solution each day, and this will probably be done.

Technically, both metallurgically and mechanically, the existing plants are far from perfect, and much remains to be done. In all departments improvements can be made which will result in better recovery, better current efficiency and lower operating and plant costs. Such improvements are not problematical, but certain, and in many instances already have been roughly mapped out.

#### Hot Mine Gases at the Tintic Standard Mine, Utah\*

Troublesome gases encountered in the Tintic Standard mine, at Eureka, Utah, are nitrogen, sulphur dioxide, and carbon dioxide, which interfere with the conduct of operation in the order named, nitrogen causing the most difficulty and carbon dioxide the least. According to the report of the Bureau of Mines, the origin of these gases is in the oxidation of sulphides in the ore. Carbon dioxide is generated through the action of the sulphuric acid on the limestone. These reactions are accompanied by the production of heat, which interferes with operations as much as or more than the gases themselves.

Separation of the different gases because of differences in specific gravity causes the ventilation problem. The nitrogen, being lighter than the atmosphere, tends to rise to the backs, and collects in such quantity in the high points of a stope or in a raise as to prohibit work in a very short time unless mechanical ventilation is provided. In the dead end of a drift which has not been worked for some time, it is possible to see where the line of demarcation is between the upper nitrogen layer and the purer air, containing more oxygen, by observing the sulphides in the wall rock, those particles below

the line being considerably more oxidized than those above.

The sulphur dioxide has approximately the same specific gravity as the atmosphere and seems to mingle quite uniformly with the air currents. It is gradually eliminated through reaction with water and carbonates, forming sulphates and carbon dioxide, and therefore is not troublesome, unless near the point of origin.

Carbon dioxide is found in objectionable quantity in the Tintic Standard only during the periods of low barometric pressure, or when a drift in the quartzite encounters open fissures, which are usually filled with it.

Both nitrogen and carbon dioxide have a suffocating effect when breathed, even when considerably diluted with air. They are often present in the Standard in sufficient quantity to extinguish an acetylene light.

The rapidity of the oxidation in the Tintic Standard is a difficult phenomenon to explain. Mr. McIlroy, of the Bureau of Mines, attributes it to the fineness of the sulphide particles. The fact that oxidation does not seem to take place so rapidly where the sulphides occur in larger crystals would appear to confirm this conclusion. However, at no place in the Standard are the sulphides so fine grained as, for instance, in the Tintic district, in the Gemini and Ridge & Valley mines, where little if any oxidation takes place. One is, therefore, a little reluctant to accept the fineness of grain of the sulphides as being the prime factor in the rapidity of oxidation. Probably the access of air through more extensive fracturing of the rock and the more porous nature of some of the Standard ores, combined with the greater temperature of the wall rocks, accounts partly for the more rapid reaction in this section of Tintic; but the real reason is still unknown.

Formation of gas would seem to depend largely upon the iron sulphide content of the ores, as the galena, with the exception of a thin coat at the surface, remains practically unaltered. The oxidized material in exposed faces extends into the walls from one-half to three-quarters of an inch, beyond which little change is apparent. The amount of surface exposed is, therefore, an important factor in the formation of gas, which has a direct bearing on methods of ore handling.

If the muck from a round of holes in heavy sulphide is not removed, the beginning of oxidation is apparent within a few hours. Within a few days, the black sulphide is coated with white oxidized material, and the muck becomes recemented and difficult to handle. The storage of broken sulphide is prohibited by reason of the amount of gas and heat generated. The storage of any great quantity would doubtless pollute the whole mine so as to render it unfit for workmen, in addition to causing great danger of fire.

With reference to the temperatures of the gases, it is interesting to note that, though the carbon dioxide approx-

\*From a paper presented by A. J. May at a meeting of the Utah Metal Mine Operators' Institute, Oct. 7 and 8, 1921, Salt Lake City.



imates the temperature of the wall rock, the nitrogen will run from 60 to 90 deg. F. more. Depending on locality, the rock temperature will vary from 80 to 110 deg. F. in the quartzite, much less in the limestone, and a few degrees more in the sulphide zones. The carbon dioxide varies from 85 to 110 deg., and the nitrogen averages 175 deg. where close to the point of origin.

Oxidation in the wall rocks can be stopped or greatly diminished by guniting, which, though economical, has its limitation in that it is practicable only in drifts and crosscuts, leaving the much larger exposed surfaces in the stopes untreated. The temperature in one drift was lowered 40 or 50 deg. by this method. In a quartzite drift now being driven guniting is being postponed until the heading is far enough advanced to prevent heavy shooting from breaking the cement, but it is confidently expected that the gunite will not only reduce the oppressive temperature in this drift, but will also dam off an objectionable seepage of carbon dioxide from the numerous fissures.

The most satisfactory method that has been found in the Tintic Standard mine to handle the nitrogen problem is to maintain raises from the stope backs to the level above and to direct the ventilating currents downward through these rather than upward. This seems to clear out the gas better and leaves fewer dead ends and gas pockets, and, in fact, gives better working conditions at all faces.

Some idea of the activity of the oxidation which is causing the Tintic Standard's gas problem may be had from the fact that sills laid in the heavy sulphides are charred from the heat of the reaction. Though such phenomena are somewhat alarming, and the resulting gases are a disturbing factor in operation, some slight consolation is to be found in the non-poisonous nature of both the nitrogen and the carbonic acid gas, as well as in their quality of not supporting combustion, thereby having a tendency to lower the fire hazard.

### American Mining Engineers Honored

Nearly two hundred engineers attended the dinner to the delegation from the American Engineering Societies to Great Britain and France at the Hotel Pennsylvania, New York, on Oct. 10. Representatives of the British and French governments and of foreign engineering societies also were present. Medals struck by the French government were presented to the general chairman of the deputation, to the chairman of each individual delegation, and to the presidents of the four Founder Societies.

Honors conferred upon the visiting American engineers included the election of C. F. Rand to honorary membership in the Iron and Steel Institute, the Institute of Mining and Metallurgy, and the Institution of Mining Engineers. Arthur S. Dwight and William

Kelly were elected to honorary membership in the Institution of Mining Engineers.

### Bain Outlines Function of Bureau in Petroleum Industry

H. Foster Bain, director of the U. S. Bureau of Mines, recently addressed petroleum engineers and operators at the Engineers' Club of San Francisco. He discussed the relation of the Bureau to the oil industry. The initial work was undertaken by Dr. Holmes, who sent Bureau men into what was then the Indian Territory to control the waste of gas accompanying oil-drilling operations by applying muddling-off methods. This early work was successful, and since then the petroleum division has grown into an important and well-recognized relation to the petroleum industry of the country. Dr. Bain said that California was in advance of many other oil-producing districts and first developed engineering as applied to the problems arising in oil production. The methods developed in this state had been spread in part by the efforts of the petroleum division of the Bureau, to other producing districts of the United States.

Dr. Bain outlined the Bureau's organization for experimental work and stated that the real problem of the Bureau was to effect the translation of the laboratory processes to commercial-scale industrial processes. Instead of securing appropriations for large scale experimentation, the Bureau was co-operating with companies and preferably with associations and thus securing sufficient funds to test out promising research results instead of allowing dust to accumulate upon the reports already available.

Dr. Bain commented upon the Bureau's administrative difficulty caused by a large turnover in its technical staff, particularly in the petroleum division. The average time of service was two years and one month in this division. He stated that the Bureau was almost a school of instruction in advanced petroleum technology and research work.

In closing his address, Dr. Bain commented upon the position of the Bureau in relation to oil-land leasing. He stated that the Bureau had nothing to do with the making of the lease, but was charged with the responsibility of administering it after it was signed. It had no police power and simply represented the land owner, the Government. Its function is to check the returns and help people in handling the wells.

At the conclusion of the address, the chairman asked David M. Folsom to speak upon the relation of the petroleum industry to the Bureau. Mr. Folsom said: "The relation of the industry to the Bureau of Mines is extremely cordial and extremely friendly. It is welcomed in the industry because it comes to the industry conscientiously trying to help it."

### The Requirements of Hoist Signaling in Metal Mines\*

The simplest form of electric system comparable with the bell rope system comprises a pull switch at each station for each hoisting compartment, a pair of insulated wires (a common return may be used), a source of current at top, and single-stroke gongs.

An addition to the simple electric system can be made to guard against "illicit" signals. It comprises locked signaling switches at each station that can be operated only by a man who carries the proper key or operating device. The protection is not quite perfect because it does not prevent the mistake of signaling the wrong side.

The complete signaling system must provide means for non-executive signals as well as for the purely executive signals. By an executive signal is meant a signal giving direct orders to the hoisting engineer, such a signal being given only by a properly authorized person. Non-executive signals comprise requests from any one for the cage, and certain emergency signals. All such non-executive signals should be provided for by a telephone or flashlight equipment entirely separate from the executive signal system.

The classification of the types of signaling equipment can be made in many different ways, but perhaps the following is as good as any other:

First. All sending equipment located on stations with nothing on the cages.

Second. All sending equipment located on cages, nothing on stations.

Third. Part of sending equipment located on stations and part on cages.

In each classification there may be a sub-classification:

A. Signaling current the same as the gong current. This eliminates relays and permits the use of alternating current throughout.

B. Signaling current separate from gong current, the joint operation being effected by relays. This reduces the current and voltage of the signaling circuit to very small values and makes possible the use of dry cells as a source of the signaling current.

### Mining Institute of Scotland Meets

A general meeting of the Mining Institute of Scotland was held in the Heriot Watt College, Chambers St., Edinburgh, on Oct. 8. The following papers were presented and discussed: "Physical Work and the Human Machine," by Prof. H. Briggs; "The Beam Electric Head-Lamp," by William McNaughton; "A New Method of Measuring Ventilating Resistances, With Special Reference to the Operation of Mine Fans in Combination," by David Penman, and "Measurements of Air Velocities and the Testing of Anemometers," by James Cooper.

\*Abstract of a paper presented by Leonard Wilson at a meeting of the Utah Metal Mine Operators' Institute, Oct. 7 and 8, 1921, Salt Lake City.

## MEN YOU SHOULD KNOW ABOUT

Bulkeley Wells was recently in San Francisco.

Frank W. Royer has returned to Los Angeles from Virginia City, Nev.

Robert E. Palmer, consulting engineer for the Rio Tinto Co., is in New York.

John C. Ralston, of Spokane, is visiting New York and other Eastern cities.

W. J. Quigley and E. J. Donohue, of the Britannia Mining Co., were recently in San Francisco.

A. D. Chisholm left for South America on Oct. 12 to examine properties in Brazil for the Steel & Tube Co. of America.

Henry H. Armstead, president of Armstead Mines, Inc., has returned to Talache, Idaho, from a recent trip to New York.

William F. Ward sailed for Colombia last week, where he will be engaged in the examination of mining properties for several months.

E. P. Mathewson has been appointed consulting engineer to the Burma Mines, Ltd., and is on his way to the company's properties via London and Marseilles.

William Sloan, Minister of Mines for the Province of British Columbia, has been able to resume his work at Victoria after several months' absence on account of ill health.

Samuel Jewell, until recently assistant superintendent of the Marquette Ore Co.'s mines at Negaunee, Mich., has gone to Wharton, N. J., to assume charge of the Thomas Iron Co.'s mines.

R. A. Angst, former superintendent of the Woodbridge mine, Buhl, Minn., has moved to the Gogebic range in Michigan, where he has assumed his new duties as general superintendent of the Montreal Mining Co.

B. B. Thayer, vice-president of the Anaconda Copper Mining Co., was a visitor last week in Butte inspecting the company's properties. He also visited the phosphate deposits of the Anaconda at Soda Springs, Idaho.

J. L. Bruce, formerly manager of the Butte & Superior mine, and now manager of the Davis-Daly Copper Co., was in Spokane early in October, having been called there as a witness in the litigation arising from the Star-Bunker Hill-Hecla agreement.

M. J. Lorraine, of Alhambra, Cal., has completed a 2,000-mile trip by rowboat from the headwaters of the Columbia River to its mouth. Mr. Lorraine left Lake Windermere, in British Columbia, on June 13. He studied geological formations on the way and secured numerous photographs.

E. F. Burchard, of the U. S. Geological Survey, accompanied a party of state geologists on their recent visit to the mines at Cranberry, N. C. He is returning to Tennessee to take up co-operative work with the Tennessee Geological Survey on the brown iron ores of western Tennessee.

S. R. Elliott, general superintendent of the Cleveland-Cliffs Iron Co., Ishpeming, Mich., was a recent visitor to the Mesabi iron range, where he inspected the properties of his company. He was accompanied on his tour of inspection by Max H. Barber, district superintendent on the Mesabi range.

William Wearne, general superintendent of mines for the Inland Steel Co., has been given six months' leave of absence to recuperate from serious illness; and R. L. Wahl has been made acting general superintendent. Mr. Wahl, a graduate of the Michigan College of Mines, has been chief engineer for the company for the last six years.

Mining and metallurgical engineers visiting New York City last week included: E. H. MacDonald, Spokane, Wash.; E. J. Carlyle, Sudbury, Ont.; C. H. Palmer, Jr., Los Angeles, Cal.; E. W. Shaw, Tulsa, Okla.; William Kelly, Vulcan, Mich.; W. D. McMillan, Tchikapa, Belgian Congo; Paul W. Myers, Philadelphia; W. J. Priestly, Charleston, W. Va.; C. B. Murray, Cleveland, Ohio, and H. M. Boylston, Cleveland, Ohio.

## SOCIETY MEETINGS ANNOUNCED

The American Petroleum Institute will hold its annual meeting at the Congress Hotel, Chicago, Dec. 6, 7, and 8. The tentative plans to hold the meeting at Kansas City have been canceled.

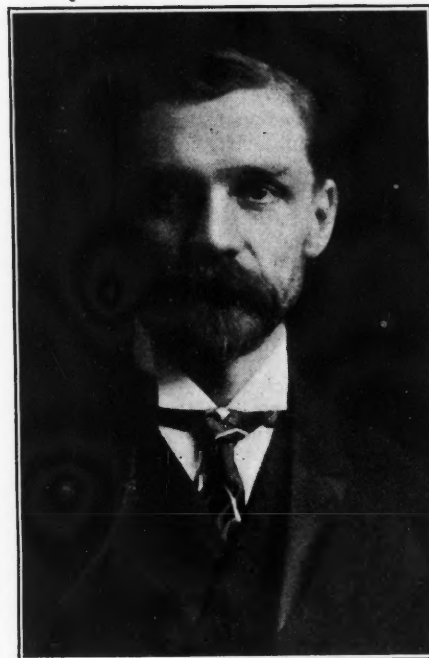
The Petroleum and Gas Committee of the A. I. M. E. will hold a symposium on foreign oil possibilities at the Engineering Societies Building on Dec. 10. Ralph Arnold is chairman.

## OBITUARY

James Kane Murphy, assistant superintendent of the Washoe Smelters of the Anaconda Copper Mining Co., died suddenly of heart disease at his home in Anaconda on Oct. 9.

Dr. Joseph Winthrop Spencer died in Toronto on Oct. 9 after a month's illness at the age of sixty-nine. He was born at Dundas, Ont., and was graduated from McGill University. He became professor of geology at King's College, Windsor, N. S., and occupied the same position at the University of Missouri, afterward being appointed state geologist of Georgia.

Dr. Joseph W. Richards, professor of metallurgy at Lehigh University, died suddenly at his home at Bethlehem, Pa., on Oct. 12. Dr. Richards was fifty-seven years old, and was born in Oldbury, England. He was a graduate of Central High University, and taught at that institution for more than thirty years. He was a member of many engineering clubs and the author of several books. He was a member of the United States Assay Commission in 1897; representative of the Franklin Institute to the International Geological Congress held in Russia in 1897; a member of the jury of awards, department of chemistry, of the National Export Exhibition at Philadel-



JOSEPH W. RICHARDS

phia in 1899; a member of the jury of awards and chairman of the metallurgical sub-jury, Panama-Pacific International Exposition, 1915, and a member of the United States Navy Consulting Board, 1915-1918. He was a charter member of the American Electrochemical Society.

Professor Richards was also a member of the following: The Faraday Society, Deutsche Bunsen Gesellschaft, American Chemical Society, American Institute of Mining & Metallurgical Engineers, former vice-president of the Institute, and chairman of the iron and steel committee since 1914; Iron and Steel Institute of Great Britain, American Iron and Steel Institute; Société de la Chimie (France); American Institute of Chemical Engineers, and an honorary member of the American Electroplaters' Association. He was a member of the Board of Engineering Foundations and of the National Research Council. On the Joint Conference Committee of the Federated Engineering Societies he was the representative of the American Institute of Mining and Metallurgical Engineers.



## THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

### Leading Events

The power supply of the Witwatersrand is described in a special article dealing with the largest power undertaking in the British Empire, the Victoria Falls & Transvaal Power Co., which will furnish the large South African gold mines with electrical power.

Railroads are to petition the Interstate Commerce Commission to reduce freight rates upon iron ore in an effort to encourage shipments and the lowering of finished material prices.

The State of Arizona is investigating the back payment of corporate fees of 33,000 mining companies and intends to dissolve delinquent corporations, of which there are many. The Consolidated Arizona Smelting Co. is to be sold and reorganized.

Secretary Mellon, in a reply to the resolutions of

twenty-two Western Senators, says that gold bonus legislation is unnecessary, as relief is gradually coming to the gold-mining industry and as the United States has more than enough gold to supply its needs.

A large contract has been signed by German potash producers and American fertilizer manufacturers. The price is believed to be below the possibility of American competition.

Reports from various sections of the country indicate that greater activity is noticeable in silver mining in Arizona, Nevada and British Columbia. Gold mining in California is on the increase. The advance in prices has stimulated Missouri and Oklahoma mining.

The experimental sulphur dioxide treatment of copper ores is giving encouraging results in the Southwest.

#### Railroads to Request Freight Reduction on Iron Ore

As an incentive and to encourage the shipment of more iron ore, the Eastern railroads have announced their intention of applying soon to the Interstate Commerce Commission for permission to lower the freight rate on iron ore shipments from lake ports to the furnaces. This reduction will amount to 28 per cent, and it was welcome news to iron and steel interests. Even though all mine operators and furnace men will not be able to take advantage of the new rate if it is established, it might have a bearing on the rate for next season. This reduction, should it be allowed by the commission, will be in effect until Dec. 31, 1921. It should be recalled that the rate on iron ore was raised 40 per cent on Aug. 26, 1920, so this reduction will greatly assist all companies that are in a position to take advantage of the same, as it will mean a reduction of 36c. per ton to Pittsburgh and 60c. to Schuylkill Valley points, which would mean approximately 75c. cheaper pig iron per ton in Pittsburgh.

Since the slump in the iron and steel business has been attributed partly to high freight rates, it is hoped that the present reduction has not come too late in the season to cheapen the cost of iron and steel products to the public, and it will also strengthen the arguments of those who have been advocating a reduction in freight rates to reduce the cost of living. If the lower rate on iron ore is absorbed by the manufacturers so that the public does not get the benefit, it would mean merely that the revenue which the railroads are willing to forego in the experiment will go into the pockets of the manufacturers.

#### The Power Supply of the Witwatersrand

Victoria Falls & Transvaal Power Co. Largest Undertaking of the Kind in British Empire—Subsidiary Furnishes Current and Compressed Air to Central Mining Corporation's Mines

BY M. EDWARD

Written for *Engineering and Mining Journal*

THE Victoria Falls & Transvaal Power Co., Ltd., in South Africa, is the largest power undertaking in the British Empire, and ranks as one of the largest in the world. The company was first formed in 1906 with the object of supplying electrical energy to the gold mines along the Witwatersrand. In 1908, the Central Mining & Investment Corporation decided to electrify its mines and agreed to purchase all its power from the Rand Mines Power Supply Co., Ltd., a subsidiary of the Victoria Falls company. It also stipulated that this company was to supply it with compressed air for its mines. At present there are two companies working under separate licenses granted by the government in terms of the Power Act passed in 1910, but both are managed in the same office and controlled by the same staff.

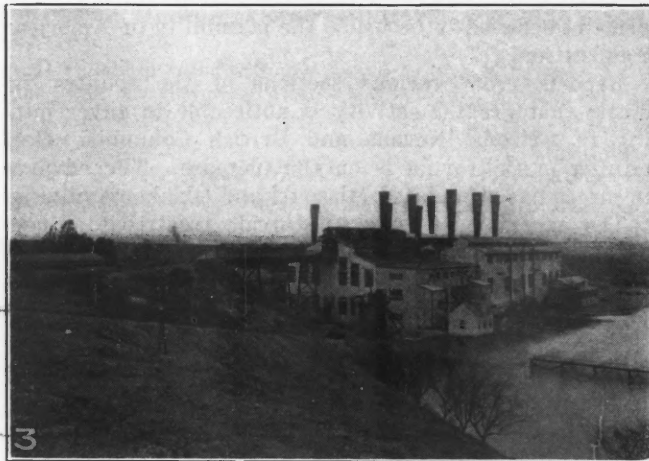
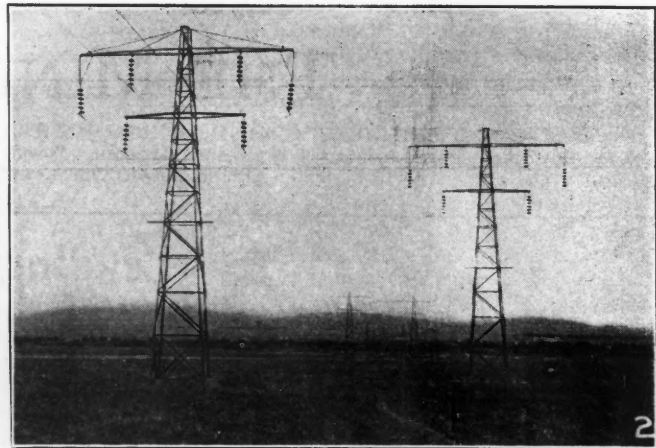
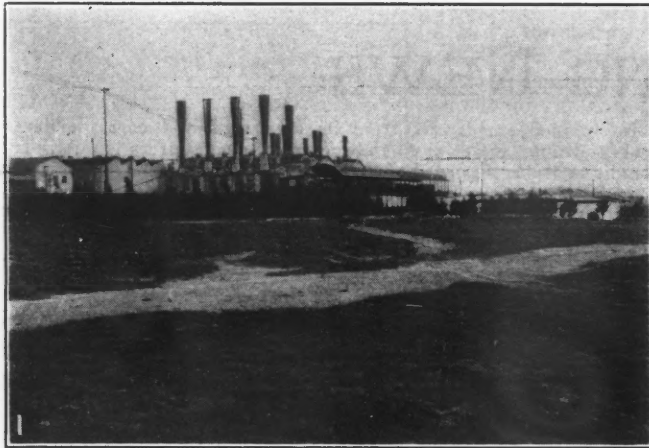
The capital of the V. F. P. (as it is most generally called) was as follows: Ordinary shares, 1,000,000 (issued as fully paid); preference shares, 2,000,000 (6 per cent cumulative and participating); debentures, 3,000,000 (5 per cent first debenture), and 1,650,000 (5½ per cent second debentures), making a total capital of £7,650,000.

The hugeness of the undertaking—all the larger because in a far-away country like South Africa—may be gaged from the power stations which were immediately erected. At Rosherville, six miles or so from Johannesburg, the largest station has been

erected with 64,000 hp. electric generators and 50,000 hp. air compressors. These air compressors and the electrically driven ones are all of the high-speed rotary type, and at Robinson station, mentioned later, are the most noteworthy of their kind, as regards capacity, in the world. The five 4,000-hp. steam-driven and the five 4,000-hp. electrically driven air compressors that were first installed were at the time the largest in the world. The three 10,000-hp. compressors which were added in 1914 remain today the largest units by far of their kind in existence, and are likely to remain so for many years, for what other industry will require as much compressed air as the chain of mines along the Witwatersrand?

Besides the Rosherville station, four other large stations were erected. These are at Simmerpan (56,000-hp. electric generators), about ten miles east of Johannesburg; Brakpan (40,000-hp. electric generators, 10,000-hp. air compressors), about twenty-two miles east; Robinson (20,000-hp. electrically driven compressors), about a mile west of the town, and Vereeniging, thirty-four miles south of Johannesburg (58,000-hp. electric generators). Vereeniging is situated on the Vaal River and is the well-known Orange Free State border town where the Peace Treaty was signed at the termination of the Boer War in 1902.

The boilers used in these power sta-



1—GENERAL VIEW OF SIMMER PAN POWER STATION, 56,000 HP. ELECTRIC GENERATORS

2—HIGH-TENSION TRANSMISSION LINE ON THE VELD IN SOUTH AFRICA.

3—BRAKPAN POWER STATION, SHOWING COOLING DAM, 40,000 HP. ELECTRIC GENERATORS, AND 10,000 HP. AIR-COMPRESSORS

4—ENGINE (TURBINE) ROOMS AT ROSHERVILLE POWER STATION, 64,000 HP. ELECTRIC GENERATORS AND 50,000 HP. AIR-COMPRESSORS

tions are of the marine water-tube type. Forty of these are installed at Rosherville, each capable of evaporating 40,000 to 50,000 lb. of water per hour into steam. The normal steam pressure is 220 lb. per sq.in. and the steam is superheated to a total temperature of about 340 deg. C. The special form of induced draft used is known as the Pratt ejector draft system.

At the time the plants were erected it was realized that one of the factors which has contributed in greatest measure to the successful evolution of large power schemes was the development of the steam turbine. The electric generating and steam compressor plants are all steam-turbine driven. The steam turbines driving the electric generators are of the Curtis-Rateau type and revolve at 1,000 r.p.m. in the larger electric generators and 3,000 r.p.m. in the smaller generators and the compressors. Practically all the circulation water and feed pumps are steam-turbine driven, the turbines running at 1,400 to 1,500 r.p.m. The circulation cooling water is obtained at Rosherville from a dam containing about 900,000,000 gal. of water and at the Vereeniging power station from the Vaal River.

The security of the supply of energy from Vereeniging station is naturally

dependent upon the reliability of the thirty-four miles of 80,000 v. transmission lines. However, as was anticipated when selecting Vereeniging as a station site, these transmission lines have proved more reliable than others.

The main transmission lines of the company extend from Randfontein, on the West Rand, to the Sub-Nigel gold mine, on the East Rand, a distance of about fifty-six miles, and thirty-four miles due south to the Vereeniging power station. The long lines of steel towers bearing these transmission lines are one of the first "sights" to be commented upon by people arriving in the "Gold City." The lines to Vereeniging appear to stretch way out into the wild veld and seem to have no object until one sees the tremendous chain of gold mines along the reef. Transmission pressures are 80,000 volts from Vereeniging, 40,000 along the reef, and 20,000 and 10,000 for distribution networks.

The mileage of the main transmission circuits is as follows: 80,000 volts overhead, 136 miles; 40,000 volts overhead, 82 miles; 20,000 volts overhead, 93 miles; 20,000 volts underground cable, 49 miles; 10,000 volts overhead, 40 miles; miscellaneous low-tension circuits, 21 miles; pilot and telephone cables, 202 miles; and telephone overhead, 55 miles; in all a total of 678 miles.

The following facts will be of general interest: In 1920 over 800 million units of energy in the form of electricity and compressed air were sold to consumers. This meant the burning of more than 1,000,000 tons of coal, a large proportion of which consists of duff, a byproduct from the collieries.

The Victoria Falls & Transvaal Power Co., Ltd., still remains the largest power undertaking in the British Empire, and would be considered large in the United States. As regards the supplying of compressed air, its position is, of course, unique. During 1920 about 1,500,000 short tons of air passed through the main pipe network from two compressor stations to the mines. At the time of the maximum load each day air is delivered at the rate of nearly ten short tons per minute. I am indebted to Bernard Price, chief electrical engineer of the V. F. P., for the details of this huge undertaking.

### Welsh Spelter Works Reopen

*By Mail From Reuters to "Engineering and Mining Journal"*

London, Oct. 4—Villiers' Spelter works, near Swansea, restarted 50 per cent of its plant yesterday. This is the first Welsh spelter works to reopen after many months of idleness.



### Arizona Checking Delinquent Corporations

There is to be a grand scattering of Arizona incorporations, most of them based upon alleged mining or oil prospects. In all, the Arizona Corporation Commission has in its files the incorporation papers of 33,000 companies. More than half of them have failed to file annual reports or to forward the annual filing fee of \$20. Now there is to be notification, mailed to the Arizona statutory agent, to the effect that the corporation concerned will be dissolved and its power annulled unless all missing reports are completed and all annual fees are paid within ten days. These demands, checked by the Attorney General, are to be sent out at the rate of 100 a day till the last letter of the alphabet is completed.

Some of the corporations are delinquent since their first filing, even twenty years ago. Most of them are believed to be out of business, though word has come of the sale of stock in the East by a number of corporations that have failed to obey the Arizona laws under which they exist. It is believed that at least 15,000 corporations will have been wiped out when the task of checking them has been completed here. A large proportion date back to the Nome rush and to the

earlier Texas oil boom, which happened in a time when the Arizona incorporation laws were of the "wide-open" variety, passed mainly for the benefit of local incorporation agents.

### Tin Output Curtailed in Dutch East Indies

*By Cable From Reuters  
to "Engineering and Mining Journal"*

London, Oct. 17—A cable dispatch received from Amsterdam states that the board of directors of the Banka & Billiton Tin Mines, in the Dutch East Indies, has decided to close several unprofitable mines, thereby reducing the production.

### Consolidated Arizona Smelting To Be Sold

At Tucson on Oct. 24, in the U. S. Court, will be heard a receiver's petition for the sale of the property of the Consolidated Arizona Smelting Co. of Humboldt. The Southwest Metals Co. has been organized for the purpose of taking over the property, its assets, and liabilities, and already is understood to have acquired by purchase nearly all the claims against the old corporation. Small claims have been paid in cash, and larger claims generally have been satisfied by exchange of stock in the new company.

The property is of large value, including a modern smelter of efficient type, capable of handling complex ores, a concentrating mill and two large mines, the Blue Bell and De Soto, from which has come a large part of the copper ore tonnage handled by the furnaces.

### Spain Forms Chambers of Mines

*By Mail From Reuters to  
"Engineering and Mining Journal"*

Madrid, Sept. 28—A royal decree announces the obligatory formation of chambers of mines in all the mining districts of the country. The object of the new chambers will be to encourage the mining and metallurgical industries, to furnish statistics and information, to found or subsidize mining schools, to raise loans with the authorization of the Ministro de Fomento, to intervene in labor disputes, to attend to all questions relating to hygiene and sanitation in the mines, and to assist in the distribution of labor by the establishment of labor exchanges.

The number of members in each chamber is fixed at not less than ten nor more than forty. The new chambers will act as consulting bodies to the government, and their views will be requested on all new projects, customs changes, and related matters.

## NEWS FROM WASHINGTON

By PAUL WOOTON  
Special Correspondent

### Mellon Gives Reasons Against McFadden Gold Bill

Events Have Proved That Government Subsidy Is Unnecessary, Says Secretary of Treasury

No legislation, such as the McFadden gold bonus bill, is needed to protect the gold reserve, says the Secretary of the Treasury in reply to the resolution of twenty-two Western senators transmitted to Secretary Mellon by Senator Oddie, of Nevada. Secretary Mellon expresses the opinion that the conditions which have affected gold mining adversely will right themselves gradually, "without a Government subsidy."

Senator Oddie is preparing a reply to the Secretary. This reply, he states, will reveal many vulnerable points in Secretary Mellon's letter. Mr. Mellon in his reply said:

"The Treasury's position with respect to this bill has already been stated in my letter of May 9, 1921, to the chairman of the Committee on Ways and Means, a copy of which is inclosed for your information. The developments which have occurred since this letter was written have confirmed the Treasury's views and have shown that as commodity prices return toward nor-

mal and costs become stabilized on a lower level relief should gradually come in the ordinary course of events from the difficulties of which the gold mining industry has been complaining. Already there are signs of some improvement.

"The bill presents two main questions, the first of which is of chief concern to the Treasury; namely, whether it is necessary or advisable to pay the proposed premium of about 50 per cent on newly mined gold and impose a tax on gold used in the arts in order to protect the monetary gold reserve of the United States. I think it is clear that there is no need for the legislation from this point of view. The market for gold is international, and in the present state of the exchanges the United States draws gold from every quarter and receives practically the whole gold production of the world, with the exception of what goes to the arts. The effect has been an unprecedented gold movement to this country during the past year or more, which has resulted in net imports many times greater than this country's normal annual production of gold. . . .

"The result of the operations of the last few years has been to accumulate in the United States the largest monetary gold reserve in its history, and the largest stock of monetary gold in the world. The total amount of mone-

tary gold in the country on Sept. 1, 1921, according to the inclosed monthly circulation statement of that date, is \$3,377,417,980, of which \$2,641,061,000 was held on Aug. 31, 1921, in the reserves of the Federal Reserve System. Since that date the reserves have been augmented by additional imports, and on Sept. 28 were \$2,725,966,000. Imports of gold are continuing at a heavy rate, and there are as yet no indications that the movement is at an end. . . .

"These figures show that there is no shortage of gold in the United States, and that there is nothing in the position of the gold reserves which makes it either necessary or advisable to encourage by subsidies or other artificial means new mine production of gold. As a matter of fact, the monetary gold supply of this country, instead of decreasing, has greatly increased in recent years, and is more than ample to meet the credit and currency needs of the country. The monetary stock of gold of the world has also increased during the last ten years, it has been estimated, by as much as \$2,000,000,000.

"The other question raised by the bill is one of legislative policy, on which the Treasury is not called upon to express an opinion; namely, whether a subsidy or bonus should be paid to domestic producers of gold because of

the hardships which the gold-mining industry has suffered during the period of abnormal war costs. As already indicated, I believe that these conditions will gradually right themselves without a Government subsidy, and that the difficulties in which the producers of gold have found themselves in the meantime are due chiefly to the fact that gold is the standard of value. It is true, of course, that the price of gold, as the monetary unit, is fixed by law, but this, in turn, gives compensating advantages to gold producers in other times, when production costs are low, because of the assured market at a fixed price which is always available. It is difficult in these circumstances to see what special equity there is in the claim for a premium when costs are high. There would certainly be no suggestion of a discount if costs were low.

"The tax which the bill would impose upon the use of gold for non-monetary purposes, while in form a tax, would in fact put restrictions upon the free convertibility of the currency into gold. If gold could not be used, except under heavy penalties, for anything else than money, its value would be impaired and there would be, in effect, a clog on the convertibility of the currency. One dollar in paper currency, in other words, would not buy one dollar's worth of gold, if the gold was to be used in the arts. Gold in large quantities, moreover, is imported from abroad and even under legislation like that proposed could be purchased in foreign countries in the open market. To put a penalty on foreign gold thus brought into this country for non-monetary purposes, in order to pay a premium to domestic producers, would seem to have little or no relation to the protection of our own monetary gold reserves.

"I have noted particularly the request made in the resolution which was presented with your letter that if the Treasury be opposed to H. R. 5,025 it formulated a proposal for enactment by Congress to relieve the gold-mining

industry and protect the gold reserve. As already indicated, I believe that no legislation of this character is needed in order to protect the gold reserve, and therefore have no proposal to suggest for this purpose. On the question of possible legislation to provide a bonus for the mining of gold, the Treasury also has no proposal to submit, believing, as indicated herein, that if such a bonus were to be granted it would come as an exercise of legislative discretion by Congress."

The letter of May 9, 1921, to the chairman of the Committee on Ways and Means, to which reference is made in the above letter, states:

"I hold the general view that the difficulties in which the gold producers find themselves are due to the fact that gold is the standard of value. In a sense this is the penalty which gold pays for being the standard. These difficulties should gradually adjust themselves without a Government subsidy as deflation progresses and commodity prices return toward normal. As I see it, the question of whether the Government is to give a bonus on these terms to a special class of producers is a question of policy which addresses itself to the judgment of Congress, and not a question upon which the Treasury is in a position to express an opinion."

#### No Enthusiasm for Exchange Stabilization Conference

Presentation of arguments for an international conference on exchange have failed to arouse any enthusiasm on Capitol Hill. The consensus of opinion appears to be that nothing will be gained by such a conference as is proposed in a pending bill. The opinion seems to be that the causes of the difficulties in the exchange situation are thoroughly understood, as are the steps that would be necessary to

remedy it. A conference could only recommend. It could not put its recommendations into effect. As these recommendations could be written in advance, the efforts should be concentrated on securing the necessary legislation and on inducing the banks of issue to take the steps which are obvious.

#### Sign Contract for German Potash

Six large manufacturers of fertilizer, according to information reaching the U. S. Potash Producers' Association, have closed a contract for 80 per cent of their potash requirements for the next season with the German syndicate. The price is understood to be close to the pre-war level. The closing of this contract, it was stated, leaves comparatively little business to be divided between the French and American producers. No American producer of potash is able to compete with the German product at the price offered. It was stated that they would not attempt to enter the market at the present price level.

The delay in the passage of the tariff bill is blamed by the domestic producers for this large contract going to Germany. They contend that they would have been able to meet the price of the German potash had the duty carried in the tariff bill been in effect.

#### Pittman Act Silver Purchases

The purchases of silver by the Bureau of the Mint during the week ended Oct. 15 totaled 2,282,000 fine ounces. This brings the total purchases of silver under the Pittman Act to 78,173,866 fine ounces. Purchases will total 207,000,000 ounces.

## NEWS BY MINING DISTRICTS

### London Letter

#### The Position of New Modderfontein Gold Mining Co., Ltd.

By W. A. DOMAN

London, Oct. 4—Though maintaining its position as the premier gold mine of the Witwatersrand—it might perhaps be truthfully said the greatest gold mine of the world—the New Modderfontein felt adverse influences during the twelve months ended June 30 last in the same way as other mines on the field. But being such a rich property—relatively, of course—it was better able to bear the burden. In various directions working results created a record; the outcome, however, would have proved in a sense disappointing had it not been for the additional price received for the gold. The position for the twelve months ended June 30 may be shown thus:

	1919	1920	1921
Tons milled....	920,500	968,500	1,083,000
Profit at standard price....	£1,089,891	£1,029,188	£947,625
Gold premium....	nil	£464,657	£751,427
Total working profit.....	£1,089,891	£1,493,845	£1,699,052
Premium contributes to profit per cent.....	nil	31.1	44.2

In other words, owing to the rise in costs over the period shown and a slightly lower grade of ore milled, the treatment of 162,500 extra tons produced less profit at standard rate by £142,266. In part explanation of the increase in costs in the latest period must be mentioned a large amount of abnormal work which represents about 9d. per ton milled.

If expenses be calculated at per ounce of gold produced, the showing during the last four years is: 1918, 38/10; 1919, 38/6; 1920, 42/6; and 1921, 48/2. White wages over the same years have risen from 6/4 per ton in 1918 to 7/1

in 1921. The balance is made up of enhanced prices for stores and materials. Shareholders have again derived considerable benefit from the year's operations, as is indicated as follows:

	1919	1920	1921
Total profit....	£1,089,891	£1,493,845	£1,699,052
Dividends, per cent.....	62½	82½	100
Amount distributed.....	£875,000	£1,155,000	£1,400,000

It would almost appear from the development viewpoint that the mine had exceeded expectations, for "very satisfactory values" were obtained in the western section, where active work has been resumed, and the eastern section continued to fulfill expectations.

The western section, giving the "very satisfactory values," contributed between the 12th and 13th levels west of No. 2 shaft 302,800 tons, of 9.7 dwt. value over 82 in. stoping width. As there is over seven years' supply of ore



for the mills, the reserve position is decidedly strong. The consulting engineer states that the general position of the mine is all that can be desired, and given sufficient labor, the output for the current year can be increased a further 200,000 tons. The mine has worked only 87.4 per cent of its complement of natives, and consequently is to a certain extent handicapped.

A feature of the New Modderfontein is the narrowness of the reef and the great stoping width. A distance of 9,105 ft. was sampled on the Main Reef Leader, the average width being 15 in., the average assay value 53.5 dwt., and the number of in.-dwt. 803. As the stoping width averaged 69 in., the reef was only 21.74 per cent of the total, and surrounding rock 78.26 per cent, or 27 in. on each side of the reef.

### Johannesburg Letter

#### Rand Gold Output for August Greater Than July's—Board of Trade Organized

BY JOHN WATSON

Johannesburg, Aug. 12—The Transvaal gold output for August was reported by the Chamber of Mines on Aug. 10, and shows an increase over that of July of 21,971 fine ounces, the increase in value being equal to £88,010. The total output for August was 711,526 oz. fine gold, equal in value to £3,966,751. The value for August was taken at £5/11/6 per fine ounce, whereas in July the figure was 1s. per fine ounce more. Out of a total of forty-two gold mines, thirty-one show an increase and eleven mines show a decrease. The largest individual increases are shown by Government Gold Mining, with 5,863 oz., and Van Ryn Deep, with 3,258 oz. increase. On the other hand, the largest decreases are shown by Modder B, with 1,595 oz., and Crown Mines, with 1,203 oz. decrease, as compared with July. The native labor returns show a total of 184,661 natives employed during August on gold, coal, and diamond mines, this total being an increase of 1,728 as compared with July.

A Board of Trade and Industries has been appointed for a period of three years, and Sir E. H. L. Gorges is chairman.

#### Rand Makes Rock-Drill Tests

Johannesburg, Sept. 6.—I referred to rock-drill tests briefly a few weeks ago in summarizing the presidential address of R. C. Atkinson to the South African Institution of Engineers. A fuller report of this portion of the address has now been published by *The South African Mining and Engineering Journal* of Aug. 27. In September, 1919, investigations were started with a view to finding out the relative merits of the various patterns of rock drills and to collect data relating to the drill steel in use on the mines.

The field of investigation included jackhammer rigs; systems in vogue for bringing drills up for repair; testing for efficiency after repair; systems of issu-

ing drill steel; methods of shanking and tempering; tests with solid and hollow steel; amount of dust created by different drills and steels; relative merits of water attachments for reciprocating machines, and considerations affecting the breaking of ground generally.

Preliminary engineers soon showed that there existed considerable divergence of opinion regarding the most efficient pattern of rock drill and the most economical size of hole. It is generally known that about 70 per cent of the working expenses of a mine are incurred underground; but it is not always realized that the operation of drilling holes involves a greater expenditure than any other individual operation on the mine, either underground or surface. The costs on one of the mines in the central area of the Rand showed: Rock-drilling (excluding blasting) 20 per cent of total working costs; shoveling and tramping, 15 per cent; winding, 10 per cent; pumping, 3 per cent; total reduction costs, 14 per cent of total working costs. One factor which accounts for the high cost of machine rock drilling is the fact that only about three and a half hours (out of the twenty-four) are available for drilling and the machine is actually in operation only about two hours. In some cases a reorganization of the underground shifts has been suggested by the management and opposition was encountered from the advisers of the very men for whose benefit the change was suggested. The industry has thus been handicapped, working costs remain high, tending to close low-grade mines to the detriment of mine workers themselves and of the trading community at large. At the outset of these investigations it was recognized that their magnitude was so great that no one man, or even a number of mining men, could deal (in their spare time) with the records and trials. A strong and representative committee was formed, embracing consulting mining engineers, mine managers, and mechanical engineers, who met frequently in committee and also at the working face underground.

The machines underground were operated under the constant supervision of some one who could be relied upon to conduct the tests without prejudice, and who had the necessary training for experimental work, so that each machine could be operated under parallel conditions. The mining man appointed for this work was trained at the Royal School of Mines, London, and has had considerable and varied underground experience, both practical and in an official capacity. The operator was assisted by observers from the Miners' Training School, (one to each machine), who recorded detailed observations, continuously, throughout the shift, together with the usual complement of "machine boys" (native operators) and drill carriers. The actual results of these trials will be given in detail at a later date; but the president dwelt now upon what is being done and the cost of these trials, in the hope that the average

mine worker might be brought to realize that heavy extraordinary expenditure is continually being incurred—necessitating capital—in order to determine the cheapest methods and also to improve the conditions for the operator.

### CANADA

#### Toronto

#### Allied Porcupine-La Palme Porcupine Agreement Reached

The disagreement between the Allied Porcupine Gold Mines, Ltd., and the La Palme Porcupine Mines, Ltd., referred to in our issue of Sept. 10, and the misunderstanding that arose between the companies, has been satisfactorily arranged. The amalgamation planned is being carried through.

#### British Columbia

#### Silver-Lead Mining Improving

Cranbrook—Nickel possibilities of this district have been recently investigated by outside capital.

Cleaning up is under way at the placer property of Wild Horse Creek Placer Gold Mining Co., Perry Creek, and upon completion operations will suspend for the season.

Kimberley—A considerable number of the men employed by the Consolidated Mining & Smelting Co. at the Sullivan mine have been laid off.

Ainsworth—Leasing activity is increasing slightly here, with G. McPherson and Jack Sherman appearing as new lessees at the Silver Hoard, and T. Hawes and Amil Peterson have secured a block of ground at the Consolidated's No. 1 property. W. E. Zwicky and R. Foulkes, of Kaslo, have begun leasing operations at the Krao, owned largely by Butte interests, and which produced several shipments of high-grade silver ore last season.

Neisor—Improvement in the "foreign" price of silver and the likelihood of improved smelter settlements on the part of the Consolidated Mining & Smelting Co.'s Trail plant have combined, along with some reduction in operating costs, materially to better the outlook for silver-lead mining operations throughout East and West Kootenay generally. Prospectors have made several promising strikes during the season, and it is generally felt that the worst of the depressed level in mining has been passed.

Alice Arm—A rich strike of high-grade values in gold, silver, and copper has been made recently by John Hauber and William McLean on the Cascade Falls group of claims, in the vicinity of Kitsault glacier. A 16-ft. ledge has been traced for the full length of two claims.

Stewart—Right of way for the tram to the Silverado property, with other outside work and camp construction, is well in hand.

Development by the Fitzgerald brothers on their Independence group, Goose Creek, during the last season, has opened up low-grade milling ore.

## ARIZONA

Sulphur Dioxide Ore Treatments  
Encouraging

Tucson—Tests completed in the University of Arizona laboratories are reported to have demonstrated the success of the sulphur-dioxide leaching process on mixed ores from the Miami district. The Inspiration company, at Miami, has been conducting exhaustive experiments looking toward betterment of the methods by which the semi-carbonate ores are handled that now so materially reduce extraction.

From Cananea word has been received of the employment of a force of men for work in connection with the property's rehabilitation, putting the several mines in condition for operation in the event of the expected resumption of the copper industry. A number of the mines are understood to need unwatering, and much repair work will have to be done.

Percy Williams, manager of the Tiro Lease, at Silver Bell, has returned from New York and states that he expects early resumption of work on the property. Production costs are low.

Calumet & Arizona is reported to have purchased ten mining claims in Steeple Rock district, just across the New Mexican line, southeast of Clifton. The property embraces the Ballalli and Norman King groups, both gold-silver producers. Near Lordsburg, to the southward, the C. & A. operated the 85 group of copper mines, managed by Karl H. Mohler.

Near Patagonia, the Montana Development Co. has started on development of silver, lead, and zinc mines. John Hoy, of Nogales, is in immediate charge. Charles J. Vopicka and Mrs. Jennie H. Strong, both of Chicago, are interested in the company.

A business men's organization has been established in Globe, to combat alleged rank discriminations in freight rates in the Southwest. It is said that Montana, which is even more remote from San Francisco than Arizona, enjoys much more favorable freight tariffs than this state. An instance is bar iron, from Kansas City, which takes a rate of \$3.78½ per 100 lb. to Anaconda and \$5.32 to Globe. Coast bullion rates also show discrimination.

William H. Reynolds, who is rated as the largest individual stockholder in the Copper Mountain Mines Co., has filed protest with the Arizona Corporation Commission against a petition offered by the officers of the company who wish to discharge the corporation's debts by a sale of 194,000 shares of treasury stock at 5c. a share, with possible exception of 60,000 shares. The property is near Mayer.

## More Silver Mines Resuming

Tombstone—Regular shipments by the various lessees are going out from here to El Paso, and mining in general is picking up and will take on more life as soon as the two mills that are now

idle resume milling. The Milgrim mill is idle, but will again start up as soon as it can get a larger engine. Burt Holland is adding a rod mill to his concentrator and will soon be turning out white metal from the Emerald dumps. The old Pueblo Leasing Co. is working three shifts in its mill and in the State of Maine mine, on which it has a lease. Several bars of bullion have been shipped to the mint.

The Tombstone Extension Mining Co. is hauling vanadium ore from its properties at the old town of Charleston to the concentrator formerly operated by the Co-operative Milling Co. and now operated by Mr. Stockham. The ore concentrates better than 25 per cent  $V_2O_5$ , with a goodly per cent of silver and lead. Others that own vanadium-bearing ores at Charleston are considering the advisability of hauling ore to the concentrator. The Tombstone Extension Mining Co. is a new concern, and J. B. Gallagher is its president. It is understood that the majority of the stock is held in San Antonio, Tex.

## MONTANA

## Moderate Activity Around Butte

Butte—The Butte & Superior drift on the copper orebody on the 2,200 level of the Black Rock mine is continuing. A program for the opening of this orebody on the 2,600 level has been mapped out.

Tuolumne Copper Co.'s west drift is showing improved ore, with the silver content holding up to 12 oz. and the copper up to 2½ per cent. The promise is such now as to warrant the belief that a large body of ore of a shipping grade is near.

Anaconda is doing a moderate amount of development work. Chief feature of interest in connection with the affairs of this company is the production of a copper-zinc shingle, the size of which has been enlarged to six ft. Work is being pushed at its phosphate deposits near Soda Springs, Idaho, where 200 men are employed.

East Butte Mining Co. is preparing to resume operations at its gold property near Elkhorn, Mont., where it has a cyanide mill. The company has an extensive deposit of iron ore, which carries up to \$8 in gold values.

North Butte has a good showing of high-grade ore on its 3,600 level of the Edith May vein.

Deer Lodge—The concentrating plant of the Emery Mining Co. will resume operations this week.

The Evening Star Co. is making regular shipments from the Big Dick mine, near Elliston, to the A., S. & R. Co.'s East Helena plant.

Virginia City—The Old Channel Placer Mining Co. has been organized for the purpose of prospecting the Old Channel of Alder Gulch, the most famous placer gold producing district in the world, considering the area worked.

## UTAH

## Utah Copper Wins Tax Suit

The controversy between the Utah Copper Co. and Salt Lake County in regard to the assessment of the company's tailings dump as a part of the mine or as a personal property and assessable as such was decided by Judge Tillman D. Johnson in favor of the copper company, which held to the first-mentioned contention, i. e. that the dump is a part of the mine and therefore not otherwise assessable than as mining property. In Utah mines are assessable according to three times the value of the net annual proceeds. Acting on the theory that the dump be considered as personal property apart from the mine, Salt Lake County assessed the dump, holding it to be assessable even though there were no net proceeds from it. This assessment the copper company contested.

A similar case is pending between the South Utah Mines and Beaver County, although in this case the positions taken by the mining company and the county are reversed. The South Utah Mines is contesting an assessment made according to the net proceeds, which would make the dump a part of the mine, and which was fixed by the state board of equalization, which took the sum of \$120,547, net proceeds from a year's operation in 1918, when the dump was entirely worked out by a leasing company under agreement with the owners. The mining company, which for a number of years has not been working its mine, is contesting this assessment on the grounds that the property value could not possibly have been three times the profits received, that the dump was separate and apart from the mine itself, and that the method of assessing mining properties is in violation of the constitution. Judge Johnson, as mentioned above, holds the tailings dumps of mining properties are not separate properties. The additional issues, however, are of importance inasmuch as the method of reaching the valuation of mines for assessment is involved.

Bingham—The Utah Apex and the Utah Consolidated are at odds in the accounting for ore taken by the Utah Consolidated, from a ground, by court decision, awarded the Utah Apex, the Utah Consolidated presenting \$650,000, and the Utah Apex claiming about \$1,500,000. The Utah Apex obtained court permission to permit an audit of the Utah Consolidated books, and this it is claimed showed errors and discrepancies which brought the sum up to about \$1,500,000. The accounting hearing began in the trial court on Aug. 22, and lasted until Aug. 27. The Utah Consolidated admitted errors and discrepancies, but maintained different charges objected to by the Utah Apex, and applied for an extension of time. The hearing did not take place until Sept. 29, when the court took the case under advisement.

Park City—Shipments for the week ended Oct. 7 amounted to 1,923 tons, as compared with 1,805 tons the week pre-



ceding. Silver King Coalition shipped 765 tons; Judge Allied companies, 720 tons; Ontario, 393; and New Quincy, 45.

The New Quincy has opened ore of shipping grade, and the find is regarded as promising. A shipment of thirty-two and a half tons of this ore, dry weight, brought \$1,441 net returns. The Spiro tunnel, which has been driven over 14,000 ft. to prospect the Thaynes canyon ground and to make connections with the California Comstock ground, is approaching its objective. Some ore has been recently encountered in drifts from the tunnel.

**Salt Lake**—The Alta Tunnel & Transportation Co. has opened silver-lead ore of shipping grade. Stoping has been started, and a 5-ft. bed of ore followed upward about 40 ft. from the No. 3 raise. Fifty feet from the raise drifts will be driven each way to determine the lateral limits of the ore. Four teams and two trucks are hauling the ore down Big Cottonwood canyon.

**Eureka**—Tintic shipments for the week ended Oct. 7 amounted to 178 cars, as compared with 144 the week preceding. Shippers were: Tintic Standard, 63 cars; Chief Consolidated, 40; Iron Blossom, 13; Victoria, 12; Eagle & Blue Bell, 11; Iron King, 9; Dragon, 8; Centennial-Eureka, 6; Bullion Beck, 4; Colorado, 3; Swansea, 2; Gemini, 1; Mammoth, 1; Gold Chain, 1; Alaska, 1; Eureka Hill, 1; and Sunbeam, 1.

#### COLORADO

##### Hidden Treasure Mill Ready To Start

**Ouray**—The Hidden Treasure Mines Co., under E. R. Baur, has nearly completed its experimental mill and expects to be in operation within a few weeks. The mine has a quantity of silver ore developed, carrying lead and zinc. The mill will be started with crusher, rolls, tables, Huntington regrinders, and tables while the flotation apparatus is being assembled. Results from the experimental work will be the basis for more elaborate plant.

The Hardinge 5-ft. ball mill and Dorr Duplex Classifier for the Mountain Top Mining Co. have been delivered and are being put in place to effect the doubling of capacity planned. The scheme involves roughing table operation with additional flotation apparatus. The mine is in unusually good silver-lead ore and making a good production.

**Golconda Mines Consolidated** have completed their long crosscut in Hurricane Basin and have begun drifting on the vein, with a good showing of milling ore. Operations will continue until the end of the year and be suspended until next spring, the experience of the company during recent winters having shown it to be extremely difficult to continue operations throughout the winter at so high an altitude, so far from the base of supplies at Lake City.

The Lucky Twenty Co. resumed operations the first of the month under J. A. Lannon, after a shutdown of nearly a year. The air compressor

was started for the first time with the intention of driving a new crosscut to reach the main vein on the Guadalupe mine under the old shoot.

Fred G. Farish, of the Metals Exploration Co., recently visited the camp and made several examinations, but the company is not now operating anywhere in the county, the Red Mountain Mines Co. being still shut down. Kirby Thomas, of New York, also visited the camp recently, and the old Wanakah is being examined by P. F. Welch, of Denver.

**Ophir**—The New Dominion property is being operated by Morgan & Chandler, lessees, and ore from development is being shipped to the smelter at Durango. The Carbonero mine is producing two or three cars of shipping ore per month. The American Frenchman and O'Brien properties are being developed by lessees, and payable ore-bodies have been opened.

#### CALIFORNIA

##### Gold Mining Activity Increasing

Gold mining in California continues to show improved interest. Sales of mining property and options on smaller properties are increasing in number. Machinery companies report more inquiries, especially in placer mining equipment. Minor discoveries are announced in local papers, indicating considerable small activity. Grass Valley, Sutter Creek, Jackson, and the Mother Lode, south of Angels, are back to a normal condition.

**Sutter Creek**—The Central Eureka reports increased production for the current month.

**Keswick**—Construction of the new wire-rope tramway of the Mountain Copper Co. is going ahead rapidly.

**Dedrick**—Machinery and other equipment of the Globe mine are being dismantled and shipped to Gold Hill, Nev., for use in the United Comstock Mines Co.'s new mill.

**Redding**—The old Gladstone mine, near French Gulch, is being rehabilitated. At Lewiston the new 7½-cu.ft. dredge under construction by the Gardella Dredging Co. is expected to be launched next week, when its equipment will be placed in position.

**Downieville**—The Gold Gravel mine, at Little Grass Valley, is reported to have struck rich gravel in a recently discovered channel.

**Oroville**—The Morington Mining Co., operating at Hartman's bar, on the Middle Fork of the Feather River, has closed operations for the winter.

#### NEVADA

##### Increased Interest in San Antone District

**Virginia City**—The portal tunnel heading of the main haulage tunnel of the United Comstock Mines Co. made connection to the Knickerbocker heading on Oct. 4. The haulage tunnel, when completed, will have a total

length of approximately two miles, and to date the work is 85 per cent completed with only about 1,500 ft. to drive. It is estimated that the work will be completed by Jan. 1, 1922. Building operations on American Flat are progressing satisfactorily.

**Mina**—The power line now being constructed by Mineral County between Hawthorne and this district will be completed about Nov. 1, and the Simon Silver Lead Mining Co. will begin production at that time. The mill as constructed has a capacity of 200 tons per day, is of selective oil flotation type, making two concentrates, one lead-silver and the other zinc. The lead-silver concentrate will be shipped to Salt Lake smelters and the zinc concentrate to the company smelter at Harbor City, Cal., and manufactured into zinc oxide.

**San Antone**—The Hudson Mining & Milling Co., twenty-eight miles north of Tonopah, in the San Antone mining district, is about to resume operations. Prominent Tonopah and Salt Lake men are interested in the company and former differences between stockholders have been satisfactorily settled by reorganization. Past production is about \$40,000 in gold and silver, with a little lead. Development consists of several shafts, the deepest of which is an incline 300 ft. deep. This shaft is to be sunk to a depth of 600 ft. In addition to company work leases are being granted.

**Tonopah**—Recent bullion shipments from Tonopah, representing clean-up of operations for the last two weeks of September, are as follows: Tonopah Belmont, \$150,000; West End, \$65,000; Tonopah Mining, \$50,000; Tonopah Extension, \$47,000; and MacNamara, \$26,000. This is at the rate of over \$650,000 per month, which is normal and shows the healthy condition of the industry in this locality. All mines are working at capacity, and labor conditions are good. Developments are as usual and about keeping pace with ore production. Operating profit reported by the Tonopah Extension for August was \$17,326; the net profit of the Tonopah Belmont for the same period was \$52,320, and for the West End \$63,745.

#### MICHIGAN

##### The Copper Country

**Coal-Pulverizing Plant at Michigan Smelter Giving Good Results—Possibilities of Peat—Copper As a Roofing Material**

**Houghton**—The Michigan smelter, which treats Copper Range, Mohawk, and Wolverine mineral, has effected a notable economy by means of its coal-pulverizing plant. It has been in operation now for several months and is working smoothly and efficiently, the results being most gratifying. It has cut coal consumption down almost two-thirds in the furnaces. The coal is ground into a fine dust and automatically fed into the furnaces by means of compressed air. Whereas it formerly took 1,500 lb. of coal to treat a ton of

mineral, it now requires only 525 lb. The plant was built at a cost of \$150,000, but will pay for itself in three years' time.

A possibility exists that some day powdered peat will be used as fuel in furnaces in place of coal. There are immense peat beds only a few miles from Houghton, which are about to be developed. One of the first experiments will be with powdered peat as fuel. It is probable that a test will be conducted at one of the local smelters to compare the relative efficiency of coal and peat for furnace purposes. The peat deposit has been declared to be almost inexhaustible, and preliminary tests have already established the possibilities of the product as a fuel.

Much interest has been taken here in the announcement that the Anaconda company has entered upon the manufacture of copper shingles. The belief is expressed that in an extension of the uses of copper the greatest possible outlet for the metal is for roofing purposes.

A Copper Country man just back from Germany reports that roofs in that country were quite generally stripped of copper during the war, and that eventually the metal taken from government buildings in all cities and towns will be replaced. Much copper will be required for this purpose alone in Germany, but it will not be purchased until Germany's finances are on a better basis. For a great many years the Germans have been partial to copper roofs, having found copper the best and cheapest material in the long run.

In connection with the wearing qualities of copper for roofing, it is interesting to note that the Houghton County courthouse, built in 1886, has a copper roof which has required no repairs and is as good as the day it was put on; the tower of the town and fire hall of Houghton was covered with copper in 1883, and no repairs have been necessary to date, a period of thirty-eight years.

There is no change in developments in Mayflower-Old Colony. The main south drift for practically its entire length of 300 ft. from the crosscut at the 1,700 level is still in commercial ground. This opening holds out a greater promise than any other developed in the property to date. No faulting is in evidence and apparently the best values will continue to be found in this direction. The drift to the west from the 1,700 is continuing, but the values are negligible, and it is probable this work will be suspended soon, and that exploration will be started with two drills on the 1,400 level.

Early delivery of a hoist for No. 2 Gratiot shaft of the Seneca is anticipated. It is expected it will be in operation before winter sets in. This shaft is to be sunk to a depth of 4,000 ft. and then connected with the Seneca shaft. All openings in Seneca continue in good ground.

## MINNESOTA

### I. C. C. Rate Case Postponed

The iron-ore rate case now pending before the Interstate Commerce Commission, known as the Adriatic Mining case, was to have come up in Chicago on Oct. 10, but has been postponed until some date in December.

Duluth—The anticipation of the earlier season that Lake shipments of iron ore would be concluded by Nov. 1 will not be realized. The ore has not been moved from either mines or docks as rapidly as had been expected, owing to the congestion of storage areas at the lower Lake ports. As certain of the consumers have tonnage and grade requirements which must be supplied before shipping season closes, it is probable that final cargoes may not leave the docks until Nov. 15. The ore-carrying railroads always desire an early wind-up of the shipping, owing to the expense of thawing frozen ore.

Shipments from all Lake Superior docks for the season up to Oct. 1 amounted to only 18,661,194 tons, compared with 44,273,356 tons on the same date last year, a decrease of 57.85 per cent. The total season's shipments will not reach 25,000,000 tons.

Buhl—The lease on the Woodbridge mine, formerly operated by the Fort Henry Mining Co., has been given up, and all equipment will be dismantled and moved to other operating properties. The houses were sold to individuals who intend to move them elsewhere.

The controversy relative to the payment of taxes between the village of Chisholm and three of the operating mining companies within the village limits—namely, the Shenango Furnace Co., the Hanna Ore Mining Co., and the Oliver Iron Mining Co.—has virtually been settled. The settlement is to be made on a basis which was advocated by the business men of the village several months ago, and which was acceptable to the mining companies, for the sum of \$600,000.

### Menominee Range

#### More Companies Resuming Operations

Crystal Falls—The McKinney Steel Co. has resumed operations at the Tobin and Odgers mines, idle since last spring. Over 300 men are now employed at the two properties on a two-shift basis. Practically all employees who were working at the mines when they were shut down have been given places. Hoisting will be done through the old Odgers shaft until the new shaft, which is nearly finished, is completed. These are the first mines on the range to resume work, but it is thought that some others that have little ore in stock will be reopened at an early date. The Balkan Mining Co. is shipping from stockpile from the Balkan and Judson mines. About 200,000 tons will be moved, of which amount 50,000 tons will be from pocket. The new 1,000-gal. Aldrich duplex pump is now in operation.

## MISSOURI AND OKLAHOMA

### Advance in Metal Prices Stimulates Mining

Joplin, Mo.—With lead ore strong at \$60 a ton and zinc showing a tendency to advance toward \$25, there is talk of a revival of mining operations in the Missouri section of the Tri-State field, particularly in the vicinity of Duenweg and Joplin. It is an admitted fact that there are innumerable untouched deposits in and around Joplin and Duenweg, as well as at Webb City and Cartersville. At \$60 a ton, and with the present price of labor and supplies, lead can be mined profitably. In a large number of cases, however, the mining operations now being considered would be carried on by practical miners, working for themselves. It is believed that the situation marks a revival of the once popular practice of "grub-staking." There are many miners in the field who are not steadily at work at other employment, who would be glad to turn to "gouging" for lead, and with prices even as they are now, there will be people ready to back them with money.

West Plains, Mo.—The consolidation of the Missouri Iron & Steel Corporation and the St. Louis Iron & Steel Co. is said to involve an important development. The officers of the company gave it out that it means the blowing in of the big blast furnace at Haigart, ten miles southeast of West Plains, at an early date. Coke will be used as fuel to blow in the furnace and later on will be supplanted with charcoal to be made from timber found in near-by forests. The consolidation of the two companies adds 5,500 acres of ore and timber land to the company's holdings. This land is in Wayne County. It gives the company a visible ore supply of 15,000,000 tons. This is enough to operate several blast furnaces for many years. St. Louis will be the headquarters of the consolidated company, to be known as the Consolidated Iron & Steel Corporation. The officers of the company plan to make St. Louis a rival of Pittsburgh in the iron and steel industry, and predict that within five to ten years St. Louis will have the supremacy over the Pennsylvania industry.

Picher, Okla.—Construction has been started on the new mill of the Commerce Mining & Royalty Co., which is located just to the northeast of the Vinegar Hill Barr mine, north of Picher. It is understood that preliminary development of this property has shown it to be rich in minerals and probably a worthy rival of the Barr mine and the Blue Mound and Webster properties on the other side of the road. The new mill will be at the foot of the big hill known as the Blue Mound. It is understood that it will not be started until the ore price situation has been considerably improved, but the recent upward trend is said to have caused the promoters of the mine to seriously consider beginning operations soon. Several mines have opened recently and the production of the field is steadily increasing.



# THE MARKET REPORT

## Daily Prices of Metals

Oct.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
13	12.75	26.875	27.25	4.70	4.45	4.65
14	12.75	26.875	27.25	4.70	4.45	4.65
15	12.75	27.125	27.50	4.70	4.45	4.65
17	12.75	27.625	28.00	4.70	4.45	4.675
18	12.75	27.625	28.00	4.70	4.45	4.675
19	12.75	27.625	28.00	4.70	4.45	4.675

\*These prices correspond to the following quotations for copper delivered: for the entire week, 13c.

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 deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

mit information for use in determining these prices.

### Copper

A good business was done on last Thursday, but since then the market has been exceedingly quiet. Producers are generally well sold up, however, and are showing no disposition to cut prices, holding at the 13c. delivered figure of last week. In fact, some producers are quoting even higher than this. Plenty of copper is obtainable at 13c., even for delivery as late as December. Some consumers, quickly sensing the decreased demand, have been endeavoring to contract for future supplies at reduced prices, but have had little success. Trading at 12½c. might be done on particularly desirable business for near-by delivery, but the price is not a general one.

Foreign demand has quieted down at the same time, and in the last three days practically no business has been done either by the Copper Export Association or outside interests. However, at least one order was placed in Germany, despite financial conditions in that country. Export copper has generally netted domestic producers not far from 13c. New York.

### Lead

The American Smelting & Refining Co.'s official contract price of 4.70c. continues unchanged. New York sales have been in fair volume, and one or two good orders have been placed even since Monday. A tendency is discernible to cut prices slightly in some quarters, but the movement seems to have been started by consumers rather than by producers anxious to dispose of the metal, and it would be extremely hard to find any lead under 4.70c., though rumors of 4.65 and 4.675c. are heard. The St. Louis market is quiet. We are discontinuing the range up to 4.50c. as quoted last week, for plenty of lead of the desired kinds seems to be available at 4.45c. However, this price is the bottom figure, as is the Chicago quotation at 4.55c. It now seems unlikely that any material change will take place in the price of lead during the remainder of the year.

### Zinc

The activity in zinc has continued, with a good demand from all galvanizing interests, though the brass companies continue generally to be out of the market. Most producers of zinc are willing to sell at present prices, and there is even some talk of a resumption of smelting at one or two of the Western plants. Production is now round 12,000 tons a month, with shipments 5,500 to 6,000 tons in excess of this figure. Stocks in England are reported to be small, and in time it may

## London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
13	68½	69½	75½	155½	157½	23½	23½	26½	27
14	67½	68½	74½	155½	157½	23½	23½	26½	26½
15	..	..	..	..	..	..	..	..	..
17	66½	67½	74	157½	159½	23½	23½	26½	26½
18	65½	67	73	157½	159½	23½	23½	26½	26½
19	66½	67½	73	156½	159	23½	23½	26½	26½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

## Silver and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver			Oct.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
13	384½	99½	73½	42½	17	391	99½	73½	42½
14	385½	99½	72½	42½	18	392	99½	70½	40½
15	388½	99½	73	42½	19	390½	99½	69½	39½

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. Sterling quotations represent the demand market in the forenoon.

## Metal Markets

New York, Oct. 19, 1921

The metal markets have been extremely quiet since news of the threatened railroad strike was given out on Saturday afternoon. Buyers have been waiting to see if there was likelihood of their plants being closed for lack of transportation before contracting for further supplies. At this writing, probability of a strike is rather remote, and if it comes at all it is not likely to last long, in view of the number of unemployed, of the split in the union ranks, and of the temper of the public.

Ocean freight rates have again been reduced. They are now \$4 per long ton to English ports, Hamburg, and Bremen,

and \$3.50 to Antwerp and Rotterdam. The \$5 rate to Havre is so far unchanged. These rates are still about twice the pre-war figures, but represent a big drop from those which have existed in the last few years. Domestic freight tariffs on the railroads are likely to be reduced before the end of the year, though to what extent and in what manner is yet to be decided.

With this issue we are omitting the repetition of the prices of many minerals and mineral products the quotations on which change only at rare intervals. It is planned to publish a complete list of quotations in the first issue of every month, and in the other issues prices of many commodities will be published only if changes occur. We are always glad to have subscribers sub-

be necessary to export some metal unless Continental production improves. A premium of 5 points per month is generally asked for forward delivery.

### Tin

Sales were fairly numerous toward the end of last week, but in the last three days inquiries have fallen off. There is a scarcity of 99 per cent still, though supplies are in somewhat larger volume than at one time. The cessation of shipments of concentrates from South America should aid the disposal of the Far Eastern tin stocks. About two-thirds of the South American tin ores have been coming to this country, the rest going to England, but producers are not satisfied with present prices and are willing to wait for them to get higher.

Forward deliveries have been commanding premiums of one-quarter to one-half cent.

Arrivals of tin, in long tons: Oct. 6th, Straits, 75; 11th, Straits, 5; 13th, Straits, 15; 14th, Straits, 10; 17th, Rotterdam, 25; 18th, Liverpool, 35; London, 25; Straits, 200.

### Gold

Gold in London: Oct. 13th, 107s. 2d.; 14th, 106s. 5d.; 17th, 105s. 4d.; 18th, 104s. 1d.; 19th, 105s. 7d.

### Foreign Exchange

Continued strength in sterling and a further depression of German marks featured the week. On Tuesday, Oct. 18, francs were 7.165c.; lire, 3.885c.; and marks, 0.595c. New York funds in Montreal,  $9\frac{7}{8}$  per cent premium. Sterling cables continue to be quoted at one-half cent premium over demand as given on page 675.

### Silver

The features in the silver market for the last week have been the sharp advance in sterling exchange from 384 to 392, and the sudden fall in the London quotation from  $42\frac{1}{2}$  to  $39\frac{1}{2}$ d. The drop in the London price was caused by weakness in the China and India exchanges and by speculative selling in London. India is reported as selling silver to China.

Mexican Dollars—Oct. 13th, 56 $\frac{3}{4}$ ; 14th, 56; 15th, 56 $\frac{1}{2}$ ; 17th, 56 $\frac{1}{2}$ ; 18th, 54 $\frac{3}{4}$ ; 19th, 53 $\frac{3}{4}$ .

### Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 17.50@18c. with practically no sales.

Antimony—Chinese and Japanese brands, 5@5.25c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb<sub>2</sub>O<sub>3</sub>, wholesale lots, 6 $\frac{1}{2}$ @7c.

Bismuth—\$1.50@\$1.55 per lb.

Cadmium—Range \$1@\$1.10 per lb.,

in 1,000-lb. lots. Smaller quantities, \$1.10@\$1.25 per lb.

Cobalt—Metal, \$3@\$3.25 per lb.; black oxide, \$2@\$2.10 per lb. in bbls.

Iridium—Nominal, \$150@\$170 per oz.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, \$32@\$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—\$70 per troy oz. Nominal. \$70, Los Angeles, Cal.

Palladium—Nominal, \$55@\$60 per oz.

Platinum—\$82 per oz.

Quicksilver—\$39@\$41 per flask. San Francisco wires \$43.75.

The prices of the following metals remain unchanged from the figures published in these columns on Oct. 15: Rhodium, Selenium, Thallium, and Tungsten.

### Metallic Ores

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Oct. 15 issue: Chrome, Iron, Magnetite, Manganese, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

### Zinc and Lead Ore Markets

Joplin, Mo., Oct. 15—Zinc blende, per ton, high, \$26.50; basis 60 per cent zinc, premium, \$25; Prime Western, \$23.50@ \$25; fines and slimes, \$23@\$20; average settling price, all grades of blende, \$23.07.

Lead, high, \$64.50; basis 80 per cent lead, \$60; average settling price, all grades of lead, \$58.33 per ton.

Shipments for the week: Blende, 6,939; lead, 1,388 tons. Value, all ores the week, \$241,220.

Sellers practically forced all week-end sales of blende on \$25 basis, yet purchases exceeded 5,000 tons. Heavy purchases the previous three weeks enabled shipments to exceed production and materially reduce stocks. The resumption of operation of mills long idle, to meet the increased demand for lead at high prices, was more than offset in zinc production, it is claimed, by large mills that have closed. Latest surveys of production point to this condition, showing the production around 5,900 tons, with a nine-months' average of 6,300 tons per week.

Platteville, Wis., Oct. 15—Blende, basis 60 per cent zinc, \$27@\$29 per ton. Lead ore, basis 80 per cent lead, \$60 per ton. Shipments for the week: Blende, 160; lead ore, 160 tons. Shipments for the year: Blende, 8,621; lead ore, 1,565 tons. Shipped during the week to separating plants, 457 tons blende and 168 tons sulphur ore.

### Non-Metallic Minerals

Generally dull markets also exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Oct. 15

issue: Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica, Sulphur, Feldspar, and Talc.

### Mineral Products

The prices of Arsenic, Sodium Nitrate, Sodium Sulphate, and Potassium Sulphate are unchanged from the quotations published in these columns Oct. 15.

### Ferro-Alloys

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Oct. 15 issue: Ferrotitanium, Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovandium.

### Metal Products

Yellow Metal—Prices have been advanced 1c. Dimensions sheets, 17.25c. per lb.; sheathing, 16.25c.; and rods,  $\frac{1}{2}$  to 3 in., 14.25c.

Copper Sheets and Wire, Lead Sheets, Nickel Silver, and Zinc Sheets are unchanged from the quotations given in the Oct. 15 issue.

### Refractories

Prices on the following are unchanged from the figures published in the Oct. 15 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

### The Iron Trade

Pittsburgh, Oct. 18, 1921

Steel ingot production is at a rate slightly above 35 per cent of capacity. The increase has been chiefly on the part of the Steel Corporation, which booked a fair amount of business in bars, shapes and plates before it advanced prices to 1.65c. for bars and 1.75c. for shapes and plates.

Most of the independent sheet mills have announced a \$5 a ton advance, to 2.75c. for blue annealed sheets, 3.25c. for black and 4.25c. for galvanized.

The general tone of the finished steel market is hardly as good as a fortnight ago, as to current buying and as to prospects for increasing consumption in the next few weeks, but the tone as to prices is improving.

Railroad strike talk naturally has a depressing influence upon business sentiment, but it has not affected actual trade to a noticeable extent.

Pig Iron—The pig-iron market is extremely uncertain, one factor no doubt being the expectation of reduced freight rates, affecting both the cost of producing pig iron and the cost of moving it to consumer. Prices are not quotably changed: Bessemer, \$20; basic, \$19.25 to \$20; foundry, \$21, f.o.b. Valley furnaces. Freight to Pittsburgh is \$1.96, against 90c. in 1914 and 75c. in 1901.

### Coke

Connellsville—Furnace, \$3.35@\$3.50; foundry, \$4.25@\$4.75 per ton.



## The Copper Situation From the Investment Standpoint

BY HARRY J. WOLF

Written for *Engineering and Mining Journal*

THOSE WHO ARE INTERESTED in buying and selling securities for their own account may be divided into eight or ten classes according to the particular attitude they assume in the security market. For ordinary purposes of investigation, buyers and sellers of bonds and stocks may be divided into four general classes, namely, 1, investors for income; 2, investors for profit; 3, traders; and 4, speculators. In this discussion we are interested in the first two classes only.

Investors for income are those who buy a security that is likely to have a stable market value for a reasonable period of time, and pay a regular dividend. In this case the regularity of the dividend is the chief consideration, and the investor does not concern himself over moderate fluctuations in the market price of his security, so long as the corporation is well established and represents an industry that is likely to experience average prosperity over a period of several years. All the investor for income demands is his interest at regular intervals, and his money back at some distant date when he may need his capital for other purposes, or when he is no longer convinced of the stability of his investment.

Investors for profit are those who buy securities of well-established corporations at a time when they believe these securities are selling at a relatively low price as compared to their average market price over a period of years or months, and the dividend on such security is a secondary consideration. Such an investor buys his security with the firm intention of selling it again whenever the corporation is in one of its more prosperous periods and the security has a market value above its average value over a period of years. The investor for profit expects to make much more out of the appreciation in market price than he expects to receive in the form of dividends.

In view of the fact that the term "investment" is usually associated with the payment of a dividend, it might seem at first thought to be inconsistent to review a list of the leading copper securities when all but three of the important copper-producing corporations have discontinued paying dividends. However, those who have a fair conception of the great copper-mining industry know that the temporary dividend policy of a corporation that is strong financially, that is in good physical condition, with many years of life ahead, and that is reasonably sure to resume its distribution of profits after it has passed through a period of unusual depression, should not be eliminated from the investment class, but only suspended.

There are sixteen copper stocks listed on the New York Stock Exchange, as follows: Anaconda, Calumet & Arizona, Cerro de Pasco, Chile, Chino, Granby, Greene-Cananea, Inspiration, Kennecott, Miami, Nevada, Old Dominion, Ray, Seneca, Shattuck, and Utah. Only two of these companies are paying dividends at present, Miami and Utah. The last company to pass its dividend was Cerro de Pasco. Many of the coppers that are not paying dividends at present will be restored to the investment class in due time, for the physical condition of their property and their earning ability are well known. Some of these companies, on the other hand, are in a doubtful position with regard to their future earning ability, and others must be classified as speculations for the time being, and until they can establish a record as dividend payers.

The list of copper stocks on the Boston Exchange is a very long one, and it includes many famous producers. Nine of the Boston coppers paid dividends in 1920, namely Ahmeek, Calumet & Hecla, Copper Range, Davis-Daly, Mohawk, New Cornelia, Osceola, Quincy, and Wolverine.

It is apparent that investors for income only would not be attracted by the copper stocks at this time. However, the investor for profit would find the copper list an interesting study, and his knowledge of conditions in the copper industry, and influences affecting certain individual corporations, would suggest to him that many attractive oppor-

tunities for investment for profit are to be found in the copper list, in view of fundamental conditions surrounding the copper market. Such an investor may have good reason to believe that substantial copper stocks are ready to advance in price, because they will have a tendency to discount future prosperity, which is appearing on the horizon, and beyond this he realizes that many former dividend payers are certain to resume their customary distribution of profits in due time.

It is of interest to inquire into some of the fundamental reasons why the investor for profit should be attracted now by the leading copper securities. The conservative investor, who exercises care and discrimination in making his commitments, thinks as an engineer should think, and demands fundamental and logical reasons for every action that he takes. Some of the fundamental reasons why the copper situation is now interesting from the investment standpoint are as follows:

First. The unsold supply of refined copper in the United States, which has been one of the outstanding influences in the situation up to this time, is estimated at about 680,000,000 lb. This is substantially less than the supply at the time curtailment of production was initiated. It is probable that this estimate should be increased by secondary coppers and scrap material that may be available, and which might increase the total quantity of metal to as much as 1,000,000,000 lb. However, the fact remains that the unsold supply is beginning to decrease materially.

Second. The demand for copper now exceeds domestic production by about 30,000,000 lb. a month, and from now on this demand is more likely to increase than to decrease or remain stationary.

Third. If it be assumed that the unsold supply of copper under normal conditions is about 300,000,000 lb., the present excess supply of 380,000,000 lb. of refined copper would be absorbed in less than thirteen months.

Fourth. It requires approximately three months for copper to work its way from the producer to the refineries and into the market. Therefore, with a reduction in stock of 30,000,000 lb. per month, the unsold supply would be below normal at the end of thirteen months, unless normal production should be resumed three months earlier.

Fifth. American brass makers, who have been securing brass scrap from Europe until recently, are now entering the domestic copper market with substantial orders.

Sixth. Increase in building construction, which is likely to be accelerated in the near future on account of the increased demand for buildings during the past few years, will be accompanied by increased consumption of copper.

Seventh. European demand for virgin copper for wire-drawing and sheet-rolling purposes will increase as available European stocks become liquidated.

Eighth. As domestic business conditions improve, American consumers will discontinue buying from hand to mouth, and will enter the market with more substantial orders, so as to accumulate supplies before a substantial rise in the market price of the metal.

Ninth. Increased demand for the metal during the last few weeks has hardened quotations, and many of the contracts for future delivery are being made at slightly advanced prices.

Tenth. An organized effort is being made to re-establish old uses and develop new uses for copper metal, and it is not improbable that an organization like the Copper & Brass Research Association, composed of domestic producers and fabricators of the metal, will become a factor in advancing the consumption of copper. It is apparent that the metal has a great many uses that have been neglected during the last decade, because the producer found a ready market without going to the trouble of cultivating the less important uses. This was particularly true during the war period.

Eleventh. The above influences are all operating to re-

store gradually the normal balance between demand and supply, and it is reasonable to suppose that this process may be accompanied by an increase in the market price of copper.

Twelfth. As the price of copper rises above the cost of production of the various producers, one at a time they will resume operations, earn profits, and resume the payment of dividends.

The experienced investor realizes that the resumption of profitable operations on the part of the leading producers of any commodity may be discounted by many months in the market price of the shares of the producing corporation. It may be that this discounting process is now under way with respect to the shares of the leading copper producers.

It would not be good engineering to consider only the favorable factors in a situation. It is necessary to consider the unfavorable influences. The disturbing element in the situation is the unsettled financial condition in Europe,

which is likely to decrease in importance, however, as the domestic demand improves.

In reviewing the above situation from the investment standpoint, the unbiased investigator is led to believe that although there is the possibility of facing a temporary setback due to reaction from current prices, on account of unfavorable European influences or artificial share-market manipulation, there appears to be a greater likelihood of losing a chance to take advantage of gradually rising share prices corresponding to fundamental improvements in the industry, by delaying the serious consideration of the position of leading copper shares until the situation becomes apparent to the general public.

It is beyond the province of this discussion to offer any specific advice with regard to the purchase or sale of securities, but it is proper and fair to call attention to a very fascinating problem, and an industrial situation in the process of important transition.

## Conditions in the Mining Industries

EDITORIAL MARKET STUDY\*

**C**ONDITIONS ARE IRREGULAR in the different mining industries, but on the whole are better than they were six months or a year ago.

Iron mining is abnormally depressed, the deflation in this industry having lagged behind that of the other metallic-mining industries such as copper, as has been characteristic for years. Lake Superior ore shipments fell off during September, and the total shipments up to Oct. 1 are less than half of those in 1920. A quiet winter is looked for in the iron districts.

The copper industry continues to suffer from the greatest depression it has experienced in many years; nevertheless, conditions are better than they were a year ago. Of the surplus copper stocks, 400,000,000 lb. have been financed by the issuance of bonds by the Copper Export Association, removing this weight from the shoulders of the producers. Most of the large copper mines have closed down in order to curtail production, which has been cut to the lowest figure in twenty-four years. There is a slightly increased demand for the metal, due to domestic buying, and the price has risen somewhat from its low of a few months ago. A beneficial result of the abnormal depression in copper has been to force the attention of producers to the science of merchandising, which is being taken up seriously under the Copper and Brass Research Association; and also to force a study of more economical methods of production.

Just as copper was absolutely deflated before the deflation process in iron and steel had even begun, it is to be expected that it will recover much earlier. The future depends largely upon general world conditions, and upon developments in Europe, especially in Germany, which must be able to absorb something like her pre-war importations of American copper before full production may safely be resumed. There is, however, remarkably little evidence of a serious condition of unemployment due to the idle copper camps, indicating that the miners have for the most part been temporarily absorbed by other activities.

The zinc-mining industry is so dependent on the iron and steel trade, on account of one of the chief uses for zinc being for galvanizing, that a return to prosperous times is not very likely to precede by much the improvement in the latter, which, as above stated, is not expected immediately. Nevertheless, the price of the metal showed an upward trend in September, due to heavier buying, and there are indications of a somewhat better permanent posi-

tion. Like the copper producers, the zinc producers have been driven to a study of the science of merchandising the metal, and through the Zinc Institute, an association of producers, are trying to find new uses for zinc. Meanwhile, the zinc-mining districts are very dull.

Largely due to its constant demand for paint, lead has never been depressed as much as the other metals. Lead-silver ores have benefited by the prosperous condition of the American silver-mining industry. The silver producers have enjoyed immunity from the industrial depression, for their product has been pegged at a dollar an ounce by the Pittman Act, while the world market for silver slumped as low as 52½c. in March, 1921, and now stands around 73c. This support will last some years longer. The Pittman Act, passed during the war, provided for the purchase for the Treasury reserve of American silver till 207,000,000 oz. had been accumulated, to take the place of the same amount borrowed by England to take over a sudden crisis in India, and paid for at the same figure (one dollar) now being paid the mines. This has equalized the silver-mining industry and kept it prosperous.

Compared with a year ago, the gold-mining industry is much better off, and is certain to see increasingly favorable conditions. Gold is, of course, permanently pegged at \$20.67 per ounce, and just as high supply and labor costs nearly prostrated the industry during the war and post-war period, the period of deflation and falling prices spells increasing prosperity to it, regardless of business depression, as the marketing factor does not enter into gold mining. Many of the large gold mines are now running again at full capacity.

The non-metallic mining industries, such as those of talc, magnesite, graphite, mica, fuller's earth, barytes, fluor-spar, gypsum, and feldspar, go largely into manufactured products and, therefore, have suffered with the depression of manufacturing in general. These industries had an abnormal prosperity during the war. In general, they have never been organized on an efficient, competitive basis, and, therefore, can ill stand the competition resulting from the post-war resumption of importation. Besides being handicapped, in common with other industries, by high freight rates, they have the disadvantage of putting out in many cases unstandardized or poorly standardized products, and in not having worked out the science of merchandising and of proper utilization.

In general, the mining industries, except iron, seem to have recovered from the greatest depression, and to be started upon the slow climb upward.

\*Contributed by *Engineering and Mining Journal* to the Symposium on Industrial Conditions at the National Conference of Business Paper Editors, in Chicago, on Oct. 24.

### COMPARATIVE PRICES OF THE METALS

	Average 1909-1913	Average 1919	Average 1920	Low 1921	Oct. 19, 1921
Copper, per lb. ....	13.94c.	18.69c.	17.46c.	11.43 (Aug. 23)	12.75c.
Lead, New York, per lb. ....	4.40c.	5.76c.	7.96c.	3.75 (Feb. 26)	4.70c.
Zinc, St. Louis, per lb. ....	5.73c.	6.99c.	7.67c.	4.125 (Aug. 27)	4.68c.
Pig iron, Pittsburgh, per ton, (a) .....	\$14.40	\$29.26	\$43.85	\$18.20 (Aug.)	\$19.50
Silver, per ounce .....	\$0.554	\$1.111	\$1.009	\$0.526 (Mar. 5)	\$69.25

(a) Basic



## COMPANY REPORTS

### Chile Copper's Deficit Increases

A statement showing results of operations of Chile Exploration Co. for the second quarter of the year 1921 shows that 335,871 tons of ore, averaging 1.75 per cent copper, was treated, and in the preceding quarter 581,644 tons, averaging 1.64 per cent, yielding 12,001,873 lb. and 18,006,774 lb. respectively.

The cost of copper produced during the quarter was 11.971c. per lb., including selling and delivery expense, but excluding depreciation and Federal taxes and with no credit for miscellaneous income, compared with 11.012c. per lb. for the previous quarter.

The financial outcome of the Chile Copper Co. and Chile Exploration Co., combined (earnings being based on copper actually de'ivered). shows for the quarter ended June 30, as compared with the preceding quarter, as follows:

	Second Quarter 1921	First Quarter 1921
Pounds copper delivered.....	13,878,412	15,070,157
Net profit on copper delivered.....	\$291,667.31	\$283,768.18
Miscellaneous income.....	8,827.58	24,691.75
Interest on call loans and bank balances..	122,883.19	181,845.99
<b>Total income.....</b>	<b>\$423,378.08</b>	<b>\$490,305.92</b>
Depreciation.....	\$697,249.54	\$696,058.99
Amortized discount on fifteen-year 6 per cent convertible bonds.....	35,000.00	35,000.00
Accrued bond interest of Chile Copper Co.	787,500.00	787,500.00
Expenses of Chile Copper Co.....	13,661.92	8,035.44
<b>Total charges.....</b>	<b>\$1,533,411.46</b>	<b>\$1,526,594.43</b>
Balance undivided profits for quarter, both companies.....	\$1,110,033.38(a)	\$1,036,288.51(a)
(a) Loss.		

It will be noted that of the above loss of \$1,110,033.38, the sum of \$697,249.54 is for depreciation, which is a book entry and is computed on a time basis, regardless of production or sale.

On Sept. 1 the companies had \$8,813,000, representing cash on hand and marketable securities, after setting aside \$1,921,000 to complete payment of purchase price of the two tank ships mentioned in the last annual report of the company.

### Davis-Daly Copper

A report of operations of Davis-Daly Copper Co. for the three months ended June 30, 1921, states that the company has been one of the few copper-mining companies to be in operation, due, fortunately, to the silver values contained in the ore. Practically all work at the property not immediately essential has been discontinued and the organization reduced to what seems to be the minimum practicable for single-shift operation. Sunday operation has been discontinued and hoisting of ore is confined to six days a week. The results obtained, however, were satisfactory. The grade of ore was a little below the average.

Production at the Hibernia has been quite active, and early in June the sinking of the shaft to the 750 level was started, which will determine the values at this depth.

Tonnage hoisted at the Colorado mine, including Hibernia mine, for the quarter amounted to 32,246 tons, producing 1,892,992 lb. of copper and 417,008 oz. of silver. The average assay of ore shipped from the Colorado was 5.44 per cent copper and 5.31 oz. of silver to the ton and from the Hibernia 26.41 oz. of silver to the ton.

Receipts from ore returns were \$240,342.54; from miscellaneous revenue, \$16,856.87; total receipts, \$257,199.41. Disbursements were: Development, \$27,586.28; mining cost, \$82,619.32; equipment, \$3,629.14; Butte general expense, \$29,695.03; Boston expense, \$28,072.06 (including United States income and capital stock taxes). Total disbursements totaled \$171,601.83.

### Tonopah Belmont Development Co.

A condensed statement of operations of Tonopah Belmont Development Co. for quarter ended June 30, 1921, follows:

Received and receivable for ore.....	\$120,957.98
Mining, milling, and administration expenses.....	89,822.55
Net earnings for three months.....	\$31,135.43
Miscellaneous income.....	1,452.14
<b>Total net income for three months ended June 30, 1921.....</b>	<b>\$32,587.57</b>
AVAILABLE RESOURCES, JUNE 30, 1921	
Due from smelter.....	\$32,151.29
Due from others.....	53,026.67
Cash in banks.....	81,548.77
U. S. Government certificates of indebtedness.....	100,012.70
<b>Total.....</b>	<b>\$266,739.43</b>

The net loss for the quarter ended June 30, 1921, of the Belmont Surf Inlet Mines, Ltd., of which this company owns 80 per cent, was \$12,649.27.

### American Smelting & Refining Co. Shows Deficit

A report of operations of the American Smelting & Refining Co. for six months ended June 30, 1921, states that a net deficit of \$1,100,297.54 was incurred after the payment of dividends on the preferred stocks. A consolidated profit-and-loss account of the A. S. & R. Co. and the American Smelters Securities Co. follows:

	Six Months Ended June 30, 1921	Six Months Ended June 30, 1920
Net earnings of smelting and refining plants and industries immediately dependent thereon....	\$2,494,892.52	\$6,678,412.10
Net earnings from mining properties.....	(a) 77,131.61	2,070,773.12
Net earnings of operating properties.....	\$2,417,760.91	\$8,749,185.22
Other income, net		
Interest, rents, dividends received and commissions.....	30,805.25	941,902.11
Net earnings, before deducting administrative expenses and corporate taxes.....	\$2,448,566.16	\$9,691,087.33
Deduct		
Administrative expenses.....	461,681.01	665,347.17
Research and examination expenses.....	64,094.14	49,681.41
Corporate taxes.....	3,775.50	502,771.47
	\$529,550.65	\$1,217,800.05
Net income from current operations, before providing for bond interest, depreciation, obsolescence and depletion, and after providing for all taxes.....	1,919,015.51	8,473,287.28
Less		
Interest on A. S. & R. Co., 5 per cent first mortgage bonds outstanding with public....	791,201.14	795,187.47
Interest on Rosita Coal & Coke Co., 6 per cent collateral trust bonds outstanding.....	29,275.78	39,070.00
Profit-and-loss adjustments.....	96,700.88	819,535.86
	\$917,177.80	\$1,653,793.33
Balance before deducting depreciation and depletion.....	\$1,001,837.71	\$6,819,493.95
Depreciation.....	\$1,679,323.30	\$1,778,421.95
Ore depletion.....	424,345.90	1,010,231.12
<b>Total.....</b>	<b>\$2,103,669.20</b>	<b>\$2,788,653.07</b>
Balance before deducting dividends.....(a)	\$1,101,831.49	\$4,030,840.88
Dividends		
On preferred stocks		
A. S. & R. Co.....	1,750,000.00	1,750,000.00
American Smelters Securities Co. preferred "A".....	283,554.00	287,982.00
American Smelters Securities Co. preferred "B".....	68,581.25	77,435.00
Total preferred stocks.....	\$2,102,135.25	\$2,115,417.00
On A. S. & R. Co. common stock.....		1,219,960.00
<b>Total dividends.....</b>	<b>\$2,102,135.25</b>	<b>\$3,335,377.00</b>
Net balance for period.....(a)	\$3,203,966.74	\$695,463.88
Profit-and-loss surplus at beginning of year.....	25,987,292.65	25,974,571.20
<b>Total profit-and-loss surplus, June 30.....</b>	<b>\$22,783,325.91</b>	<b>\$26,670,035.80</b>
(a) Deficit.		

MINING STOCKS

Week Ended October 15, 1921

Table with columns: Stock, Exch., High, Low, Last, Last Div. for various mining stocks including Copper, Gold, Silver, Lead, Nickel-Copper, Quicksilver, Zinc, and Vanadium. Includes sub-sections like COPPER, GOLD, SILVER, and VANADIUM.

\*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.



