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ENGINEERING AND MINING JOURNAL

December 4, 1920

McGraw-Hill Company, Inc.

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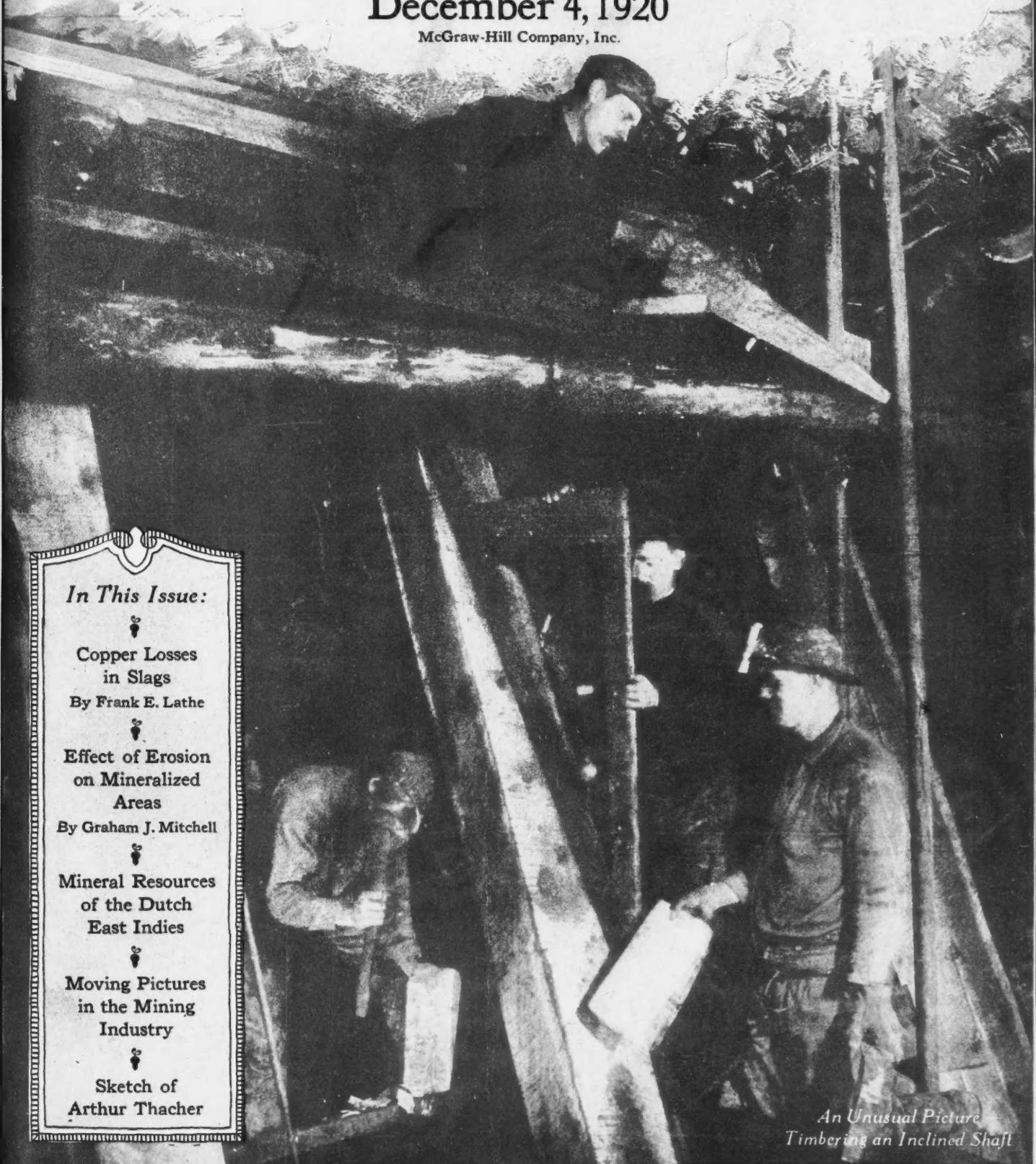
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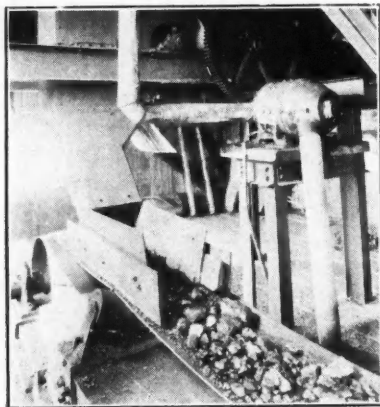
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Volume 110

New York, December 4, 1920

Number 23

Groping for the Light

THE discussions at the meetings of the Gold Conference in Denver disclosed clearly the mist that hangs in the minds of most persons concerning so complex a subject as the gold problem. Many of the speakers recited the decay of gold mining in various districts from which the speakers came, without analyzing how far this decay was due to the exhaustion of ore reserves by mining, and how far it was to be attributed to cost inflation brought on by the Great War. Certainly, no legislation can restore worked-out mines to vigor. Other speakers voiced the plaint that, during the war, the Government had urged the production of gold as a war necessity, and now should protect those enterprises which had so nobly and unselfishly rallied to the protection of their country. Of course this is bunk, and unconscious hypocrisy. The Government simply failed to put the gold industry on the black list, and Secretary McAdoo declared openly his recognition of the need for continued gold production. That any call was ever made that influenced the policy of gold producers in the least is not true.

But it was the economic and especially the monetary aspects that the conference was called upon to consider which proved to be of the tanglefoot variety. One gentleman wanted to know if it was not true that "Wall Street" was buying British gold for \$27 an ounce and selling it for \$32. Oh, you Wall Street! Naughty, naughty Wall Street! Even such a profound student of the problem as Gov. Boyle of Nevada was, it seems to us, unduly impressed by the theory of the "economists" that the rise of prices before the war was due to enormously increased gold production. The economists, like the rest of us, are groping for the light; and there were certainly other causes for the pre-war rise, notably the flow from the rural districts to the cities and the consequent decrease of production of raw materials per capita—if indeed the increased gold production was at all contributory in view of the also vastly increased volume of business. And in any case, the main inflation of prices, during the war, was certainly brought on by paper, and not by gold.

There was, in short, no clear conception as to the justification for the proposed measure—whether it was a war mineral relief measure, a measure designed to be protective of a domestic industry, a measure for the amelioration of the national currency, or one for the betterment of world economic conditions.

There is only one justification that can properly be urged upon Congress as an adequate reason for the passage of the McFadden Bill—that it is a relief measure to supply gold to help bolster up the dreadfully insufficient reserves on which rests the outstanding currency of the world: and this puts it upon a national and international basis. Believing it would have this effect, and be beneficial as a temporary measure, we support it.

Gold and High Prices

THE reason prices are so high, according to the opinion of a certain variety of common or garden economists, including several financial missionaries of current writers who undertake to educate the public through the popular magazines, is that we have so much gold. The gold reserve of the United States has doubled since 1913; also, prices have increased about 200 per cent since 1913. It is an economic axiom that the more the gold the cheaper it is, and the less it will buy; so that commodity prices rise. Therefore, the rise of prices since 1913 has been due to the vastly increased stock of gold. *Quod erat demonstrandum.* Throw away the gold, and prices of shoes and flour will fall. So runs the propaganda.

Well, let's see. Let us take the case of Austria. According to the London *Statist*, Austria's gold stocks fell from 51 million pounds in 1913 to 9 million in 1920. But prices, as the Viennese tell us, are fantastic. It takes a suitcase full of money to buy a drink, and a wagonload to buy a horse. In fact, prices are so high that they have gone beyond all rule and measure. In the case of Germany the country has also succeeded in keeping out the noxious cheap gold. Gold is not cheap in Germany: the stocks are somewhat less than they were in 1913. Yet it takes a thousand marks, or something like \$240 par value, to buy a pair of shoes.

Nor is gold in other countries proving itself so common as to be cheap, or a thing to be reduced in the future. The gold reserves of France, according to the *Statist*, are 50 per cent greater than they were in 1913; even in Italy they are around 20 per cent larger. Yet all parties agree that the trouble with France and Italy is that they have not enough gold; that if they had more the franc and the lire would be worth more, and prices would come down.

The real determining factor as regards the relation between cheap money and high prices is evident, and was pointed out in a previous editorial. It is true that abundant money produces high prices for commodities, but in the world today—the whole world, practically—the cheap money is mainly paper. Prices of commodities will tend to decrease as the ratio of paper to gold reserve or "cover" decreases; and this can be accomplished by reducing the paper, or increasing the underlying gold security, or both. The most expeditious way is to do both; in fact, for countries like France and Italy, which are in a desperate condition of inflation, the double remedy is imperative, and is being eagerly sought by the countries in question.

To apply this remedy to the disordered financial world an added beneficial factor would be the maximum production of new gold, in addition to the supply of existing gold. When the critical stage of the inflation fever is passed—if it does pass without the bankruptcy of a number of European countries—will be time enough

to consider the relation of the volume of gold to existing commodities, and its effect on their price. We doubt if there will be any too much. The wealth and population of the "civilized" world have increased rapidly in recent decades, along with the building up of the world's gold reserve.

Minerals Separation at Denver

THE Flotation Conference in Denver was an interesting one. We have purposely avoided commenting on it editorially till now, in order to get the proper perspective lent by distance. For the first time, perhaps, an association of mine owners, many of whom were licensees of Minerals Separation, met the officials of that company for discussion, outside of a court of law. As it was, the meeting partook too much of the nature of a court proceeding, because the Mining Congress side was presented by two able attorneys, Mr. Nye and Mr. Montague, and because Minerals Separation also chose for its representative an attorney, Mr. Cook, its chief counsel.

The grievances of the Mining Congress against Minerals Separation were presented vigorously by the attorneys of the Congress, and in scathing terms. The reply of Mr. Cook consumed the entire afternoon of one session, and was good-humored, conciliatory, but vague. He described in general terms the fairness of the American public, the broad and liberal policies of his own company, the wrongful and wicked slanders under which his company had had to suffer, and the annoying tactics of the opponents of the company, without getting down to brass tacks. When his opponents immediately took the floor, and at once informed him that he had contributed nothing definite to the discussion, he was plainly disappointed and angry, and informed the Congress in effect that he had been exceedingly generous with it, and if it wanted to fight, why, come on.

Doubtless some explanation may be found for this attitude in the sharp attack—perhaps unnecessarily sharp and bitter in opening a conference between two parties—under which his adversaries in the debate had forced him to smart. Mr. Cook, however, made one helpful suggestion—perhaps the most constructive suggestion made at the conference—that the American Mining Congress should appoint a committee to confer with Minerals Separation and have a frank understanding as to how far they could agree, and a clear definition of the points on which they disagree. We understand that this will be done, and believe it a step in the right direction. This and possibly a better and more friendly understanding of each other by the opposing parties, due to each having expressed its opinion of the other frankly, were the chief points of progress; but no real advance, we believe, was made toward a satisfactory settlement of detailed points of difference.

To an observer who here studied the problem without conscious prejudice, it seemed that the Minerals Separation problem is a new and important one in our economic history. It is not a patent problem at all. To Minerals Separation belongs the credit of having invented a new thing. This discovery is, that by the aid of a multitude of interlocking patents and contracts, each carefully fitted to the other so as to make a coherent structure, a perpetual monopoly may be created, and yet the organization be quite within its

legal rights—unless indeed it be deemed to come under the Sherman Anti-Trust Law. Minerals Separation, to defend its patent rights, early had to lean strongly upon its lawyers, and—this is the house that Jack built. It is really an architectural success, but one that the mining industry will look upon with increasing disfavor, and that it will continue to seek means for demolishing.

Anything that approaches exclusive power and the arbitrary exercise of that power is repugnant to the American spirit, and cannot long survive, however firmly entrenched in law.

There are two ways out of it. The better way is for concessions to be made on both sides: and for Minerals Separation to condemn its new invention, which, however fascinating in the model, will not work long on an operating scale; on the other hand, for users of the essential Minerals Separation process to recognize its fair (rather than its legal) patent rights. The other—the less desirable—will be to fight it out, with all the hostile forces of attempted strangling monopoly on the one side, and bitter near-socialistic feeling on the other; in which case there is no doubt that Minerals Separation will ultimately lose in its main contentions, and have to foot its campaign bills as well.

Locating a Bureau of Mines Station

THE decision some weeks ago to place the new Southern Station of the Bureau of Mines at Tuscaloosa, Ala., came, it is believed, as a disappointment to the Bureau itself. Placing it at Tuscaloosa determines its principal work as on iron and steel problems, and the Bureau is already in possession of iron and steel stations, such as the one at Minneapolis, which is given over entirely to those investigations, and the expensive plant at Pittsburgh, originally at least intended as the main iron and steel station.

It had been hoped that the Southern States station would be assigned to the interests of non-metallic mining, to whose broad problems no experiment station has yet been devoted; and that in this connection the chemical phase of the Bureau's work would here be centralized. Special political influence, it is understood, namely the efforts of Senator Oliver and Representative (now Senator-elect) Underwood, of Alabama, finally attached the station to Alabama's chariot wheel; and the indications are that the Bureau of Mines is having difficulty in knowing just what to do with it now that it is there. The Bureau's own choice for a location, we believe, was in Tennessee, a favorable situation for work on non-metallic minerals: but the Tennessee statesmen were not sufficiently awakened to what was going on before the station had found its resting place on the broad bosom of the steel corporations operating at Birmingham.

It is difficult to visualize and state these problems nicely and justly; but if it is true that, from motives of the ever-present and sometimes necessary but always dangerous expediency, the Bureau felt obliged to trade its own conviction for the political support of the powerful Southern Democrats, the subsequent landslide of Election Day, putting these same powerful politicians very much on the away back row, must have led to some philosophical reflection by the Bureau chiefs on the uncertainty of politics and the vanity of all things earthly.

The Futility of "Cribbing"

NOT infrequently we note in current publications an article which seems strangely familiar, and, upon closer scrutiny, we find that it is in fact an abstract, excerpt, or material which is skillfully rewritten but nevertheless can be recognized as having appeared originally in our columns. There is missing, however, the usual credit line, and to this we take exception.

It is our practice, and one which is followed in most publications, we believe, to credit sources of information when they can be obtained. In some instances, we admit, there is the possibility of omission, for it must be obvious that we cannot be held entirely responsible for the sins of plagiarism committed by our contributors.

Early in the year we announced that it was not our intention to follow a "scissors and paste-pot" policy, and pledged ourselves to present to our readers as much original material as possible. Realizing, also, that there is much general and technical information of interest that appears elsewhere, we have not hesitated to publish extracts from other periodicals, reports and the like, but in rational amounts, and we have been only too glad to give full credit where credit was due.

Certainly we are glad to see our "stuff" in print—even editors have their vanities—for it not only affords a personal satisfaction but offers suggestions as to possible ways of improving the service we wish to render.

We do not believe ourselves incapable of error, and, therefore, we welcome all reasonable criticism and are only too glad to rectify such mistakes as may appear in our columns. There seems to be no hesitancy on the part of our contemporaries to attribute to us such faults as we may make; therefore, we ask, why not full credit for other material that they reprint, even if a different phraseology is used?

The discernment of reprinted information which is not properly credited may not be visible to the average reader, but to one who has prepared material for publication the effect is usually evident, and the futility of "cribbing" quite apparent.

Stamping Out a Dread Disease

THE questions of dust abatement and proper ventilation in mines have been extensively investigated by the Bureau of Mines, other organizations, and the individual companies, and it is hardly necessary to state that where measures have been taken to secure these and other healthful conditions the spread of pulmonary diseases has been in a large degree prevented.

In the metal-mining and related industries the death rate from tuberculosis is stated to be higher than that for other workingmen, and this is particularly true at copper, silver, and lead mines. The reason for this large number of deaths and greater amount of sickness in the mining industry is apparent, as conditions surrounding most phases of mining are accompanied by considerable dust, particularly hard, sharp, flinty particles. These enter the lungs and set up an irritation that makes fertile soil for the development of the tuberculosis germ.

It is also true, in this connection, that over 80 per cent of the miners are between the ages of fifteen and forty-four, when tuberculosis is always most prevalent. According to statistics, every third man who dies between these ages dies of tuberculosis, so that the problem of preventing this dread disease in industry is not alone

one of humanitarian value, but also that of saving man power and millions of dollars in wasted production.

In an editorial published on Nov. 2, 1918, referring to the use of respirators in mining, we said: "Dust prevention may properly be considered as much a part of the duties of a mining engineer as mine surveying. The mine office should be equipped with dust-sampling apparatus, and regular surveys of dust conditions should be made a part of the routine work of a mine where there is a conspicuous or dangerous amount of dust. There is no panacea for dust, but by intelligent application of the various methods of prevention that mining practice has evolved, its pernicious effects may be greatly lessened, if not eliminated." This, of course, refers particularly to the suppression of the dust evil, but the responsibility for other healthful conditions is also incumbent upon the mine manager, and much may be done by him and his associates, not only in the actual work of pulmonary-disease prevention but in the spread of propaganda concerning tuberculosis.

The National Tuberculosis Association and its 1,200 affiliated agencies are fighting a winning war against tuberculosis. They have clearly demonstrated that proper community organization will control the disease. It costs money to develop community organization. The sale of Christmas seals furnished the funds. From Dec. 1 to Dec. 11 this annual sale will take place. By buying and using liberally the seals and health bonds, any mining man will help not only himself but his community.

Eating With Foreign Knives

THE editor of *The Canadian Mining Journal* complains that food eaten by Canadians "is cooked by Pennsylvania coal in a stove made from United States ore and served on a platter that came from Europe, or Japan, maybe. It is eaten with a Sheffield or Connecticut blade, and the platter is washed with soap from Chicago."

We do not think the situation is as black as painted. Would it not be better to say, for example, that the food is eaten with spoons and forks, rather than knives, plated with Ontario silver on base metal made up of Canadian copper, British Columbian zinc, and Ontario nickel? Furthermore, the food, even if partly foreign, is paid for with Ontario gold or with credit secured by the export of Quebec pulpwood or Saskatchewan wheat.

With the domestic population profitably employed, it is no disgrace to purchase what someone else can produce more cheaply, provided the supply is adequate. In the case of coal, we admit, it is not.

A Case of Depreciated United States Paper Currency

THERE was related to us at the Mining Congress the recent instance, which we believe, from our sources of information, to be entirely authentic, of a Colorado dentist who a few weeks ago bought \$2,000 worth of gold in twenty-dollar gold pieces, paying \$22 an ounce. The explanation given was that he would have had to have gold notes in order to secure gold from the Mint, and that the Colorado banks were not paying out gold on any other notes. Therefore, this dentist paid \$22 in United States paper currency other than gold notes, for \$20.67 in gold. Are there other authentic instances?

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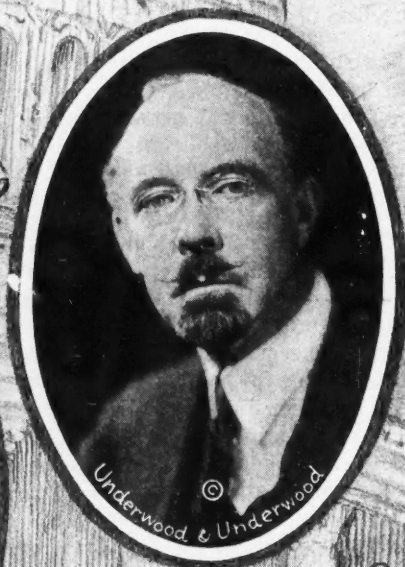
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L. W. WALLACE
SOCIETY OF INDUSTRIAL ENGINEERS
TREASURER

WHAT OTHERS THINK

Conserving the Rights of Inventors

In one of your recent editorials entitled "The Government Employee and His Discoveries," objections are raised to the Cottrell Bill, providing for the taking over and licensing of inventions of Government employees by the Federal Trade Commission, on the ground that Government employees who have aspirations to invent, will under the provisions of this bill become unduly favored individuals. You say:

"He would be in an enviable position—nothing to lose for the time spent in his researches, for the Government would support him comfortably and indefinitely, and everything to gain. We can imagine what a horde of hungry inventors, who have had experience of being on the losing side of the gamble, would apply for the government jobs."

The same sentiment is expressed by David Wesson in the discussion on the bill. Quoting from the *Chemical & Metallurgical Engineering* article to which you refer, he is reported as saying:

"In the first place, it is well established by decision and precedent under United States patent law, that inventions by an employee using information and facilities of the employer belong to the latter. This, of course, would put employees of our great U. S. Corporation in a separate and privileged class."

It may be proper to say at this time that the authorities will not support the statement of law put forth by Mr. Wesson. It is well settled that when an employer, even the U. S. Government, hires an inventor to make improvements and to invent, unless there is an express agreement whereby the employee undertakes to turn over to the employer any inventions he may make, as well as the patents based thereon, the only right that the employer acquires is an implied license to use the invention, or what is otherwise designated as a shop right.

On the other hand, if an employer suggests the main plan of an invention, any inventions ancillary to the main plan devised by the employee will inure to the benefit of the employer, and the employer's patent may be drawn to cover them. The employer and employee in such cases, however, stand in the relationship of co-operating inventors.

The ruling of the courts on the first proposition is in accord with a pronounced tendency, which they have always exhibited, to conserve the rights of inventors. It is not with a spirit of charity for the inventor that they have taken this position, but, after having weighed all the factors, they have decided that such a policy is in accordance with the purposes for which the patent system was founded.

Our patent system has had its great success owing to its liberality to the inventors, with the consequent stimulus to invention. Might it not be possible still further to stimulate invention by further liberality toward the inventor? At least, Thomas A. Edison seems to think so. In a hearing last year before the Congressional Committee on Patents, he authorized his representatives to say:

"You might say that if there is any possible way whereby the law would in actual practice work out so that the inventor would be protected from the capitalist either by the impossibility of alienating his interests or in that a fixed per cent should always be his in spite of himself, it would be of great value to the people of the United States. The United States has very little interest in having inventions operated almost wholly for the benefit of the capitalist. Their interest is in providing money for the inventor to permit him to continue to invent, which he certainly will do as long as he commands a dollar. This is a natural peculiarity of the inventive mind."

It was stated at the hearing that the idea of Edison was not to benefit the inventor, but to benefit the people by making it possible for the inventor to continue his experiments, thereby developing new inventions which would not be developed under the present system.

In reaching a decision on the merits of this bill, therefore, it is to be hoped that proper consideration will be given to the policies and objects of the patent system. Is the principle underlying the bill a correct one and will it stimulate invention? Bearing on this question, Professor Elihu Thompson, the celebrated inventor, has recently said:

"Publish an invention freely, and it will almost surely die from lack of interest in its development. It will not be developed, and the world will not be benefited. Patent it and, if valuable, it will be taken up and developed into a business."

Having decided that the objects sought to be accomplished by the bill are in general accord with the policy of the patent system, the next question to be answered is, Is the bill properly drawn? If it is not properly drawn to carry out these objects, redraft the bill.

The tendency for the discussion to drift off from the real merits of the bill on to questions of patent policy that have been considered as well settled, is unfortunate. It is with the object of directing attention to the necessity of intelligent consideration of the untried features of the bill that this communication is written.

Washington, D. C.

JOHN BOYLE, JR.

Specie Payments

Recently you called attention to the inability of one of your editors to obtain gold coins at the bank to which he applied for them. You made the very pointed statement that if there isn't enough gold to enable it to be fairly distributed, the banks can at least assist in stimulating production. Of course, the reason that it is difficult to obtain gold at any bank in spite of the enormous amount of gold in the country is the relatively low percentage of metallic gold reserves to the amount of paper money in circulation, and no doubt it is the desire of those in authority to conserve all the gold possible. So long as faith in our present system is unshaken the present condition will work, but it is mighty fortunate for us that there are no countries that we are indebted to, for our currency would then surely reflect its depreciation.

F. G. ADAMSON.

Expenditures of the Bureau of Mines

An Official Explanation of the Use of the Bureau's Appropriations, With Special Reference to Recent Editorial Comment—Question Raised Whether Metal Mining Is Not Receiving More Than Its Proper Share of Attention

BY DR. F. G. COTTRELL, Director
Written for *Engineering and Mining Journal*

THE editorial in the *Engineering and Mining Journal* of July 24, 1920, pp. 147-48, relating to the work and organization of the Bureau of Mines, asked if the Bureau was expending perhaps an undue portion of its funds in the interest of safety and at the expense of economic mining and metallurgical investigations. In addition, an analysis of the Bureau's appropriations was given, and the belief expressed that certain phases of the industry were receiving undue attention at the expense of others.

Frankly, it is probable that the Bureau appropriations are not balanced from the point of view of many men engaged in particular divisions of the industry. For example, attention has been forcibly directed to the fact that the appropriation for carrying out the work in petroleum and natural gas, supposedly falling within the Bureau's sphere, is entirely inadequate in proportion to the importance of the industry. It is equally true that the Bureau recently has been urged to devote more time and money to research in fuel testing, economic mining problems and to problems in the metallurgical and chemical industries. However, to get a clear perspective from the Bureau's point of view, it is necessary to go back to the beginning and ascertain what the Sixty-first Congress specifically had in mind when in 1910 it created the Bureau of Mines.

ATTITUDE OF CONGRESS IN ESTABLISHING THE BUREAU

For many years prior to this, efforts had been made to have the mining industry represented by a department in Washington, which would function in a manner similar to that of many foreign countries which have a cabinet officer directing a department which represents the mining and mineral industry. Specifically, however, the matter did not progress toward completion until 1907 and 1908, when a series of mine disasters occurred in America which took such an unusual toll of lives that the public and Congress were thoroughly awakened to the necessity of creating a bureau which could help in making the mines safer.

Statistics were presented which showed that the death and accident rate in the mining industry in America was greater than in European countries. Reports and hearings before Congress brought out clearly that mine operators felt they did not have the knowledge which would help them avoid similar disasters, and, perhaps of most significance, they felt that the problems involved such sums for their solution and the results were of such importance to the mining industry in all parts of the country that a central Federal agency was the best means of carrying out the needed work. Thus, in the organic law creating and continuing the Bureau the investigations relating to the safety of miners and prevention of accidents were particularly emphasized.

For these reasons the appropriations for mine acci-

dents have consistently been the largest single appropriations given the Bureau. As stated in the editorial, including the appropriation for mine rescue cars and stations, this amounts to 43 per cent of the total money received. It is, perhaps, natural that the public should associate this appropriation with the first-aid and mine rescue training and its attendant slogan of "Safety First."

MANY BRANCHES OF "MINE-ACCIDENT" WORK

However, the term "Mine-Accident Appropriation" is only an abbreviated term used for convenience to cover an appropriation which reads as follows: "For investigations as to the cause of mine explosions, methods of mining, especially in relation to safety of miners, the appliances best adapted to prevent accidents, the possible improvements of conditions under which mining operations are carried on, the use of explosives and electricity, the prevention of accidents and other inquiries and technologic investigations pertinent to the mining industry," and this in turn covers both the coal- and metal-mining industries.

Thus, out of this fund comes not only about \$112,000 for expenses of mine rescue cars and stations and direct first-aid and mine rescue training and disaster work, but more than \$297,000 in addition which is devoted to the expenses of testing and research into explosives and the use of electricity and mechanical appliances underground, ventilation, coal- and metal-mine dust, and their relation to the health and safety of miners; the operation and maintenance of the fifteen Bureau schedules of approval for explosives and safe equipment underground, and the extensive field and experimental mine investigations relating to the prevention of explosions from coal dust and gas. In short, this appropriation not only supports the basic investigations of the fundamental problems pertaining to the improvement of health and safety conditions in the whole mineral industry but investigations which have the widest economic importance. Safety in mining has a significance today which is inseparably linked with efficiency and economy.

Of the \$154,000 appropriated for operating mine rescue cars and stations, \$126,000 is spent for the regular work of training and the remaining \$28,000 for investigative work on subjects relating to the health and safety of the miner, which studies can be best carried out by the personnel of the rescue cars. Thus, of a total of \$563,000 appropriated for "mine accidents" and "operating mine rescue cars," \$238,000 is spent in so-called regular first-aid and mine rescue training and stations and cars and \$297,000 is devoted to the investigational work as just described.

Concerning the mining experiment stations, of which there are ten distributed in mining districts throughout the country, and for which there is an annual expenditure of \$200,000, it is a fair question for dis-

discussion as to whether the industry is better served by this number of stations, each small in itself, and by reason of their location peculiarly in touch with local needs and industries, or by having an equal amount of money spent in the construction of a single central large station, where, as at the Pittsburgh station of the Bureau, a trained corps of specialists is available on any problem. It is a fact that local industries prefer to have their problems worked out locally. Furthermore, the distributed stations are far more closely in touch with the general industry than a central station could be. At the same time, as brought out in the editorial, there is the possibility of multiplying overhead expenses, of loose co-ordination and possible duplication of work at the several scattered stations. The Bureau is trying to avoid these faults by close liaison and supervision of the stations through the central office of supervisor of stations. The Bureau believes that the results of the last year justify the continuance of the work at the individual stations. Furthermore, it believes thoroughly that certain industries, as, for example, the coal industry, have enough great and general problems to justify the building up of central stations of a larger magnitude than those represented by the so-called "Foster" or "Mining Experiment Stations Act," which receive only \$25,000 per year.

Fuel testing and petroleum are subjects so definitely defined as to offer little chance of discussion as to the purposes of their expenditure.

The editorial states that mineral mining, including both coal and metal mining, receives 10 per cent only of the appropriations. Again there may possibly be misapprehension due to the use of the abbreviated term "mineral mining." Actually, none of the mineral mining appropriation money is expended in coal mining. The full estimate of the appropriation reads as follows: "For inquiries and scientific and technologic investigations concerning the mining, preparation, treatment and utilization of ores and other mineral substances, with a view to improving health conditions and increasing safety, efficiency, economic development and conserving resources through the prevention of waste in the mining, quarrying, metallurgical and other mineral industries." This includes a broad field, recognizing the need for economic work in the whole mineral mining, metallic and non-metallic, ore dressing, and allied fields of the treatment and utilization of the metals and minerals contained therein. Thus, many ore-dressing, metallurgical and economic studies are supported from this fund.

"MINERAL MINING" DOES NOT COVER COAL FIELD

There has been a prevalent idea that the Bureau of Mines spends more of its money in the coal industry than in the general mineral, metallurgical, and economic fields. Without discussing the relative merits of the question, an analysis has been made of the past year's expenditures of the Bureau of Mines in these fields, which shows approximately the following:

Expenditures chargeable to coal mining and combustion:

1. For mine accidents, including mine rescue cars and stations.....	\$333,126
2. Testing fuel.....	142,510
3. Engineering experiment stations.....	5,000
Total	\$480,636

Expenditures chargeable to mineral mining, ore dressing, metallurgy and to mining and preparation of earthy minerals:

1. For mine accidents, including mine rescue cars and stations.....	\$142,892
2. Mineral mining.....	125,000
3. Engineering experiment stations.....	170,000

Total \$437,892

Thus, if fuel testing (which is mostly mechanical engineering) is deducted from coal mining, a larger amount was spent for work and investigations in the metal- than in the coal-mining industry, and the question may be raised whether metals are not receiving more than their share of attention. The answer to that question is that it is more expensive to investigate a number of subjects than it is one subject; the ore-dressing of the different metallic minerals offers more problems than the washing of coal, for example. Moreover, it is highly desirable to investigate problems in the area in which they exist, so far as possible, to maintain close contact with the industry, and it is less practicable to centralize investigations of metal-mining problems than it is of the coal-mining problems.

Altogether, the field functionally within the activities of the Bureau is broad, and there are many spots as yet cultivated not at all or only casually. If the work under way is or will be of value to the industry it is reasonable to suppose that funds may continue to be apportioned to the Bureau until all branches of mining and metallurgy shall receive their just dues.

Malaria Control

The methods followed by the American Bauxite Co. at its plant in Bauxite, Ark., for malaria control by anti-mosquito measures, as described in *Bauxite News* for October, 1920, are as follows:

The control measures employed consisted of draining and oiling all streams thought to influence the incidence of malaria by producing a sufficient number of mosquitos to become of sanitary importance. Areas were cleared and regraded or otherwise treated, so as to insure rapid run-off of normal waters. Such major obstructions were removed from the bottom of streams as would retard the normal flow of waters or prevent the formation of complete films during subsequent oilings.

In clearing the streams of obstructions, special efforts were made to remove all overhanging brush that by coming in contact with the normal flow of water could produce favorable places for the mosquito to rest and deposit eggs. As a rule it was necessary to remove the underbrush from one side of the stream only, as this was found to give free access to the water during inspection and oiling wherever practicable.

Narrow ditches were cut in the bottom of wide ditches so as to confine the receding water after heavy rains to narrow banks. New ditches cut for the purpose of draining known breeding places were constructed as narrow as possible, remembering that cattle are less likely to trample the bottoms of deep narrow ditches while in wide bottoms. Ditches where cattle are permitted to roam and small isolated areas due to hoof prints can often be seen in which mosquitos may breed without fear of being molested by any of their natural enemies. Mosquitos will deposit eggs in almost every conceivable artificial container, water barrels, cisterns, cans, cellars; in fact, any receptacle that will hold water.

Copper Losses in Slags

Investigation of Methods for Determining Amounts of Sulphide and Oxide Present—Analyses Of Characteristic Slags and Their Interpretation—Wisdom of Pouring Converter Slag Into Blast-Furnace Settlers

BY FRANK E. LATHE

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Written for *Engineering and Mining Journal*

FOUR ARTICLES published in technical journals during the last ten years have given the results of investigations to determine the condition in which copper exists in slags. Considering them in order of publication they are:

1. Thomas Kiddie, *Jour. Can. Min. Inst.*, 1911, Vol. 14, p. 487. Using dilute sulphuric acid as a solvent, Mr. Kiddie determined the copper in the oxidized condition in a number of slags, and concluded that, at least under the conditions investigated, this constituted more than half of the total copper.

2. Frank E. Lathe, *Eng. and Min. Journ.*, 1915, Vol. 100, pp. 215, 263, and 305. In my investigation I followed to a large extent the lines laid down by Mr. Kiddie, for although the limitations of the sulphuric-acid method for oxidized copper were recognized, this appeared to be the best reagent of the purpose. The results obtained on Granby and Anaconda slags were similar to Mr. Kiddie's, most of the copper being soluble in acid.

3. C. G. Maier and G. D. Van Arsdale, *Eng. and Min. Journ.*, 1919, Vol. 107, p. 815. Messrs. Maier and Van Arsdale made a careful microscopic examination of slags, and also treated finely pulverized samples with 1 per cent silver-nitrate solution. The copper dissolved by the reagent they called suspended sulphide copper, and that insoluble was believed to be dissolved sulphide. Oxides and silicates they considered to be absent.

4. C. G. Maier and G. D. Van Arsdale, *Chem. and Met. Eng.*, June 16 and 23, 1920, Vol. 22, pp. 1101 and 1157. This was chiefly the results of an investigation to determine the effect of magnetite on slag losses. Magnetite was found to increase the losses due to sulphide flotation by attached gas particles. The authors reaffirmed their faith in the silver-nitrate method for determining suspended sulphide copper, and again assumed that copper oxides or silicates were absent under ordinary smelting conditions.

On account of the contradictory conclusions reached in the above investigations I decided to begin another series of experiments, using new methods, and including a sufficient variety of slags to cover most of the conditions commonly met in copper smelting. To the results of these experiments I have added various observations made since the publication of my previous article.

First I wish to acknowledge the courtesy of those companies which have provided samples for these experiments and have consented to the publication of the results obtained. In no degree are my remarks intended to imply a criticism of the practice of any company, nor with the facts at hand could a fair criticism be made, for a slag loss which might indicate admirable practice under one set of conditions frequently would not be permissible under those prevailing in another district.

The method for determining oxidized copper in ores using sulphurous acid as solvent was developed by

Messrs. van Barneveld and Leaver,¹ of the U. S. Bureau of Mines, and is highly satisfactory. This reagent completely dissolves oxidized copper, whether present as silicate, carbonate, or cuprous or cupric oxides, but does not under any condition attack the sulphides. As distinguished from the sulphuric-acid method, here the presence of metallic iron, frequently introduced in pulverizing samples, does not interfere with the solution of the copper, for metallic copper, which might be precipitated by it, is itself soluble in sulphurous acid. Neither do ferric compounds have any effect, for if these go into solution they are immediately reduced by the reagent.

As already noted, Messrs. Maier and Van Arsdale claim that silver nitrate, acting on finely pulverized slags, dissolves only the sulphide particles which were suspended in the molten condition.

Assuming, then, that these two methods were all that was claimed for them, it seemed possible to determine directly both the oxidized and suspended sulphide copper, and if the total of these was less than the gross amount of copper present, the difference must occur in another chemical combination or physical condition—probably as true dissolved sulphide. These methods were therefore made the subject of a careful and painstaking investigation.

My experiments on the sulphurous-acid method fully confirmed the results obtained by Messrs. van Barneveld and Leaver. The reagent does readily dissolve oxidized copper, but has no action whatever on the sulphides. As for the limitations of the method, its originators noted that very fine pulverizing of samples was required to insure complete solution of the copper in a reasonable time. To this slight disadvantage I would add two more serious ones, at least as applied to slags. First, the 3 per cent solution of sulphur dioxide recommended does not thoroughly decompose all slags, especially if these have been air-cooled. Second, in the presence of considerable iron sulphide either the oxidized copper is incompletely soluble or copper already dissolved is afterward precipitated as sulphide. Both of these disadvantages tend toward low oxide results.

THE SILVER-NITRATE METHOD

Upon trying the silver-nitrate method of Messrs. Maier and Van Arsdale I was much disappointed at the results obtained. It was claimed² that silver nitrate would completely dissolve the copper sulphide which was in the molten slag as suspended matte particles, but that it would not attack dissolved sulphide, oxides or silicates. The presence of metallic iron was said to be detrimental. Taking these points one by one I found: (1) That silver nitrate does usually dissolve copper sulphides, but not in all combinations. (2) That the assumption that copper sulphides dissolved in the

¹*Eng. and Min. Journ.*, 1918, Vol. 105, p. 552.

²*Eng. and Min. Journ.*, 1919, Vol. 107, p. 815.

molten condition will not be attacked is not justified, as such sulphides would probably not be equally soluble in the solid slag, and might therefore be found in the latter as small sulphide particles, readily soluble. (3) That cupric oxide is slightly attacked by silver nitrate. (4) That cuprous oxide is readily attacked, though it does not appear to be completely soluble. (5) That the presence of metallic iron is not detrimental, except in consuming more of the reagent.

When silver nitrate was tried on slags peculiar results were obtained. Some yielded only traces of their copper to it. On the other hand, one converter slag, in which nearly 60 per cent of its copper was soluble in sulphurous acid, nevertheless yielded 90 per cent of it to silver nitrate. It was evident that part of the copper was soluble in both reagents, and as the sulphide had been proved to be insoluble in sulphurous acid, it followed that the silver nitrate must be dissolving oxidized or metallic copper. That the latter was not present in appreciable quantity seemed probable from the fact that the sample had been passed through a 200-mesh screen without any appearance of metallics. Moreover, metallic copper is not found in converter slags in quantity except in the unusual case of an overblown charge. After many experiments I was therefore compelled to abandon the use of silver nitrate as unreliable. It is worthy of note that this was also done by Wanjukov² in his elaborate series of experiments.

EFFECT OF HYDROFLUORIC ACID

As was noted before, sulphurous acid does not completely decompose all slags. The addition of a sufficient amount of hydrofluoric acid would decompose the silicates, so the effect of a combination of sulphurous and hydrofluoric acids was thoroughly investigated. Results showed that under the conditions of the experiments the only action of the hydrofluoric acid was to break up the silicates and liberate some copper for possible solution by the sulphurous acid. Even chemically precipitated copper sulphide is not attacked by a

copper only one gram was taken for the experiment, and where decomposition appeared to be slow a further addition of 5 c.c. of hydrofluoric acid was made. After filtration of the residues, which contained all the copper sulphide, the sulphur dioxide was boiled out of the filtrates, and copper precipitated therein by hydrogen sulphide, being afterward determined by the electrolytic method.⁴

As in the original sulphurous-acid method for ores, under ordinary conditions results will be sufficiently accurate, and such difficulties as may be found, e.g., the presence of much iron sulphide or incomplete decomposition, tend toward low rather than high results for oxidized copper. In no instance are copper sulphides attacked.

SLAG ANALYSES

The results of the experiments are shown in Tables I, II and III, for blast-furnace, reverberatory-furnace and converter slags, respectively. For the sake of comparison the copper soluble in sulphurous acid alone is also given, though it should be clearly borne in mind that this does not usually represent the total oxidized copper, owing to poor decomposition of the samples. It is believed that the copper soluble in hydrofluoric and sulphurous acids represents closely the total of oxide, silicate, and metallic copper in all samples analyzed.

An examination of Table I shows that both the actual amount of oxidized copper and the percentage of that to the total vary greatly. With a high percentage of sulphur on the charge and no oxidized copper present, as at Nickelton, Trail, Anyox, and Ducktown, the amount of oxidized copper in the slag is almost negligible. At Douglas and Globe, on the other hand, partly oxidized ore is smelted to a high-grade matte, and the conditions are not sufficiently reducing to eliminate all the oxide, although the low percentage of sulphide copper indicates efficient settling.

Matte concentration at Ducktown considerably increased the amount of oxide in the slag, but did not

TABLE I. BLAST-FURNACE SLAGS

Sample No.	Company	Location of Plant	Nature of Charge	Per Cent Total Cu	Per Cent Cu Soluble in H ₂ SO ₄	Per Cent Cu Soluble in HF and H ₂ SO ₄ "Oxidized Copper"	Per Cent Oxidized to Total Cu
1	British America Nickel Corp.	Nickelton, Ont.	Heavy sulphide ore containing nickel as well as copper....	0.05	0.00	0.015	30
2	Cananea Con. Copper Co.	Cananea, Mex.	Little oxidized copper.	0.33	0.055	0.135	41
3	Con. Mining & Smelting Co.	Trail, B. C.	Heavy sulphide ore.	0.255	0.02	0.03	12
4	Granby Con. M. S. & P. Co.	Anyox, B. C.	Heavy sulphide ore.	0.145	0.025	0.025	17
5	Granby Con. M. S. & P. Co.	Anyox, B. C.	Matte concentration.	0.295	0.025	0.015	7
6	Old Dominion Copper Co.	Globe, Ariz.	Some oxidized copper.	0.38	0.13	0.25	66
7	Phelps Dodge Corp.	Douglas, Ariz.	About 1% Cu in oxidized condition.	0.42	0.14	0.34	81
8	Tennessee Copper Co.	Ducktown, Tenn.	Heavy sulphide ore.	0.22	0.03	0.02	11
9	Tennessee Copper Co.	Ducktown, Tenn.	Matte concentration.	0.44	0.025	0.155	35

combination of these reagents, although in experiments on this material precautions had to be taken to avoid oxidation by the air during filtration.

The general method followed was to treat two grams of the sample, ground through 200 mesh, with 100 c.c. of a 3 per cent solution of sulphur dioxide and 10 c.c. of hydrofluoric acid in a stoppered bottle at room temperature and with occasional agitation—continuous until the silicates had sufficiently decomposed not to stick to the bottom. Decomposition was nearly complete in twenty-four hours or less, but the treatment was continued for from five to ten days. There was some action on the glass bottles, but this merely increased the consumption of acid. Of certain samples high in

do so at Anyox, on account of the less strongly oxidizing conditions there. The sulphide loss in both operations noted increased considerably over that normal to ore smelting, no doubt partly because of the composition of the slag and the grade of the matte, but also indicating that when so much copper is present on the charge, careful attention should be paid to the settling facilities.

Under the more uniform conditions of reverberatory smelting one would expect less variation of oxidized copper content than in blast-furnace practice. Sufficient samples were not available to prove this point, although the Anaconda and Phelps Dodge slags gave similar results, showing that three-quarters of the total copper present is in the oxidized condition. Regarding the

²*Metallurgie*, 1912, Vol. 9, pp. 1 and 48.

⁴*Eng. and Min. Journ.*, May 1, 1920, Vol. 109, p. 1010.

Cananea slag, both the low total copper and smaller percentage of oxidized copper are accounted for, in part at least, by the lower grade of the accompanying matte, which averages 15 to 20 per cent.

The results obtained with the slag from the furnace treating converter slag at Anaconda are peculiar. Although the total copper is considerably higher than in ordinary reverberatory smelting, the oxidized copper is not, which shows that the conditions for the reduction of the oxidized copper (see also No. 15, Table III) were better than those for the separation of the sulphides. It is probable that in this instance gas flotation of sulphides, as observed by Messrs. Maier and Van Arsdale⁵ in the presence of magnetite, was responsible for a considerable loss. To retain such a slag in the

effect of iron, already mentioned. Although no samples from straight copper converting were available to show this, Nos. 16 to 18 of Table III illustrate the regular but moderate increase of oxidized copper during the progress of the blow in copper-nickel converting.

The amount of magnetite formed, the kind of flux used, and the temperature and composition of the slag produced are all factors which doubtless have some influence on the condition as well as on the amount of copper in the slag.

POURING CONVERTER SLAG INTO SETTLERS

The practice of pouring converter slag into blast-furnace settlers seems to be increasing. When one can thus dispose of a troublesome intermediate product

TABLE II. REVERBERATORY SLAGS

Sample No.	Company	Location of Plant	Per Cent Total Cu	Per Cent Soluble in H ₂ SO ₄	Per Cent Cu Soluble in HF and H ₂ SO ₄ "Oxidized Copper"	Per Cent Oxidized to Total Cu	Remarks
10	Anaconda Copper Mining Co.	Anaconda, Mont.	0.35	0.155	0.24	69	
11	Anaconda Copper Mining Co.	Anaconda, Mont.	0.37	0.14	0.30	81	
12	Anaconda Copper Mining Co.	Anaconda, Mont.	0.60	0.105	0.24	40	Converter slag furnace.
13	Cananea Con. Copper Co.	Cananea, Mex.	0.145	0.03	0.07	48	Low-grade matte produced
14	Phelps Dodge Corp.	Douglas, Ariz.	0.29	0.115	0.24	83	

furnace until much of the gas had escaped and the accompanying copper sulphide had settled might be metallurgically possible but commercially inadvisable, owing to the reduced tonnage of the furnace.

Converter slags show a wide variation in their oxidized-copper content. This is attributable to a number of different factors, of which a few may be mentioned. The chief factor is the protective effect of iron, which oxidizes in preference to the copper, although the periods of oxidation overlap somewhat. From this it follows that, other things being equal, the average converter slag produced at a plant treating low-grade matte will contain a lower percentage of oxidized copper than the slag from one treating high-grade

without raising the copper content of the blast-furnace slag by more than a few hundredths of a per cent, the temptation to do so is strong. The practice is justified by some metallurgists on the theory that the copper is present as sulphide of metal, and will therefore settle if given a chance. Others⁶ believe that much of the copper is in the oxidized condition, and that therefore settling alone cannot recover it; and from the results given in Table III it will be seen that this opinion has usually sound foundation in fact. It must be remembered, however, that when converter slag is poured into a settler it falls through the lighter blast-furnace slag to the surface of the matte, and, particularly if the matte be of low grade, the chances for the

TABLE III. CONVERTER SLAGS

Sample No.	Company	Location of Plant	Per Cent Total Cu	Per Cent Soluble in H ₂ SO ₄	Per Cent Cu Soluble in HF and H ₂ SO ₄ "Oxidized Copper"	Per Cent Oxidized to Total Cu	Remarks
15	Anaconda Copper Mining Co.	Anaconda, Mont.	4.88	2.76	3.85	79	
16	British America Nickel Corp.	Nickelton, Ont.	1.23	0.065	0.06	5	Beginning of blow, Ni present
17	British America Nickel Corp.	Nickelton, Ont.	1.46	Undet.	0.10	7	Middle of blow, Ni present
18	British America Nickel Corp.	Nickelton, Ont.	0.845	0.045	0.25	30	End of blow, Ni+Cu, 70 to 80 per cent
19	Cananea Con. Copper Co.	Cananea, Mex.	1.54	0.085	0.565	37	
20	Con. Mining & Smelting Co.	Trail, B. C.	1.97	0.45	0.88	45	
21	Granby Con. M. S. & P. Co.	Anyox, B. C.	2.56	0.205	1.045	41	
22	Old Dominion Copper Co.	Globe, Ariz.	3.61	0.39	2.40	67	
23	Phelps Dodge Corp.	Douglas, Ariz.	3.53	0.97	2.21	63	
24	Tennessee Copper Co.	Ducktown, Tenn.	1.09	0.135	0.77	71	

matte. The figures in the second-last column of Table III show that this is actually so, and that the variation is considerable.

Nickel, like iron, has a protective effect on the copper,⁹ so that the slag produced even while a copper-nickel matte approaches white metal will not contain much oxidized copper, the nickel slagging first. Some of the variation is probably due to different samples representing different parts of the blow, as detailed information regarding the samples analyzed is usually not available. It is only another phase of the protective

reduction of some oxidized copper are good. Further investigation of this point is desirable.

The difficulty in calculating the actual loss in pouring converter slag into blast-furnace settlers is increased by the above-mentioned tendency of the heavy converter slag to settle to the surface of the matte and thus find its way out of the settler only very gradually, so that its influence is felt over a long period of time. A method I have used of calculating the actual loss will now be illustrated by an example.

The Mond Nickel Co.⁸ has given the following figures

⁵Chem. & Met. Eng., June 16 and 23, 1920, Vol. 22, pp. 1101 and 1157.

⁶First suggested to me by Ivar Holé.

⁷John W. James, Eng. and Min. Journ., 1914, Vol. 97, p. 1114. Lathé, Eng. and Min. Journ., 1915, Vol. 100, p. 266.

⁸Report of the Royal Ontario Nickel Commission, p. 451.

regarding its practice of pouring converter slag into settlers:

	Cu	Ni	Fe
Blast-furnace slag.....	0.17	0.22	26.6
Converter slag.....	0.7	1.3	45.4
Settler slag (b. f. + conv.).....	0.20	0.29	29.9

According to the micrographic work of Messrs. Maier and Van Arsdale,⁹ the amount of iron sulphide suspended in slags is small, so I shall assume for the purpose of this calculation that the iron settled from the mixture of blast-furnace and converter slags may be neglected. The settler slag may then be considered as simply a mixture of the other two with a portion of the copper and nickel removed. Let

x = per cent blast-furnace slag in settler slag,
 $100 - x$ = per cent converter slag in settler slag.
 Then, considering the iron content of each,

$$26.6x + 45.4(100 - x) = 2,990,$$

whence the settler slag consists of 82.5 per cent of blast-furnace slag and 17.5 per cent of converter slag.

Now, of the 0.20 per cent Cu in the settler slag, 0.17×0.825 , or 0.14 per cent, belongs to the blast-furnace slag, so that $0.20 - 0.14$, or 0.06 per cent, belongs to the 17.5 per cent by weight of converter slag, giving the settled converter slag alone a copper content of 0.34 per cent. This indicates that 0.36 per cent of Cu has been settled, a recovery of 51.4 per cent. Similarly, it may be shown that 0.63 per cent of Ni belongs to the settled converter slag alone, a recovery of 51.5 per cent.

Instead of calculating the proportions of the two slags, it is of course better to use the actual weights, if these are available over a considerable period of time. In making such a calculation two points should be remembered. First, that the samples of slag taken at the furnace spout have not had the opportunity of settling that they would have had if they had gone through the settler. To be correct, the assay of the blast-furnace slag when settled alone should be used instead of that of the spout sample. Second, if the converter slag were resmelted in the furnace, the copper content of the blast-furnace slag would also be increased somewhat. The calculation, nevertheless, shows how much lower the actual recovery is than one might suppose from the low assay of the mixed slag.

SOME PRACTICAL APPLICATIONS

In Table IV are given some analyses of slags produced at the Grand Forks plant of the Granby company which show how the determination of oxidized copper may be used as a check on furnace conditions. All the oxide determinations were made several years ago by the sulphuric-acid method, and my experiments since then with sulphurous and hydrofluoric acids indicate that the results given are slightly high, but they are certainly comparatively and, I believe, approximately correct.

TABLE IV. EFFECT OF VARIATION IN BLAST-FURNACE CHARGES UPON THE COPPER CONTENT OF THE SLAGS PRODUCED

No.	Copper			of Oxidized to Total Copper	SiO ₂	Fe	CaO	Approx. Temp. of Slag in Deg. C.
	Total	Oxide	Sulphide					
1	0.19	0.12	0.07	63	47.0	13.3	22.2	1,275
2	0.215	0.155	0.06	72	.....	.....	.....	1,275
3	0.205	0.115	0.09	56	.....	.....	.....	1,225
4	0.41	0.175	0.235	43	.....	.....	.....	1,175
5	0.22	0.05	0.17	23	41.7	21.9	19.0	1,225
6	0.21	0.07	0.14	33	40.1	24.3	18.8	1,225
7	0.24	0.09	0.15	38	38.6	26.2	17.8	1,225

⁹Eng. and Min. Journ., 1919, Vol. 107, p. 815.

EXPLANATION OF TABLE IV

Sample 1. Slag produced in normal smelting operations, the charge consisting wholly of a calcareous ore containing a small amount of chalcopyrite and pyrite, but no oxidized copper.

Sample 2. The result of addition to the regular ore charge of about 25 per cent of an ore containing a little oxidized copper, resulting in more oxide in the slag.

Sample 3. Similar conditions to No. 1, except that the furnaces were run with lower coke, resulting in a colder slag containing the ordinary amount of oxidized copper but more sulphide.

Sample 4. A very abnormal slag from a furnace in bad condition. It was so cold as to prevent satisfactory settling of matte, prills of which were plainly visible to the naked eye in the chilled slag. Oxidized ore was again on the charge, with consequent increase of oxidized copper in the slag.

Sample 5. Same ore charge as No. 1, but with 30 per cent of its weight of 10 to 12 per cent matte. The larger amount of sulphur present prevented the oxidation of much copper. The higher specific gravity of this slag allowed a less perfect separation of matte particles than under the more favorable conditions of No. 1 to 3, with resultant higher sulphide.

Samples 6 and 7. Similar conditions to No. 5, except that these charges contained converter slag in the proportion of 10 and 20 per cent respectively. Only a part of the oxidized copper in the converter slag was reduced in the furnaces, a little being carried through into the blast-furnace slag and raising the oxidized copper content of that in proportion to the amount of converter slag added.

CONDITION OF COPPER IN SLAGS

Enough has already been said of the widely varying proportion of oxidized copper to the total copper content. It may be added, however, that copper oxide need not be expected in slags as a separate constituent, visible to the naked eye, or even under microscopic examination of the solid slag. It will naturally combine, as do the other bases, to form complex silicates, in which no one constituent can be determined except by chemical means.

The determination of suspended sulphides, as distinguished from those chemically dissolved, can best be made indirectly, by means of the copper-gold ratios of the matte and accompanying slag. The calculation is based on the assumption that only the suspended sulphide carries gold into the slag. To illustrate such a calculation, suppose that the matte has 45 per cent Cu and 15 oz. gold per ton; the slag, 0.30 per cent Cu and 0.02 oz. gold. The matte has thus one ounce of gold for each 3 per cent of copper, the slag one ounce for each 15 per cent, indicating that only 3/15, or 20 per cent, of the copper in the slag carries its normal amount of gold, or, that 20 per cent of the copper is present as suspended sulphide. It is of no importance whether the suspended sulphide is in the form of original matte particles or of pure copper sulphide left after oxidation of the accompanying iron sulphide.¹⁰ The iron may be oxidized, but the gold will be concentrated in the remaining copper sulphide.

Chemically dissolved sulphide remains for consideration. In my previous experiments, using sulphuric acid as solvent for the oxidized copper, I found no indication of its existence, the sum of oxide and suspended sulphide (calculated from the gold content) corresponding with the total copper in the slags. But as my recent work indicates that the former results for oxidized copper were slightly high, it is probable that a little dissolved sulphide was present even in the low-

¹⁰Maier and Van Arsdale, Eng. and Min. Journ., 1919, Vol. 107, p. 819.

iron slags on which experiments were made. Iron sulphide is certainly soluble in slags, especially in those of high iron content, and it is altogether likely that copper sulphide also dissolves to some extent, although in most operations the loss of copper in this condition is the least important of the three mentioned. It may be expected to increase in slags high in iron and zinc, especially if these be low in silica.

POSSIBLE IMPROVEMENTS IN PRESENT-DAY PRACTICE

Blast-Furnace Slags.—It is customary to place immediately below the furnace spout one large settler, the overflow from which goes to waste. Although the necessity for matte storage may require a settler of large size, it will often be found that two or more smaller ones in series¹¹ will more effectively clean the slag; or the large settler may be followed by small ones. The fall of slag from one settler to another probably allows the escape of a certain amount of gas, which may have caused the flotation of matte particles. Such a treatment is especially desirable when analyses show that the percentage of sulphide copper in the slag is high, as may be true in matte concentration or in other cases with a high percentage of copper on the charge to the furnace.

If the oxidized copper in the slag be high, some may be reduced by the addition of coarse pyrite to the second-last settler of a series. This was done at the Grand Forks plant of the Granby company with some success. The coarse pyrite added settles to the matte, and the sulphur driven off by heat stirs up the slag and has an excellent chance to reduce oxides. The lower-grade matte produced in this way also has a tendency to cause the precipitation of dissolved sulphides, if present.

Reverberatory Slags.—Owing to the presence of oxidized copper in the charge, and the comparatively neutral atmosphere in reverberatory smelting, the loss as oxide or silicate is likely to be high. To reduce this loss to a minimum I know of no method more promising than that suggested to me some years ago by E. J. Carlyle, and described in my previous article.¹² I repeat it here, as I am confident that the saving secured by this means would many times repay the cost of the experiment. Mr. Carlyle thought that if a wall of refractory material were built across a reverberatory furnace near the skimming end, high enough to keep back the main body of matte, but low enough to allow the slag to flow over it, pyrite could be charged through the roof between this wall and the skimming door, thus bringing about a material reduction in the copper content of the slag. A separate tap-hole could be provided for the low-grade matte as well as a side door behind the dam for the removal of floaters. Such a practice would not involve radical changes in construction, and would appear to be of general application in reverberatory smelting. The low oxide copper in the Cananea slag (No. 13, Table II) is an indication of the great possibilities of this method.

If converter slag forms a large proportion of the charge, the sulphide content of the slag may increase, as at Anaconda (No. 12, Table II). In such results, if the loss be due to sulphides floated by gas bubbles, the low-grade matte treatment may reduce magnetite introduced in the converter slag, and consequently bring down the sulphide loss, as well as reducing the oxides. To

lower the sulphide content a succession of small settlers might also be effective, as suggested for blast furnaces. In all such instances the amount of settling which can be done outside the furnace is dependent principally upon the degree to which the slag has been superheated before leaving the furnace.

Converter Slags.—Metallurgically speaking, it may be wasteful to pour converter slag into blast-furnace settlers, but one cannot say that such a practice is never justified. As in all other industries, smelting and converting are governed by commercial considerations, and these must be the deciding factors. This much may be said, however: In most plants possessing both converters and blast furnaces, at least a part of the converter slag is resmelted, and when this is done the slag to be poured into settlers should as far as possible be that produced in the early part of the blow, when oxidized copper is at a minimum. If the suggested modification of reverberatory furnaces should, upon trial, prove commercially successful, that would appear to be the logical outlet for whatever converter slag is not required for fluxing purposes.

New Process Saves Coal Otherwise Lost in Ash

The Gruson Werk, a branch establishment of Krupp, has developed a new process for saving unburned coal out of combustion residue which, so it is claimed, is much simpler and quicker than the methods formerly known, which are based on the different specific gravities of coal and clinker. The new process makes use of the magnetic qualities of the oxides of iron into which the sulphurous pyrites are transformed by the burning and which are retained in the clinker. The basic principle of the process is the fact that owing to the contents of ferro-oxides, the clinker responds to electro-magnetic action, whereas the coal does not.

Production of Minerals in Mexico

The average Mexican monthly production of copper has reached 4,681,020 lb., according to reports of the Bureau of Mexico, of the Department of Industry, Commerce, and Labor. The average monthly production of gold, according to the same authority, is now 1,965 oz. and of silver 170,824 oz. At the present time there are in Mexico 60,569 denounced mining claims, 2,017 of which were denounced prior to 1892. Taxes are being paid on 30,990 claims, and 3,867 claims are now being worked. Metals extracted in Mexico are smelted in Monterrey, Aguascalientes, Torreón, Chihuahua, San Luis Potosí, Velardena, Saltillo, Boleo Teziutlan, Mampimi, Matehuala, and Mazapil.

Iron Ore in Victoria, Australia

Mount Nowa Nowa, at the head of Lake Tyers, Gippsland, Victoria, is stated in a recent *Melbourne Age* to be the richest and largest repository of iron ore in Victoria. Recent exhaustive tests have justified this statement. A charcoal test of 14½ lb. of ore returned 11 lb. of pig iron, and the iron when tested has been adjudged to be of splendid quality. An unlimited supply of limestone, which is required for smelting purposes, as well as an ample supply of firewood, which will provide the stocks of charcoal required, are present in the district.

¹¹Lathe, *Eng. and Min. Journ.*, 1915, Vol. 100, p. 270.

¹²*Eng. and Min. Journ.*, 1915, Vol. 100, p. 307.

Effect of Erosion on Mineralized Areas In Northern Sonora

The Removal of Rock Material Has Lessened the
Depth of Mineral Deposits in This Section
To a Considerable Extent

BY GRAHAM JOHN MITCHELL
Written for *Engineering and Mining Journal*

THE extent to which erosion has degraded mineralized areas in northern Sonora, Mexico, is a factor to be considered when prospects in that region are examined. The millions of tons of rock débris washed

The Paloma Mountains contain a variety of mineral deposits, principally copper, silver, and lead. The ore occurs in veins and brecciated areas in igneous rocks, chiefly andesite and granite. An examination of these mineralized areas shows them to be but the remnants of formerly more extensive deposits. What is left of the veins represents lower portions of ore formed at intermediate depths. In some of the copper ore in breccia, the ore does not outcrop, but is within a short distance of the surface. Such ore in breccia, in which tourmaline, molybdenite, chalcopyrite, and pyrite are characteristic, indicates deposition at greater depth and higher temperatures than the vein deposits. The depth



FIG. 1. LOOKING WEST FROM TRANSVAAL COPPER CO.'S SMELTER, CUMPAS, MEXICO
Photo by H. C. Beauchamp

down from the surrounding mountains and filling neighboring valleys impress even the most casual observer. An examination of these gravels shows rocks containing varying amounts of metallic minerals which formerly occupied veins and other types of deposits in the adjoining mountains.

Fig. 1 is a panorama looking west across the Moctezuma River valley from the Transvaal Copper

Co. to which mineral has been mined in this region is comparatively shallow, most of the mines showing decreasing values and extent of mineralization in deeper workings. The best ore has been found to range from the surface to approximately five hundred feet.

The common mineral association in the vein deposits is chalcopyrite, pyrite, tetrahedrite, bornite and galena. In some deposits tetrahedrite and galena predominate,

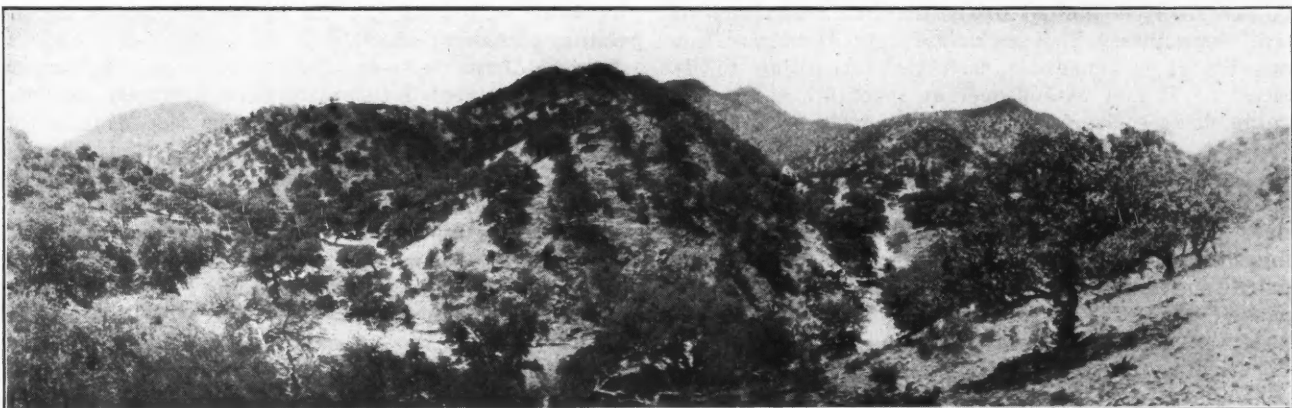


FIG. 2. COPPER-TOURMALINE PROSPECT SOUTH OF ARCHIPELAGO MINE, SONORA, MEXICO
Photo by H. C. Beauchamp
Mineralized breccia outcrops along creek in central foreground.

Co.'s smelter at Cumpas, Mexico. The outline of the Paloma Mountains, the highest peaks of which are approximately six thousand feet elevation, can be seen on the right in the distance, with low hills in the foreground. The low benches in the immediate foreground are made up of material washed from the higher range and from other mountains to the north. These benches have been further dissected by the Moctezuma River and its tributaries.

whereas in others chalcopyrite and pyrite are more abundant. In "breccia ore" chalcopyrite, tourmaline, and molybdenite are the prevailing minerals. Oxidation has developed some secondary minerals, such as covellite and chalcocite, from chalcopyrite and bornite, but the region as a whole is typically one of primary sulphide minerals.

Fig. 2 is a photograph of the maturely dissected region a few miles south of the central portion of

Paloma Range. Deposits of chalcopyrite and tourmaline are found in these hills in brecciated and silicified zones of andesitic rock, though such zones are small and scattered. Only a little surface work has been done, but very good specimens can be secured in which chalcopyrite and tourmaline form a crystalline aggregate cementing the breccia. This region, like that further north, has also undergone extensive erosion.

The fact that erosion has removed such large volumes of rock material from these mineralized areas, together with the knowledge that the remaining deposits are of the types formed at intermediate and greater depths and are only remnants or "roots," affords data upon which one may judge similar deposits in the region. Were it not for geological evidence disclosed in the developed mines of the district, deposits of the character indicated might be expected to extend much deeper. It is therefore apparent that erosion has removed a considerable volume of the mineral veins in the Paloma Mountain area, and such a condition will most likely be found to exist in other sections of northern Sonora.

Laws Regulating Mining Concessions in Serbia

BY CAPT. GORDON GORDON-SMITH
Written for *Engineering and Mining Journal*

THE statutes governing mining rights and concessions in Serbia are clear and liberal in terms. The principal law is that passed by the Serbian Parliament in 1898. The following is a summary of its most important provisions:

The Serbian state is the owner of the subsoil of its territory. It disposes of the mineral wealth and lays down all the necessary regulations concerning prospecting and exploitation. (Article 15.)

Prospecting. The prospecting rights are of two kinds, the *simple* right and the *exclusive* right. The *simple* right lasts for one year but may be prolonged for two years. It is limited to the maximum territory of three communes. The *exclusive* right lasts also one year, but it is renewable each year according to its necessity. It may extend over an indefinite number of mining fields each of 500,000 square meters. (Articles 21 to 30.)

For one field of operations, the prospecting rights, either simple or exclusive, can be accorded to only one single prospector. The obtaining of the two rights is subject to the conditions that the prospector has the legal disposition of his property. In addition, for the exclusive right, it must be shown that the mineral deposits in question are worth examining. These rights are hereditary and transmissible. (Articles 25 and 26.)

The minerals obtained by the work of prospecting cannot be treated or sold, except with a special administrative authorization. (Article 37.)

Mining Concessions. The state accords concessions for fifty years on a sufficient number of mining fields, of 100,000 square meters, which are delimited by a competent commission. To obtain a concession, in addition to possessing the necessary prospecting rights, proof must be furnished that the deposits are exploitable, that the prospector disposes of sufficient capital and that he possesses competency as a miner, and he must present a plan of the proposed work. (Article 40 to 46.)

The concessionaire becomes owner after fifteen years

of uninterrupted working, but he continues to pay the mining taxes, and is obliged, as before, to observe the dispositions of the Mining Law. (Article 47.)

Duties of the Prospector and the Concessionaire. For the prospector, as well as for the concessionaire and the owner, the law imposes the following obligations: Regular work, the assuring of the general safety and the safety of the workmen employed, an annual report on the work done, and the plan of the work for the following year. It is forbidden to mine under public roads, buildings, cemeteries, and other public works. (Article 32, 76 to 81.)

Duly constituted mining companies must keep books and hold annual meetings of shareholders as laid down in the Commercial Law. (Article 74.)

The priority, after the conditions for prospecting or exploitations have been fulfilled, belongs to the first comer. (Article 39.)

All prospecting rights and all concessions lapse if the specified works have not been undertaken the first year or if they are interrupted for any cause not approved by the Minister of Mines, or in case of bankruptcy. (Article 144.)

Rights to Concessionaires. The concessionaires or owners of mines have the right to divide or unite mining fields or their working plants, to suspend work for a certain time, if difficulties are met, and later to resume work. (Article 68.)

The mining privilege covers all kinds of minerals found in the territory conceded. (Article 67.)

The concessionaire has the right of establishing for the use of his mines all the necessary installations and constructions, machines, buildings, foundries, workshops, warehouses, roads, bridges, railways, and like complementary appurtenances. He may abandon exhausted mining fields. (Article 68.)

The state will favor importation of machines, tools and materials as well as the exportation of mineral products. (Article 69.)

The concessionaire may purchase the neighboring properties, either by private agreement or by expropriation. (Article 52.)

In case of the death or bankruptcy of the concessionaire the competent Tribunal of First Instance appoints a curator for the mines and informs the Minister of Agriculture, Commerce and Industry. (Article 87.)

Funds for the Mutual Aid of Mine Workers. The assurance of mine workers is obligatory. There are two kinds of funds for miners: (1) a fund for invalids and pensions; (2) a fund for the families of the miners, in case of the sickness or death of the latter. The first fund is common to all the mines; the other is for each particular mine. For the first 3 per cent and for the second 2 per cent is deducted from the miner's wages. The concessionaires pay into these funds an amount equal to 50 per cent of the amounts paid by the workers. Miners who work regularly in the mines are exempt from all taxes on their wages. (Articles 103 and 104.)

Mining Dues. The exclusive right is subject to the payment of a fixed due of 10fr. per annum for each mining field of 500,000 meters. For the concession a fixed due of 12fr. per annum for each mining field of 100,000 square meters is levied, and a proportional due, equal to 1 per cent of the gross revenue of the mine. The Minister of Agriculture, Commerce and Industry may suspend the imposition of this proportional due in case the enterprise, at the start, does not make any profit. (Articles 108 to 111.)

Moving Pictures in the Mining Industry

Apart From Meeting the Demand for Entertainment at Mining Camps and Villages, There Is Growing Development of Film Presentation in Safety and First Aid, Interdepartmental Organization, Promotion, and Educational Work

Written for *Engineering and Mining Journal*

THE need for diversion and the innate desire in humanity for new forms of amusement are chiefly responsible for the great development of the moving picture. As businesses, both the making and the presentation of the finished picture have proved to be highly remunerative. The use of the movie film for educational purposes is developing, but not as fast, for the money returns are moderate.

Industry has also turned to the moving-picture film, and there is at present a greater and greater tendency to resort to this popular method of exposition where it is necessary to "put over" an idea to any considerable group of humans. It is decidedly in style to increase the interest in a lecture by using the moving picture as an accessory. Not so long ago, the stereopticon was generally accepted both for illustration as well as to popularize an otherwise dull subject. It is now difficult to "get a rise" out of even an intelligent audience by means of ordinary lantern slides, however good they may be. Jaded humanity wants its "movie." The necessary thrill must apparently come through the eye, although the practical showman makes considerable use of the ear of his audience as well.

THE MOVIE IN PROMOTING "SAFETY FIRST"

The mining industry has not escaped the prevailing tendency, and is taking some of its "thrills" by the "movie route," although it is perhaps more conservative than other industries and has as yet only started. The U. S. Bureau of Mines was among the first to recognize the potent appeal of the movie. Under its direction, a number of educational films have been prepared and systematically loaned to educational institutions. The films have served a useful purpose in making possible a wider dissemination of knowledge of the mining industry. They have been exceedingly useful in visualizing different phases of the industry for mining students in the various colleges and universities of the country. As a means for bringing the "safety-first" principle to groups of miners and other workers, probably one of the most important educational methods is the moving-picture film. The larger mining companies can co-operate with the Bureau of Mines in the preparation of suitable films, but the relatively large expense and the requirement for systematic distribution where the film story will do the most good puts the burden of this work, as well as the expense, upon the Bureau of Mines.

The inculcation of the principles of Americanization, of proper living conditions, better work methods, the visualization of motion-study to workers, and the explanation of the operation of intricate machinery to the men who must either operate or repair such machinery are important fields for the moving-picture film. These subjects are educational and apply to the mining as well as to other industries.

Of more special interest to mining is the motion picture film applied to the needs of workers in ad-

vancing the lessons of "safety first" and "first aid." Elementary principles can be presented to large numbers simultaneously, and if accompanied by a concise and clear description, the result is better than can ordinarily be secured by other methods. Great care is essential in the preparation of the film, and the expense is justified, as a good film can be used in many different districts and repeatedly shown to the same audience. There will undoubtedly be a certain amount of standardization in such pictures, and in this as well as their preparation the Bureau of Mines is the most competent body to direct the work.

The introduction of new or highly specialized machinery into the mining field will undoubtedly be considerably facilitated by the use of moving-picture films, which can be used, first, more thoroughly to acquaint a prospective buyer with the machine; and, second, to instruct the men who may have to operate the machine in the details of its erection, operation, and adjustment. A complete "film story" showing the shop erection of a gyratory rock crusher, its dismantling and loading on a freight car, its removal and haulage to the place of erection, its final erection, and the adjustment and replacement of wearing parts would in itself be exceedingly interesting not only to the ordinary worker but to the engineer as well. A film story could be developed for almost any piece of machinery in a similar manner.

Engineers would be better acquainted with the erection and handling of heavy machinery if "film stories" on this subject were available. Considerable improvement in prevailing practice would necessarily result.

DANGER IN USE FOR PROMOTION PURPOSES

Who has not had an adventure with an inventor? Inventor, invention, and capitalist can be brought together by means of the movie film. Intricate processes as well as mechanical appliances can be explained accurately to capitalists and investors. This use of the movie film for promotion purposes has attained some recognition. Movie films have been taken of initial operations and the geological formations in Western oil-shale districts. It will not be surprising to hear that these films are being used actively in promoting stock sales. No special objection is to be made to the use of the movie film in the promotion of sound, legitimate enterprises, but there is danger that unsound and fraudulent projects may seek this persuasive avenue to the pocketbooks of the unwary.

It is not improbable that mining engineers will make occasional use of the movie film where important examinations are made in far-distant countries. Transportation and operating difficulties can be presented and made accurately known to directors, stockholders, and engineers. Topographical and surface obstacles that have to be overcome in plant construction can be made clear. Machinery manufacturers are also better able to appreciate the conditions to be met.

Dr. C. P. Berkey, professor of geology of Columbia University, says: "Many of the processes representing the operation of a successful mine are not very readily made clear to the non-technical board or untrained class. Nothing, of course, can wholly bridge the gap between these complicated operations on one hand and inexperience on the other, except actual contact with the work itself. But such contact is not always possible or expedient, whereas it often happens that a better comprehension of a problem or proposed change or special set of difficulties must in some way be given.

"It is usual to depend upon careful description and the imagination of the hearer to make this connection, but certainly with variable success. Perhaps at this very point the motion picture might be of special service in bridging the gap for inexperience. The imagination, unchecked by some better method than a description furnishes, sometimes pictures an impossible or a quite inadequate operation. In either case the chief object of the explanation may be lost. With a little true-to-life help in the form of a moving picture of the essential factors of the operation, however, not only may the case be made more clear but much time may be saved for all in reaching an adequate understanding."

Lieutenant William W. Hosp, an aviator, says: "Air-escape views in 'stills' and moving pictures are playing a more important part every day in commercial and industrial developments by affording impressionable evidence of the association of objects, crossroads, river, bridges and buildings upon the ground and registering the advancement of large improvements."

In the larger mining companies there is a field for the moving picture in interorganization work that has for its major objective co-ordination and increased efficiency. The interrelation of the various departments of a large business organization, however far apart they may be in a geographical sense, can be presented to the separate groups by the "movie." Both the manager and his audience can visualize the business to increased advantage.

EXAMPLES OF MINING AND INDUSTRIAL STORIES

The New Jersey Zinc Co. is in an exceptional position for a mining company, in that it not only mines and dresses its ore, but also smelts and prepares various market products therefrom. A sales organization has been developed to dispose of its products. One of the products is zinc oxide, and to extend the use of this product among paint users a single reel film has been prepared which shows the various steps in its manufacture. The film has already been shown before forty organizations in different parts of the country. These organizations consist largely of paint superintendents, large users of paints and paint manufacturing materials. Requests for the use of the film have been numerous.

BUREAU OF MINES PETROLEUM PICTURE

The U. S. Bureau of Mines, at the recent annual convention of the Independent Oil Men's Association in Denver, exhibited a four-reel moving picture of the petroleum industry. The film had been prepared in co-operation with the Sinclair Consolidated Oil Corporation. Prospecting, production, refining, distribution, and ultimate use of petroleum were shown. A comprehensive view of the petroleum industry was thus obtainable which would have required several weeks of journeying and access to a number of plants. A

moving-picture "story" of this kind, apart from its special interest to those in the petroleum industry, has considerable value in educating the public in the importance of the industry.

The Safety Committee of the U. S. Steel Corporation realized at an early period in the organization of its safety-first campaign that the moving-picture film was of special value in quickly and economically securing contact with the alien worker who could not easily comprehend the English language. In 1912, the first motion picture for the use of the Corporation was taken. It is entitled "An American in the Making." In addition to showing many safety devices, it also brought to its audiences the opportunities afforded the alien to better his condition. A second picture, "The Reason Why," was taken in 1917. It consists of two reels, 1,000 ft. each, showing safe and unsafe methods of doing work. A third picture taken in 1918 was entitled "Why." It is a continuation of the second picture. All three pictures have been shown to thousands of employees, and without doubt have well served the objectives of the safety committee.

The Province of Ontario, Canada, with the objective of making better known its resources, had a number of moving picture films made. These included the nickel industry, the Cobalt silver district and the Porcupine gold-mining district.

NEW CORNELIA OPERATIONS SHOWN

The moving-picture film of the operations of the New Cornelia Copper Co., at Ajo, Ariz., will be remembered by members of the New York Section of the A. I. M. E., before whom it was shown, as a particularly good picture. It was complete in that it showed the open-pit mining operations, the transportation of the ore to the leaching plant, the charging, leaching, and discharging of vats, and the electrolytic deposition of copper. Housing and living accommodations were also included.

It is unnecessary to quote other examples. In the aggregate, there has been a moderate use of the moving picture in the mining industry. The expense for the preparation of a picture is relatively high, and unless a definite measure of value in return for the expense involved can be figured out in advance, only the serving of an exceptional purpose would lead to the preparation of a film. As an example, the cost of the 1,000-ft. picture prepared for the New Jersey Zinc Co. was approximately \$2,000. Present prices are about \$1.30 per foot, plus the cost of the operator. A positive cost 10c. per foot or \$100 per 1,000-ft. reel. Another estimate of cost is \$1.50 per foot, which is a minimum, the arrangements for any special lighting and operator being included in this figure.

Unimportant Rumanian Gold Deposits

The beds of the rivers rising in the Carpathians produce gold, but have as yet not been prospected. Grains of gold up to 2.35 carats have, however, often been found in the washings of the Oltul. In the district of Ramnicu-Valcea, Rumania, workings of an experimental nature were begun in 1912. The ore gives from 15 to 30 grams of gold per ton, and the known reserves of these bearings is about 3,000 tons. The deposits present only a scientific interest, as no serious work has been undertaken to determine their practical importance.



HYDRAULIC MINING ON BILLITON ISLAND, DUTCH EAST INDIES

Mineral Resources of the Dutch East Indies

Important Production of Tin, Coal, and Petroleum — Gold Mining Is Developing — Petroleum Exploitation Closely Controlled by Government — Prospecting Licenses and Concessions Granted and Are Not Completely Restrictive*

Written for *Engineering and Mining Journal*

TIN ore, coal, bauxite, and petroleum are the important minerals mined in the Dutch East Indies. The government tin mines are on the Island of Banka; the privately owned tin mines on the Island of Billiton. Tin was discovered on Banka in 1710. Mining operations were first carried on by the native population, but the Chinese entered into the locality and the primitive native methods were displaced by the "Captain of Chinese," Assing, who organized a stable industry by introducing several important technical improvements. Since that time Chinese have largely remained in control.

In the middle of the second half of the eighteenth century the annual production sometimes reached from 30,000 to 35,000 piculs, and probably the same quantity was exported by smugglers. In 1812, Banka was ceded by the Sultan of Palembang to the British, and the tin mines came under European supervision, although the Chinese remained in the industry. On the restoration of Dutch rule, the European control gradually extended.

In 1852 the Dutch government organized a "Bureau of Mines" to extend geological and mining investigations and to put the mining industry on its feet. When the bureau was established it included ten engineers, and since that time it has grown until it now has more than sixty chief engineers, ordinary engineers, and geologists, in addition to many assistants. Its head-

quarters are at Batavia. Each year a Year Book is issued, one part being devoted to administrative, technical, and statistical details and the other part to scientific articles.

In developing the Banka tin-mining industry, the government engineers introduced important improvements in tin-smelting furnaces, in drainage of open pits, and in stripping, until at present the industry has reached a high state of development.

CHARACTER OF BANKA TIN DEPOSITS

Banka has an area of 12,240 sq.km. and a population of 100,000, three-eighths of the population being of Chinese origin. The exposed geological formations of Banka are granites and sedimentaries consisting of sandstone, quartzites, and shales of Paleozoic age. Strata are compressed into steep folds. The older rocks appear in the hills, the valleys and plains being filled with alluvial material. The tin ores are found in alluvial deposits along the northern and eastern coastal regions. Small veins of tin ore occur in the granite, but are not of commercial importance. The overburden is clay, sand, and gravel of varying thickness, the "pay" gravel ranging from 0.1 to 0.4 in. thick, in exceptional cases reaching a meter in thickness. The tin ore is from 2 to 4 per cent of the ore stratum, reaching in some cases as high as 10 per cent. It is mixed with pieces of sandstone, shale, and such uncommon things as fossils, shells, quartz crystals, topaz, monazite, and gold, as well as minerals ordinarily found in similar formations.

*Compiled from the Year Book of the Netherlands East Indies Exporters Directory and a bulletin of the Department of Agriculture, Industry and Commerce, Dutch East Indies Government.

Lead, copper, iron, manganese, and tungsten ores are found, but in extremely small quantities. The ore particles range from fist-size down to a finely divided powder. The clean ore from the sluices is reduced in simple blast furnaces, each mine having its own reduction plant. In three districts there is a central reduction plant. Preparations have, however, been made for a central plant to handle all of the tin concentrate produced on the Island of Banka.

Chinese coolies are employed, and a part of the actual mining is under government supervision. Introduction of modern machinery has decreased the amount of manual labor required. Banka tin is sold almost exclusively by auction in the Netherlands, every other month alternately at Amsterdam and Rotterdam. Small quantities, however, are offered at auction in Batavia. Since the war, however, most of the tin has been sold in Batavia. The product is shipped and sold, by the Nederlandsche Handel Maatschappij, agents for the Netherlands Indian government. In 1910 there were 361

tin ore from Singkep is smelted in Singapore. The Singkep company produced 834 metric tons in 1914. Later information is unavailable.

THE COAL MINES OF SUMATRA AND POELOE LAUT

Two coal mines are operated by the government, the Ombilin and the Poeloe Laut groups. The Ombilin mines are in Sumatra above Padang, on the west coast. The coal was discovered in 1868, and mining began in 1892. The coal field is 9 x 10 km., the bed reaching a thickness of 23 m. Poeloe Laut is on the small island of Poeloe Laut, lying off the southeast coast of Borneo. Mining began by private enterprise in 1903, but in 1913 the government took over the work. The center of the coal-mining operations is Stagen. In 1914 the production from the Ombilin mines was 448,141 metric tons and from the Poeloe Laut mines 110,238 metric tons.

Gold is found in Sumatra, Borneo, and Celebes in beach, alluvial, Tertiary gravel, and vein deposits. In 1914 fifty-eight concessions had been granted for pros-



MAP OF NETHERLANDS EAST INDIES. IMPORTANT OIL FIELDS IN BLACK

mines; the total production being 270,170 piculs; in 1914 the production was 234,725 piculs.

The geological conditions and the occurrence of tin ore on the Island of Billiton are similar to those on Banka, but, in addition to the alluvial deposits, several tin veins are large and rich enough to be worked. The principal operating company is the Billiton Maatschappij. A concession was granted to this company in 1852, and in 1892 it was extended a further period of thirty-five years. The company receives five-eighths of the annual profits. The industry and operations, excepting the lode mines, are organized along lines similar to those of Banka. Chinese contract laborers dominate. In 1914 there were forty-seven mines operating, and the production reached 5,194 metric tons. In 1918 the output was 11,555 metric tons of tin and 5,253 metric tons of tin ore.

The Singkep Tin Co. is another private enterprise which is operating on the Island of Singkep, in the Rhiau Archipelago. A concession was granted to this company in 1889. The occurrence of the tin ore is similar to that at Banka and at Billiton, and mining operations are similar. In the hills the mines are operated through adits. Near Singkep tin ore is found in the bottom of the sea and is worked by dredges. All

pecting and working gold and silver mines, but alluvial mining and dredging have met with little success. Natives carry on desultory operations in certain portions of Sumatra and work the Tertiary beds by primitive methods. The important gold-mining companies are operating vein deposits. The greatest quantity of gold is produced in the residency of Bencoele, Sumatra. Three gold mines are operating and in 1914 produced 2,108 kg. of gold and 9,910 kg. of silver, respectively, 60 and 30 per cent of the total production of these metals.

DESCRIPTION OF GOLD AREA

The gold area is known as the Lebong district and is 75 km. north of Bencoele. The best known mine is the Redjang Lebong. The formations are granite, slate, and limestone, with accompanying andesite, trachyte, and dacite. Veins are sometimes of important extent, in some cases strongly faulted. The gangue is finely banded quartz with small quantities of calcite. Sulphides vary in amount. Selenium is invariably present.

Treatment is by stamp and tube mills and cyanide after separating sands and slimes. Decantation and filtration are practiced. A second gold mining-district is in the northern peninsula of Celebes. There are

three producing mines. At the Totok mine the gold is found in white quartz forming pockets and stringers in metamorphic limestone. A third gold-mining center is in Central Sumatra, Padang. Development is, however, only in its initial stage.

Iodine is extracted from the hot springs of Java and is shipped to Europe as copper iodide. Wolframite, sulphur, and manganese in small quantity are also produced. Diamonds are found in the district of Martapoera, in the south and east division of Borneo. There is some activity in diamond mining, the production reaching 1,258 carats in 1914. Large-scale exploration in these minor minerals has as yet not taken place.

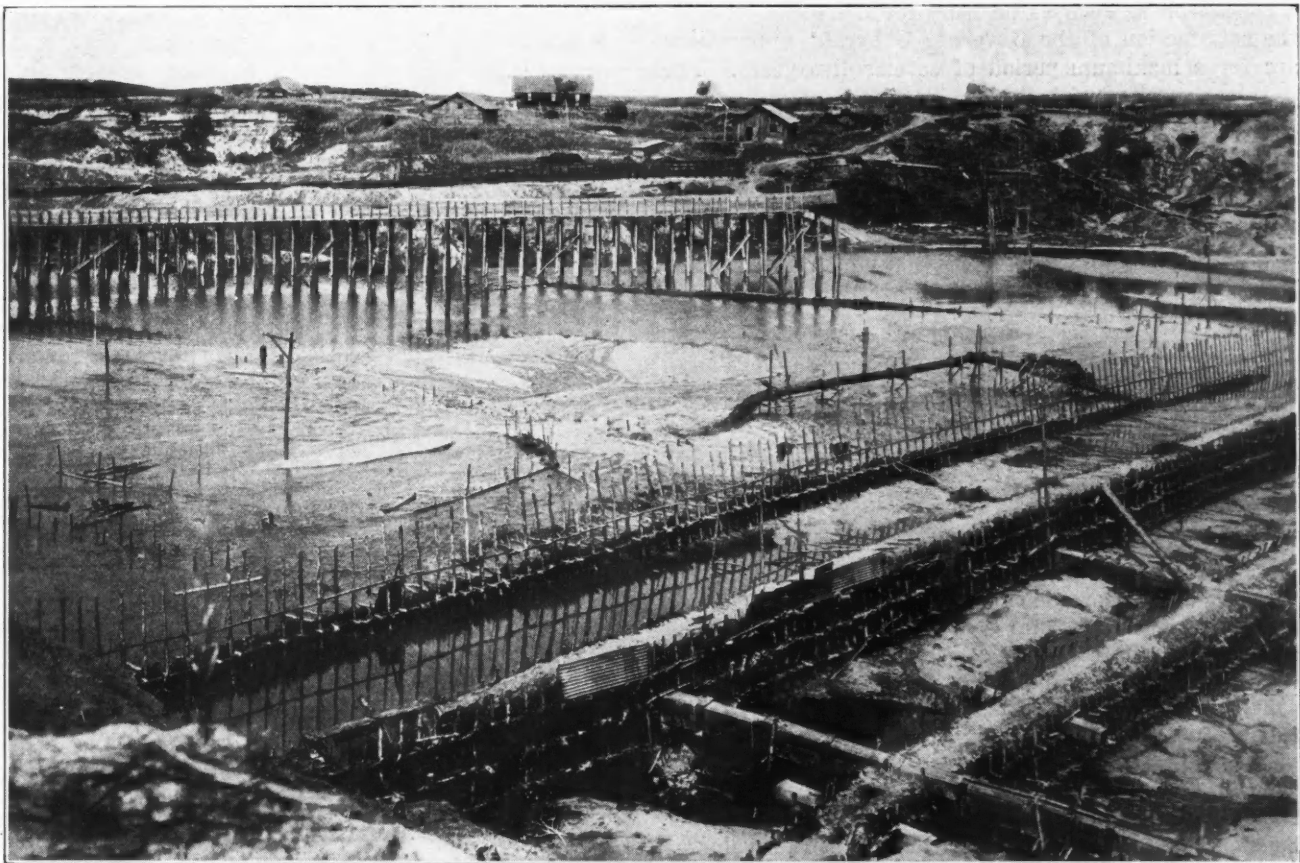
PETROLEUM PRODUCTION

The centers of petroleum production are the Langkat and Perlak districts, in North Sumatra; the residency

ing gasolene is encountered in drilling. Nearly all of the Sumatra crudes are especially rich in light products, and, generally speaking, contain little or no paraffin. The Borneo crudes vary considerably in composition, and it is no uncommon thing to find oils of an entirely different composition in the same field. The Java oils yield, as a rule, little benzine. Some crudes do not even contain kerosene; others are of a strong paraffin base.

HISTORY OF DEVELOPMENT

The Royal Dutch Company was formed in 1890 and completed its first well in 1890 in the district of Langkat. A refinery was completed at Pangkalan Berandan in 1892. The district in which this first oil enterprise was established was a tropical wilderness almost unpopulated. In 1900 the company drilled at Perlak and brought in several wells, all spouters. In 1910 the com-



SLUICES FOR WASHING ALLUVIAL MATERIAL, BILLITON

of Palembang, in South Sumatra; the residencies of Rembang and Sourabaya and the northeastern part of Java, the district of Koetei, in Borneo, and the Island of Tarakau. The oil-bearing formations occur in the Miocene and Pliocene of the Tertiary, the depth of the wells ranging from 200 to 600 m. The deepest well is 1,000 m., and is in East Java. Cable, steel-rod, and rotary systems of drilling are used. Refining of the crude petroleum is carried out at six establishments, respectively situated at Pangkalan Berandan (North Sumatra), Pladjoe and Bangoes Koenig (South Sumatra), Tjepoe and Wonokromo (East Java) and Balik Papua (East Bornea). The products are benzine, kerosene, turpene, dieseloil and solaroil, liquid fuel, asphalt and coke, batching oil, lubricating oil and greases, paraffin-wax, and batils-wax. Gas in some instances carry-

pany acquired the Shanghai Laukat Co., which owned oil fields near Tandjong Poera, in the Langkat. Work was started in Borneo in 1901. In 1907 the Bataafsche Petroleum Maatschappij was formed by the amalgamation of the Royal Dutch and the Shell Transport & Trading Co. In 1905 the Royal Dutch extended its operations to Java, and in 1911 secured control of the Dordtsche Petroleum Maatschappij. The Bataafsche Petroleum Maatschappij is the dominant company now in the Dutch East Indies.

Most of the crude petroleum is transported by pipe lines to the refineries. The most important pipe lines are four and five-inch lines, 76 miles long, from Perlak to Pangkalan Berandan; two four-inch lines, 87 miles long, from Kamp Minyak to Pladjoe; a four-inch line, 141 miles long, from Melamoen to Pladjoe, and a five-

inch line, 65 miles long, from Sanga Sanga to B. Papan (Borneo). Many smaller lines are in operation. Steel tanks are used for storage. Eight hundred whites, mostly Europeans, and 23,000 natives and Chinese are employed. Maximum production reached 13,000,000 bbl. in 1911.

The mining enactment of 1899 clearly distinguished between surface and subsoil rights. Prospecting licenses are required for exploration, and concessions for working mineral deposits. These are restricted to Dutch subjects, inhabitants of Holland or Netherlands East India, and to companies incorporated in Holland or Netherlands East India. Prospecting licenses are issued by the chief official of the province in which work is proposed, and are valid for three years. They can be twice extended for a further period of a year. The area is restricted to 10,000 hectares.

Discovery gives the holder of a license the right to a concession as soon as he has proved his discovery to the satisfaction of the Governor General. Concessions are for a maximum period of seventy-five years. The

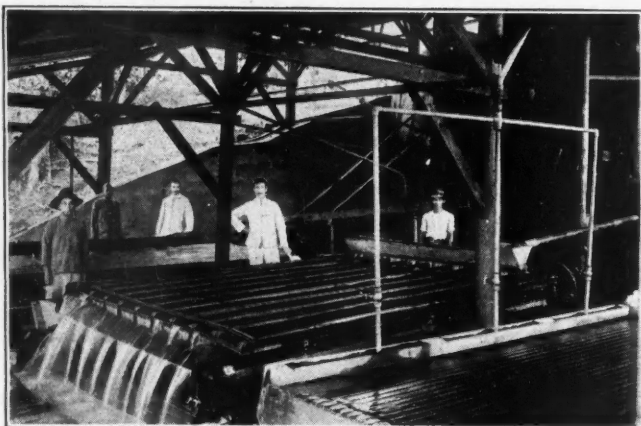


TABLE DRESSING OF TIN VEIN STONE AT KLAPPA KAMPIT MINE, BILLITON

maximum concession for working any kind of solid or liquid bituminous substance is 2,000 hectares in the islands of Java and Madura and a portion of Sumatra, 4,000 hectares in the remaining portions of the archipelago, and 1,000 hectares for any other minerals.

Prospecting license holders must pay to the government a fixed land tax of 1c. per hectare; concession holders, 10c. per hectare. In addition, the license holder must pay a royalty of 4 per cent of the market value of production obtained in the course of prospecting, of which amount a portion is free from royalty. Concession holders pay in addition to fixed land tax a royalty of 4 per cent of the gross proceeds. Mining regulations also provide for safe operation.

From a later publication it appears that prospecting licenses for petroleum are confined to an area not more than 25,000 acres, and several licenses may be applied for simultaneously. The holder of the license is compelled to prove diligent effort at the end of each year. Concessions are confined to an area of not more than 10,000 acres, the whole of which must be confined within one prospecting area, but several concessions may be granted within the same license after proving the existence of petroleum in commercial quantities. The legislation is not prohibitive to foreign interests, as foreign capital has established successful enterprises. Most of the petroleum mining has, however, been brought almost entirely under Dutch control.

Gold Mining in Venezuela and British Guiana

BY KIRBY THOMAS.

Written for *Engineering and Mining Journal*

INTEREST has been revived in a new gold-placer district in southeastern Venezuela, which first became known to the outside world in 1915. It is about 250 miles directly south of the Orinoco delta on the border of British Guiana, and extends into British Guiana where the district is as yet entirely virgin. It is claimed that General Fernandez, one of the discoverers of the new district, took out over \$300,000 of gold in three months, and other sensational strikes were reported.

Señor Quenza, a merchant of Calloa, the location of a famous gold mine of the same name, has a large concession for the new district and is directing operations there. So far, all the work has been done by natives, although some American engineers have made investigations.

The district is remote from main lines of travel. The itinerary advised is from Trinidad up the Orinoco to San Felix, and from there a three and one-half day mule-back trip to Calloa, from which point a two-day mule trip takes one to the Cayuni River. Here canoes are secured, and if lucky the remaining fifty miles to the objective is covered in one week.

The climate is reported to be bad. One engineer records in his report that "the mosquitos begin work at 5 p.m. to work all night." He also advises a formidable list of netting, and remedies. All food must be taken in from Calloa. The region is in the foothills of the little-known Usupamo Mountains. The labor available is mostly Trinidad negroes, speaking English.

According to the Department of Lands and Mines for British Guiana, the gold production of the colony covering a period of thirty years has been over \$50,000,000, practically all from river and stream placers.

The great interior highland of British Guiana is comprised almost entirely of granite and metamorphic rocks, and the streams in this formation are nearly all gold bearing. On the Cayuni River the gold is exceptionally coarse and of great purity. Many nuggets of several hundred ounces have been produced. The gravel is shallow, from a few inches to six feet in depth, and easily washed by simple methods. Pay gravel is generally narrow, though sometimes up to 200 feet wide.

The Cayuni River has many rapids and is of little avail for transportation of supplies or materials. One of the main tributaries of the Cayuni River, the Yuruon, receives the waters of the Yuru River, which flows from the Venezuela highlands, in which is located the well-known Callao gold mine, which, under an American-British company, yielded upward of \$20,000,000 in gold. These streams also drain the new rich gold-placer district in Venezuela.

Japanese Imports of White Zinc

The quantity and value of the imports of white zinc into Japan during the last five years are shown in the following table:

Years	Pounds	Value
1915.....	632,955	\$52,133
1916.....	557,941	65,379
1917.....	97,026	5,143
1918.....	497,112	26,146
1919.....	1921.2	220,995

Mining Engineers of Note

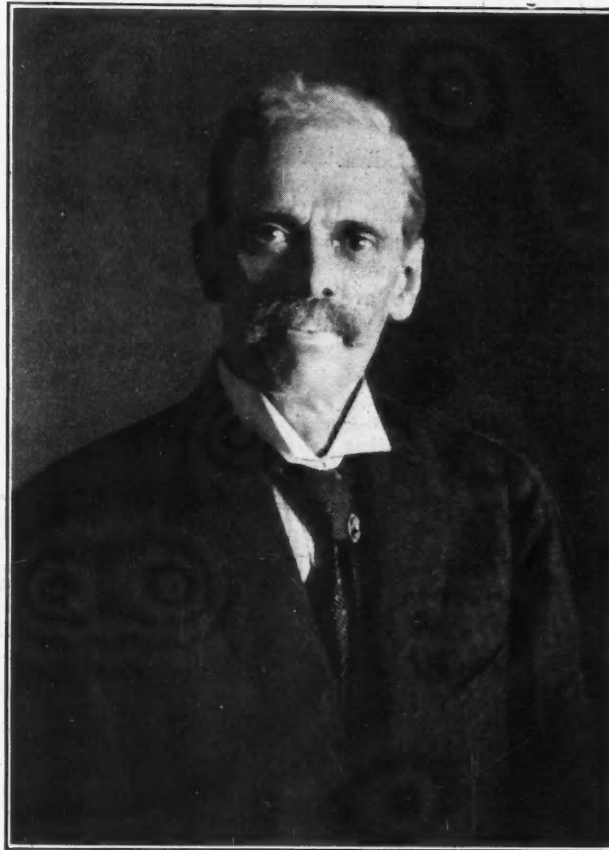
Arthur Thacher

AI. M. E. members who have been fortunate enough to attend the annual meetings in New York need no introduction to Arthur Thacher, for his is a familiar figure, and it is doubtful if any one has shown a keener interest in the activities of the Institute than he. Mr. Thacher is at present on the Board of Directors of that body. Judged by modern-day standards, he may be regarded as one of the "old boys," but this, mind you, refers only to his membership of forty-four years in the Institute, for he would loudly disclaim any other allegation; and rightly so, for we know he loves a good story, can set the pace for many of the younger men on a sight-seeing trip, and in several other ways demonstrate the fact that despite his sixty-three years, he is as youthful as the best of them. His affability and conviviality have frequently been remarked upon, particularly by the newer members of the Institute. Concerning his membership in the A. I. M. E. it may be remarked that in joining that organization at the age of nineteen Mr. Thacher set an example which should serve as an excellent one for young

mining engineers to follow. Arthur Thacher was born in Newtonville, Mass., on May 8, 1857, and was graduated from the School of Mines at Columbia College with degrees in mining and civil engineering in 1877. In December of that year he went to San Francisco and from there to Triunfo, Baja California, Mexico, for the Progreso Mining Co., which was operating the large silver mines that are still being worked. The treatment was dry crushing, roasting, and lixiviation. From there he went to New York. Since then he has been in most of the Western States. In 1887 he took up his permanent residence at St. Louis, and there assisted Prof. W. B. Potter in his private work and also gave lectures in metallurgy at the Washington University. In 1892 Mr. Thacher took charge of the Central Lead Co. in southeast Missouri, as president and general manager, and continued in that capacity until 1905, when the property was sold to the Guggenheims, who are still operating it under the name of the Federal Lead Co. For the next eighteen months he was connected

with the Guggenheim interests under John Hays Hammond. In 1906 he entered the employ of the New Jersey Zinc Co. as Western manager of mines, and has since remained with that company. His principal work has been at the Wisconsin zinc mines of the New Jersey Zinc Co., where his interest has been largely

with the treatment of the low-grade zinc ores, although he has also paid considerable attention to the low-grade lead ores of Missouri. In addition to the personal concern that Mr. Thacher has always shown in the progress of mining and metallurgy, he has also found time to interest himself with public affairs, and so we find that he rendered valuable service in 1899 as chairman of the Board of Arbitration for the New Orleans Drainage Commission and the National Construction Co. Were we to seek a friendly nickname for our friend it would be most fitting to dub him "Golden Rule" Thacher, for it is one of the strongest tenets of his industrial religion that the remedy for industrial problems lies in the simple application of the Golden Rule. It is not merely a theory with him, moreover, for he has substantial exhibits



ARTHUR THACHER

to demonstrate the practical expediency of the plan as he has practiced it, in cost-sheets showing a constant lowering of mining costs in mines under his charge, while operating costs in general were steadily mounting, and also in a record free from strikes. His cost reduction was not effected by cutting wages, for wages were steadily and voluntarily advanced from time to time, but by increased efficiency. Under the influence of the brotherly feeling engendered by the Golden Rule, his miners got unbelievably busy with the muck-stick. Such a doctrine as this is sorely needed in our mine operations of today, for it can do much to draw together the operator and employee, and by that means secure the best co-operative effort. More power to his gospel!

Mr. Thacher is also a member of the Mining and Metallurgical Society of America and the St. Louis Academy of Science, and of the following clubs: Engineers', University, Round Table, Noonday, Country, and St. Louis, of St. Louis; Engineers' Club of Chicago, and the Rocky Mountain, of New York.

BY THE WAY

Commercializing the Weakness of Palladium

We suggest a profitable side line for the manufacturers of divining rods: Palladium, as is well known (by some) will glow to the point of ignition when exposed to alcoholic fumes. In this it resembles some animate bodies. In fact this property of palladium has been used in the manufacture of automatic cigar lighters. The value of a device containing palladium to Prohibition Enforcement Officers is, of course, obvious. The nearer they get to the source of supply, the warmer they would become, a literal interpretation of one of our childhood games. They could really be hot on the trail. An added advantage is that the palladium becomes as excited about wood alcohol as any other kind, so would play no favorites as to brands of liquor. We hesitate to make things easier for the said P. E. O., but we feel that those who manufacture divining rods should have a little encouragement after some of the mean raps we have given them. Also, of course, we are anxious to develop new uses for the metals.

A Problem in Commercial Algebra

A certain applicant for relief under the War Minerals Relief Act put in an item of expense for building a mill of something over \$80,000. The Bureau of Mines accountants, on investigating the case, found that he had put the cost of the mill at something over \$10,000 in making up his income-tax statement. Question: What was the cost of the mill, and why?

The Glories of Knowledge

The *Bornite Sentinel*, of the Davis-Daly Copper Co., publishes the following, which we reprint for the benefit of our Cousin Jack devotees:

An old-time Cornish mining captain in the Lake Superior iron country had a collection of minerals of which he was very proud. Some years ago a party of students from the Michigan College of Mines at Houghton came down to Cap'n Jan's mine on an inspection trip and were invited to his home for dinner. The boys arrived at the house before their professor, and Cap'n Jan was proudly showing them his specimens. "I suppose, m'son," he said to one of the students, "thee naws a mineral an' thee can tell 'er name right h'off, can thee?" "Well, Captain, I don't know if I can, but I've studied mineralogy some and know the majority of the common minerals," answered the youngster. "Let's see 'ow thee's learned, m'son. 'Ere, naow, 'ere's a bit o' mineral [holding up a specimen of iron pyrites], w'ot's this 'ere?" "Why, that's iron pyrites, Captain." "H'iron pyrites! Dam-me! I nawed I'd get thee, but did'nt think to catch thee firs' crack h'out o' tha box. W'ot's this then [holding up a piece of cassiterite]?" "Why, that's cassiterite." "Cassiterite! W'y dam-me, 'oo ever 'eard tell o' cassiterite? Thee's wrong m'son, thee's wrong. I be afeared tha bloody college h'education 'as'nt 'elped thee one bit. 'Ere's tha professor naow; let's see if 'e naw's w'ot is un. Professor, w'ot's this 'ere bit o' stone [holding up the piece of pyrites]? Tha boys don't seem to naw tha name o' this bloody rock at all. W'ot dost thee call un?" The professor did

some quick thinking. He knew, as it was iron pyrites and would be easily seen to be that, that the boys had named it right, and therefore the Cornishman did not know the correct mineralogical name. "Why, Captain, that's *maundic* [The Cornish name for iron pyrites]." "Dam-me, w'ot's think o' that," cried the delighted captain, "I nawed bloody well thee would naw, an' these 'ere young chaps try to call un h'iron pyrites. Naow, 'ere Professor, [holding out the cassiterite] w'ot's this 'ere? She's a 'ard one, so take thy h'own time." "Well, Captain," the professor replied, "that's a bit of tin stone." "Professor, shake 'ands," shouted the Cornishman. "Dam-me, I wuz afeared w'en these 'ere young fellers did'nt naw tha names o' these minerals that thee wouldn't naw them h'either, but naow I see thee h'art an h'edicated man."

An Appeal

Conspicuous efforts are being made by New York druggists to market large quantities of epsom salts, or magnesium sulphate. This commodity is being offered in four-pound tins at an attractive price. But who wants four pounds of epsom salts all at once? Answer: Those who have avoirdupois. Bathe in it and reduce. Dissolve it in the bath, plunge in, disport, and at last emerge, almost as stout as you were before but not quite. Continued treatment is bound to show results, if not in reduced weight, at least in the greater consumption of epsom salts. Remember, every little bit helps. Pity the poor producer of magnesite, left high and dry when the war tide went out, and go take a bath at once—in epsom salts.

How To Get a Gold Medal

Doubtless the Chile Copper Co. staff has now received its full complement of gold medals from the M. & M. Society. Pope Yeatman, on receiving his medal, gave most of the credit to his staff, including primarily Cappelen Smith; and Cappelen Smith gave most of the credit to Mr. Yeatman. Both, we believe, yield the main honor to the foresight and faith of Daniel Guggenheim. But it is not expected that Mr. Guggenheim will be honored with the medal just yet. The initiation of dividends on the common stock would be a suitable occasion. Our West Coast friends may well feel discriminated against because no medals have been awarded to the pioneers of the great enterprises of Alaska Gold and Alaska Juneau; but the passage of the McFadden bill may better their chances.

A Welfare Hint

We recently introduced our readers to the Marcy collar, bound to find favor with millmen. We now take pleasure in bringing to the attention of geologists and those interested in geology the latest Ide collar, known as the Moraine. This is not an advertisement. Space in these columns cannot be bought.

Handy Knowledge

Spectacles with lenses made of optical fluorite will enable one to see double, as in the days of old. According to a bulletin issued by the State Geological Survey Division of the University of Illinois, a specimen of fluorite for optical use must contain a portion at least one-fourth of an inch in diameter, free from flaws, and colorless or nearly so. There is no way, however, of getting the old sensation along with the old vision except the old-fashioned way.

CONSULTATION

United States Mining Laws

In the Nov. 13 issue of *Engineering and Mining Journal* reference was omitted in the article "United States Mining Laws" to Bulletin 94 of the U. S. Bureau of Mines, "United States Mining Statutes Annotated," by Judge J. W. Thompson, published in two parts and containing 1,772 pages, which covers the subject thoroughly and in a different manner from both that of the publication of the General Land Office and that of the late Judge Lindley, to which references are made. It may be obtained in cloth-bound form from the Superintendent of Documents, Washington, D. C., for \$2.50.

The pamphlets of the General Land Office give a bare statement of the Federal Mining Law. "Lindley on Mines" is a compilation essentially for lawyers, and, although a standard work on the subject, its usefulness is limited practically to attorneys, its price is almost prohibitive to the ordinary miners or locators, and it is arranged without particular reference to the various sections of the mining code. The treatise of the Bureau of Mines seems relatively little known among mining men, and was prepared at the authorization of Dr. Holmes, a former director of the Bureau, in the belief that the development of the best mining law for the United States must necessarily be founded on a comprehensive and exact knowledge of existing laws. It contains every act of Congress relating to mining or the mineral industries.

"United States Mining Statutes Annotated" has the advantage that every section in the work—numbered the same as in the Revised Statutes of the mining law—is followed by simple and plain extracts from the decisions of the various courts, supplementing and making clear the statutory requirements.

As an illustration of the importance of its orderly arrangement, the following example is poignant: The question arises as to what constitutes the performance of annual labor on a mining claim to the extent of \$100 in value. This is the simple requirement of Section 2324 of the Revised Statutes, but a person without experience in the performance of the annual assessment work, and without a reference to the holdings of the courts, would be at a loss to know the nature of the work to be performed, the time when, or the place where, such work must be done. By reference to page 233 of the bulletin, under the section containing the requirement, he would find twenty pages devoted to every phase of this particular subject.

Judge Thompson has stated that Bulletin 94 has become very popular with miners and prospectors and has continued since its publication to have a remarkable sale through the Superintendent of Documents.

The Bureau of Mines is publishing annotations of the mining statutes of the different states: California and Illinois annotations have already been published; Pennsylvania is in press, and the Colorado annotations and statutes are ready to be printed. All the bulletins mentioned are valuable additions to the mining library of the prospector, engineer, or other interested party.

Chemical Lead

"Will you kindly inform me what constitutes chemical lead; that is, what impurities are inadmissible in this grade of lead and for what it is chiefly used?"

Chemical lead is a "soft" lead used in sulphuric-acid chambers and processes using sulphuric acid. It usually contains a small percentage of impurities, copper and antimony, which serves to make it more resistant to the effect of acids. The production of chemical lead is dependent upon the presence of impurities in the ore from which it is made. There are no fixed specifications for chemical lead, and doubt has been expressed as to the most efficient composition of this material. Barrs has found an increase in the purity of lead corresponds with an increase in the power of resisting acid attacks, but recommends the addition of 0.02 to 0.05 per cent copper to insure maximum resistance.

During the war experiments were made by D. W. Jones to determine the best quality of chemical lead by heating chemical lead in sulphuric acid. The results of his experiments are recorded in an article, "Chemical Sheet Lead," published in the *Journal of the Society of Chemical Industry* for July 31, 1920. It was found that lead refined by the Parkes process without further treatment is unsuitable for use in many operations using chemical lead. To test the effect of impurities on the chemical properties of lead, additions of pure metal were made. It was observed that the presence of antimony in lead to the extent of 0.01 per cent renders it unfit for use as chemical lead and that some corrective agent is required to prevent the breakdown of such lead under sulphuric acid.

The effect upon the decomposition temperature of the addition of copper to a Parkes process lead was found to be most beneficial. Copper also counteracted the harmful effect of antimony. With between 0.02 and 0.03 per cent of copper and antimony there seems to be a rise of temperature of initial attack.

That zinc, when present in lead in even small amounts, is supposed to destroy the power of withstanding the corrosive action of acid was not borne out by the experiments. Mercury was found to have a deleterious effect upon the quality of chemical lead. Tin had a degrading influence, but as it is easily removed from lead by modern refining methods it is not usually found in lead in more than minute traces. Bismuth is decidedly injurious if present above 0.04 per cent, but the addition of small amounts of copper partially counteracts its effect. The poor chemical quality of some Parkes lead is ascribed to the effect of the proportion of bismuth and antimony contained in it.

Jones concludes that of the elements used for additive purposes there are only two which consistently exert a beneficial influence upon the chemical properties of lead—copper and sodium. Of other additions it may be said that they are injurious in effect, though in most instances not to the extent supposed. Antimony, if present in quantities which a commercial metal may contain, will effectively debar its use as "chemical" lead.

HANDY KNOWLEDGE

Repairing Broken Cam Shafts

BY GEORGE J. YOUNG

A considerable amount of discard material always accumulates about a stamp mill, and ordinarily it cannot be salvaged. The distance of most mining districts from iron-working centers has usually prohibited the marketing of scrap metal, and, as a consequence, such discard material represents a total loss.

The advent of the oxy-acetylene welding torch, the electrical welding outfit and thermit has greatly extended the possibilities of reworking scrap and salvaging broken parts. The matter is primarily a question of comparative costs. The distance of the plant from manufacturing centers determines the cost of freight and the time required for the receipt of repair parts. Both are important considerations. Where plants have favorable freight rates, there is often little justification for undertaking anything more than urgent repairs, as wages for skillful repair men are high. Nevertheless, it is important for at least one or more repair men to be maintained, and the minimum volume repair work should be done to keep such men comfortably busy. The time required for shipment of parts is often excessive, whereas the time for repair, though it may represent in money an excess over replacement by shipment, is so much less that repairs

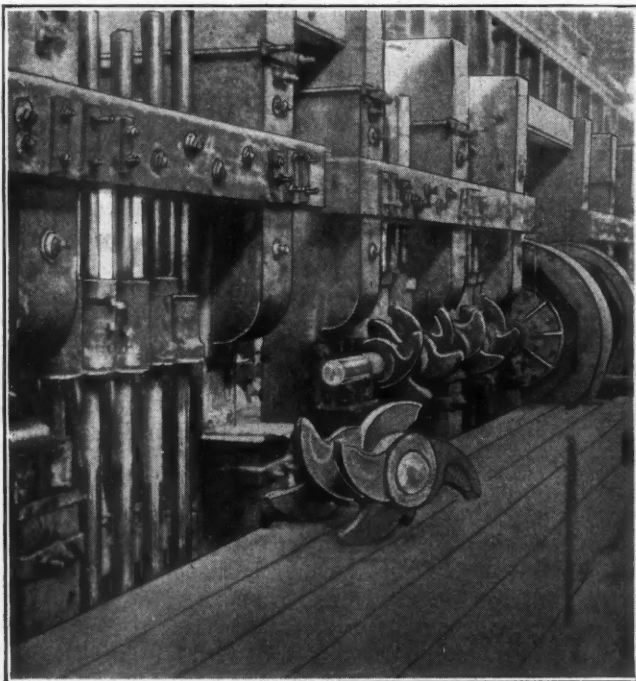


FIG. 1. BROKEN CAM SHAFT AT BELMONT MILL, TONOPAH, NEV.

are best made at the plant. A well-equipped plant necessitates the availability both of the portable welding outfits for small parts and minor repairs and thermit for heavy repairs.

At the mill of the Tonopah Belmont Development Co.,

which through the courtesy of the company I visited during the fall of 1919, cam shafts were being repaired instead of consigned to the scrap heap when broken. A single shaft is used for two batteries, and when broken represents somewhat over \$300 in value.

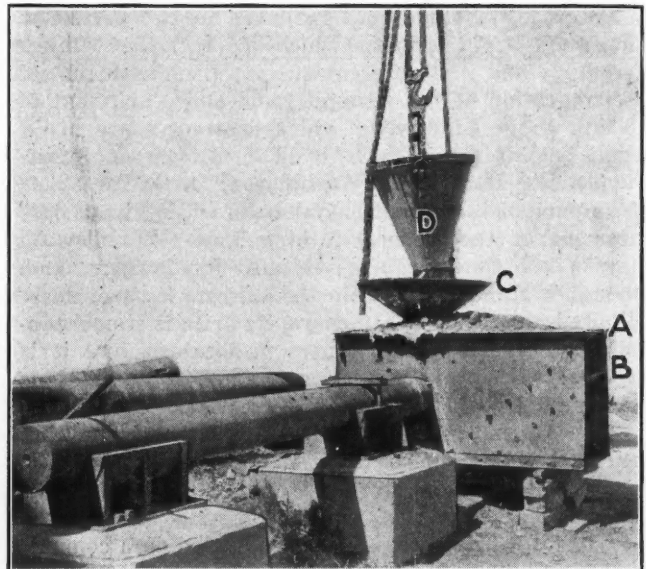


FIG. 2. READY TO IGNITE THE CHARGE OF THERMIT

Thermit is used for welding the broken ends of the shaft. A special stand consisting of four concrete pedestals each supporting an ordinary cam shaft box is used for the job. The broken ends are trimmed off and the shaft ends placed in the boxes, the ends of the shaft being brought within five-eighths of an inch apart. The shaft is then securely clamped at the two inner boxes, as shown in Fig. 2. The sheet-steel box shown in the figure is slipped onto the shaft before the shaft is set in the boxes. It is then bolted together. The illustration shows clearly the construction of the box.

Wax, softened by heat, is then forced into the space between the ends of the shaft and built up into a collar about three-quarters of an inch on each side of the ends. The weight of the container and wax is taken before and after use. All parings of wax are returned to the bucket, and the difference in weight represents the actual weight of wax used in filling the space between the ends and in forming the collar. In the specific instance two pounds ten ounces of wax were required. On the bottom of the box and the inclined steel partition fire brick is placed. Moulding sand is then rammed in, three wooden plugs being put in position. The lower one, horizontal, being so placed as to be tangent to the under side of the shaft, is called the torch hole, the middle inclined plug is the vent, and the upper one is the pour hole. These are respectively *E*, *F* and *G* in Fig. 3. Moulding sand is then thoroughly rammed about the plugs, and the box filled. While this is being done, partition *B*, Fig. 2, is out. The three plugs are then removed and an oil-compressed air torch is adjusted so that the flame passes through the lower

hole *E*. In this way the wax is burned out and the ends of the shaft are brought up to the highest heat obtainable.

In the meantime, the thermit charge, 33 lb. thermit mixture for each pound of wax, is prepared and placed in the crucible, *D*. It requires about three hours for the torch thoroughly to heat the ends if it is working properly. As soon as the desired temperature is reached, the torch is removed, an iron plug placed in the torch hole, partition *B* placed in position and moulding sand rammed in back of the iron plug to keep it in position. A funnel *C* is then placed in position, the thermit charge ignited, and the pour made. The shaft is removed on the following day. When machined the junction of the broken shaft ends is hardly visible.

To facilitate handling of the shaft and thermit crucible, a small jib crane and chain block are conveniently erected near the pedestal blocks. The entire job required two men approximately one and a half shifts, or from sixteen to twenty-four hours' time. For

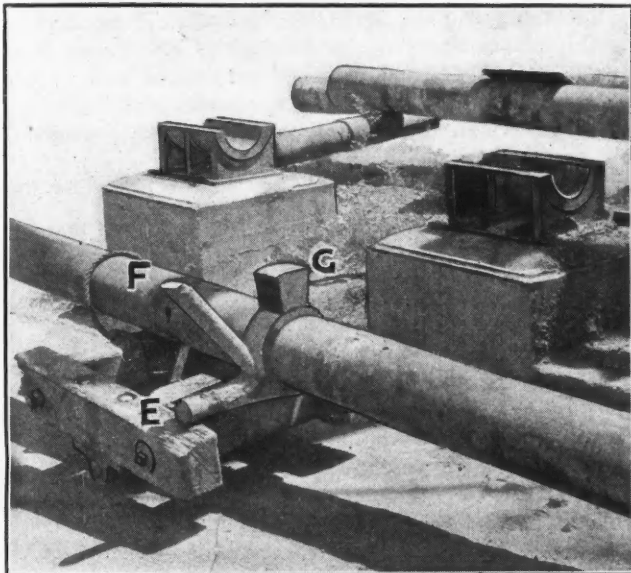


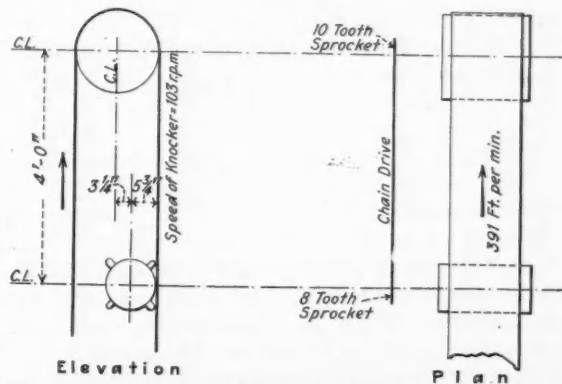
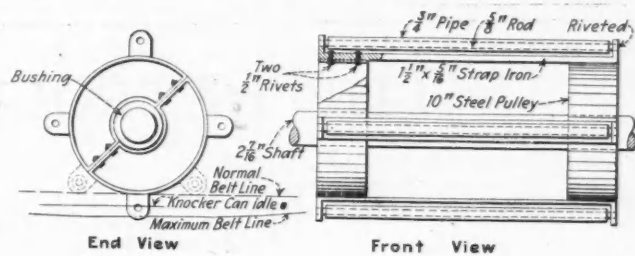
FIG. 3. THE CAM SHAFT REMOVED FROM BOX AND READY FOR MACHINING

success, the shaft ends must be perfectly aligned and the whole job carefully handled. Acknowledgment for the notes from which this article was prepared is made to F. J. O'Neill, who carried out the work described.

Knocker for Cleaning Conveyor Belt

BY W. R. CANTON

Upon starting the wet concentrating mill at the Replogle Iron Mine, near Wharton, N. J., some difficulties in handling the wet tailings arose. Drag classifiers delivered a product containing 24 per cent water to the belt conveyors. This product does not act like a dry material, and a large percentage adhering to the belt is dragged back on the return and some is thrown off at each idler. To eliminate this difficulty the knocker shown in the illustration was installed. Although the idea was not original, no data on the operation of this device were available. How hard to hit the belt and how often were points to be determined. A good sharp blow gave the best results. This was obtained by driving the knocker at 103 r.p.m. by means of a chain drive. This resulted in 412 strokes against

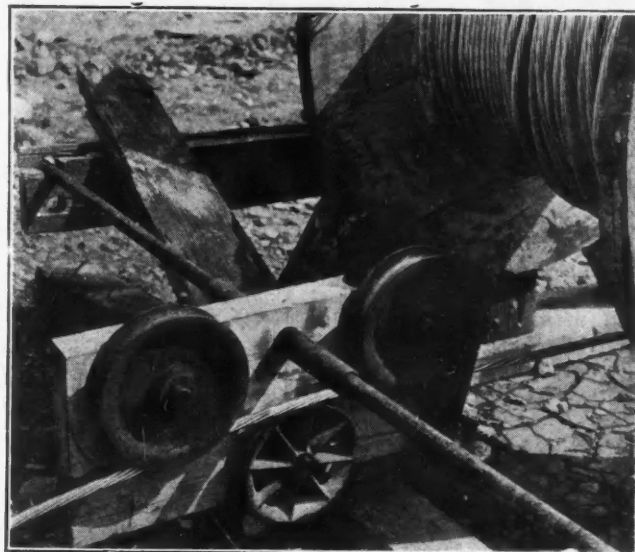


DETAIL OF "KNOCKER WHEEL" USED TO PREVENT WET MATERIAL FROM ADHERING TO THE RETURN BELT OF A BELT CONVEYOR

the belt per minute. The belt was struck every 11.38 in., and with the knocker so adjusted worked excellently.

Removing Reel Kinks From Wire Rope

A device for removing reel kinks from wire rope is described in *Engineering News-Record*. It was used in preparing wire rope for concrete block revetment at vulnerable places on the improved Miami River channel at Dayton, Ohio. This rope, cut to lengths of 20 ft. or more, was threaded through holes in precast concrete blocks, and it was important that it should lie straight to facilitate the threading operation. As indicated by the illustration, the reel of rope is suspended on an axle on a timber frame so as to unwind from the bottom. In front of the reel three pulleys attached to an axled plank, as shown, constitute the straightening device. The entire arrangement cost little and served its purpose excellently.



METHOD OF STRAIGHTENING WIRE ROPE BY MEANS OF THREE PULLEYS

THE PETROLEUM INDUSTRY

Draining Oil Reservoirs

The Mining of Oil Sands by Shafts and Tunnels in Shallow Fields Permits the Application of a Method for Determining Certain Production Estimates and the Calculation of Drainage Area

BY SETH S. LANGLEY
Written for *Engineering and Mining Journal*

OIL production is essentially the mining of a liquid. The oil reservoir is an ore which, when drilled into, is self-concentrating, and, until the gas pressure is exhausted, it will mine its concentrate. After exhaustion of the gas pressure the ore still concentrates itself and is mined by pumps. Eventually concentration is too slow to be profitable, although more than half of the original oil may still remain in the reservoir.

In a recent issue of *Engineering and Mining Journal* A. H. Fay called attention to the possibilities of drain-

no longer profitable. Data from which to base conclusions should be available. The character of the reservoir is known from the drilling records, and the porosity of the sands can be closely calculated.

Referring to "Oil and Gas Production," by Huntley and Johnson, on p. 37, "Calculations show that there are 7,758 bbl. of sand in a bed 1 ft. thick and an acre in area—assuming 15 ft. of pay sand and 4.5 per cent extractable. In Equation 1, $0.045 \times 7,758 = 5,236.55$ bbl. of oil per acre."

The above gives 349 bbl. per acre-foot. The first

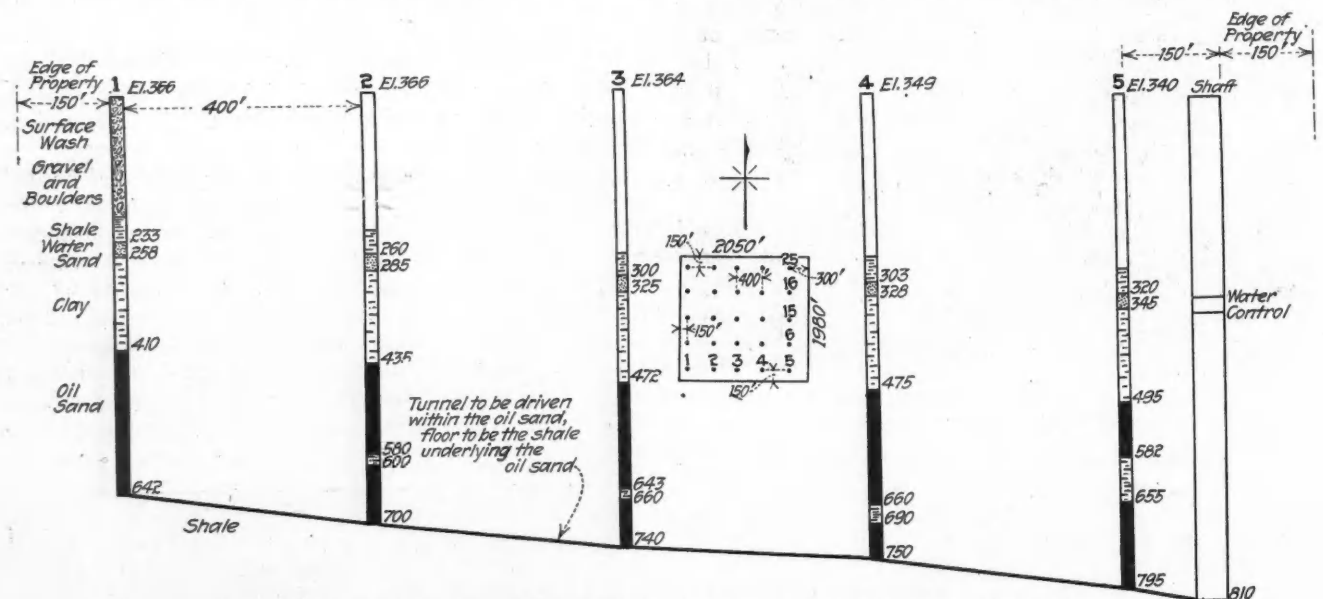


FIG. 1. CROSS-SECTION OF WELLS SHOWING POSITION OF OIL SANDS

ing oil reservoirs by the application of metal-mining methods. Intrenched in their ignorance, some seemingly intelligent operators scorn the idea on the time-worn argument, "it has never been done." It has been and is being done in Alsace, as reported in *Engineering and Mining Journal* of June 12, 1920, on p. 1320. The article states: "Three shafts, with 4,000 meters (13,000 ft.) of subterranean galleries, produce more than 25,000 tons (164,000 bbl.) of crude petroleum per year."

DETERMINING PRODUCTION IN OIL SANDS

Even were the precedent of this example lacking, the problems to be overcome are known and can be solved. Production by shafts and tunnels is applicable to comparatively shallow fields whose gas pressure has been exhausted and in which production by wells is

and third factors of Equation 1 are the variables. The first is dependent upon the porosity of the sand, and can be determined by samples from the wells. The third can be calculated from the well logs. With the original oil content known, the present content can be obtained by deduction of the total past production. All of the remaining oil will not be recovered by drainage into tunnels, but the rate of drainage per foot of exposed area should be the same as in the wells, and can be estimated on that basis.

Fig. 1 is presented as an example and represents actual subsurface conditions below the 350-ft. level. The water-bearing sand is assumed to meet a possible condition. The field map shows twenty-five wells that are distributed throughout the area represented by a lease of ninety-three acres.

By Equation 1:

$$\begin{aligned} 0.03 \times 7,758 \times 239 &= 55,624 \text{ bbl. per acre.} \\ 93 \times 55,624 &= 5,173,032 \text{ bbl. total original oil.} \\ \text{Passed production} &= 2,000,000 \text{ bbl.} \end{aligned}$$

Oil remaining in
reservoir 3,173,032 bbl.

The present production is two barrels per well per day. The wells are all finished as 6-in. holes. Hence 6-in. $\times 3.1416 \times 239 = 375$ sq.ft. of draining area per well. $\frac{375}{2} = 187.5$ sq.ft. drainage area per bbl. of oil.

It is known from the well logs that the oil sands dip to the southeast. A tunnel west and drifts north would form a gravity drainage system to the sump of a shaft sunk in the southeast corner. A shaft 850 ft. deep will provide a 40-ft. sump. From the 810-ft. level drive a 7-ft. x 6-ft. tunnel west 1,750 ft., and from the tunnel five drifts north, each 1,680 ft. in length and 7 ft. x 6 ft. in cross-section. The floor of the tunnel and drifts will not be figured as drainage area, as it will be in the underlying shale. The total drainage area of the shaft, tunnel, and drifts will be 231,480 sq.ft., and if the drainage is in proportion to the exposed area the production will be approximately 1,235 bbl. per day.

METHOD OF WATER CONTROL MUST PROTECT SANDS

The well logs—Fig. 1—show a water sand lying between the shale strata. This water must be controlled, the method outlined by G. G. Wald in the *Engineering and Mining Journal*, Dec. 28, 1918, p. 1129, being applicable. Whatever the method used, it must provide protection of the oil sands from foreign water, both for the property in question and its neighbors. This water need not be carried to the bottom of the shaft. A pump station should be cut at as high a level as possible. The experience gained in controlling the water can be applied to the oil sands encountered in sinking. When the shaft is completed it would be well to devote a month or two to the study of production per unit area of exposed oil sands. The size of the tunnel and drifts will depend upon this data.

There are probably no field records to show what percentage of the oil will be retained in the sand by capillary attraction. When the production has declined materially it may prove profitable to increase the drainage area. There will come a time when this is not profitable, and then the question of mining the entire orebody will be decided by the same factors that control all mining. The probable oil remaining can be estimated from the sands in place in the same manner that the value of any orebody is determined. The sands available for sampling will certainly be no richer than those unexposed.

In an operation such as illustrated in Fig. 1 it may be necessary to upraise through the lowest shale break shown in wells Nos. 2, 3, 4, and 5, or to drive a tunnel from the shaft to cut the shale in No. 4 at 660 and drift from this tunnel north. The local experience will decide.

Development should be done by contract, as few if any oil companies maintain technical staffs trained in this sort of work. On the other hand, as it is, in all essentials, the mining of a liquid rather than a solid ore, large mining companies with proper technical facilities would not encounter new problems.

Shortage of Fuel Oil in Vancouver

Consumers of fuel oil in Vancouver, B. C., were recently notified that the Imperial Oil Co.'s sources of supply would soon be cut off and that there is no hope of securing more oil until June 1, 1921, when two tank steamers, now building, will be ready to carry oil from the Mexican fields to Vancouver. The company announced that, after Dec. 31, 1920, all delivery wagons and tank cars will be withdrawn.

The lack of fuel oil, states Consul General Frederick M. Ryder, may force many of Vancouver's office buildings and apartment houses to convert their heating plants to the use of coal; and as most of these heating plants were not constructed with such conversion in mind at the time of installation, this announcement is likely to cost local consumers thousands of dollars. The Grand Trunk Pacific, the Terminal Navigation Co.'s steamers, the North Vancouver ferries, and a number of small boats depend on Imperial fuel oil, and considerable agitation is visible in marine circles.

It is estimated that the withdrawal of the Imperial Oil Co. from the field will necessitate an increase in the production and distribution of coal in Vancouver to the extent of 3,000 tons per month. However, according to the general sales manager of a locally prominent coal company, there need be no fear of a shortage of coal in Vancouver this winter, as the recent announcement of the oil company had been expected and the coal companies were prepared to take up at once the burden of supplying the people of this city with coal. The pulp and paper plants have announced that the new order, notifying them of a cessation of oil deliveries for six months, would have no ill effect on their operations.

American Company Secures Oil in Trinidad

On drilling a well to a depth of 1,100 to 1,200 ft., within four or five miles of the asphalt lake at Brighton, Trinidad, an American company, states *Commerce Reports*, recently secured a "gusher" which had a flush product of 30,000 bbl. of petroleum oil within twenty-four hours, and has settled down to a daily production of about 1,000 bbl. Up to the present time the drilling operations of this American company in Trinidad have been mainly for the purpose of securing petroleum to use as a flux in connection with asphalt for road paving and other purposes, although some fuel oil has been exported independently. The company is also, through a constituent company in Venezuela, extensively interested in petroleum oil deposits near Lake Maracaibo, in Venezuela, and in an oil refinery at Curacao, Dutch West Indies.

California Report Covers Field Operations

The available supply of gasoline in California and other states varies with demand at different seasons of the year. The amount stored usually increases during the winter months and falls off rapidly during the summer. Regularly compiled statistics are useful to consumers who desire to follow the situation. The monthly report of the California oil and gas supervisor contains the latest available figures collected by the Bureau of Mines and may be obtained by addressing the State Mining Bureau, Ferry Building, San Francisco. The last report issued contains a report on all oil field operations passed upon by the oil and gas supervisor during September.

NEWS FROM THE OIL FIELDS

United States Demands Equal Treatment in Mandates

A demand for the application of the principles of equality of treatment of all nations, irrespective of mandatory power, with special reference to the petroleum resources of the territories involved, and a protest against the exploitation of these resources by any nation to the discrimination of others, constitute the salient points of a note signed by Secretary of State Colby and delivered to the British Foreign Office on Nov. 24. Although dealing particularly with the distribution of the oil resources of Mesopotamia, the American protest also sets forth the right of the United States, as one of the powers associated in the victory over the Central Powers, to be consulted as to the terms of mandates and other decisions, the right to make which accrued to the Allies as a result of their common victory.

Limit Placed on Oil Claims

From Our Special Correspondent

Consequent on the discovery of oil fields in the neighborhood of Mackenzie River, the Canadian government has passed an Order-in-Council limiting the maximum area which may be staked to 640 acres. Notice is also given that the Mackenzie River Petroleum Co., Ltd., will apply for incorporation at the next session of Parliament. The company seeks all powers incident to the production and storage of oil and natural gas, the marketing and transportation thereof, except by rail. In particular, the company will seek authority to construct a pipe line for the transportation of oil and gas from a point near the mouth of the Rat River, at its junction with the Peel, a tributary of the Mackenzie, thence to the international boundary.

Up to Nov. 1 7,500 applications for permits to prospect for oil on the public lands had been filed with the General Land Office. Applications for permits to prospect for coal numbered 254. Six have made application for permit to prospect for sodium. There have been two requests for leases of oil shale lands and five applications for leases on phosphate lands.

That the Government may expect a considerable income from the operation of the leasing law is indicated by the estimate that oil lands leased under the act, in Wyoming and California alone, promise during the next fiscal year a production of 14,000,000 bbl. If that production is achieved, the Government's share will amount to more than \$6,000,000 at present prices.

France Defers Making Oil Law

According to authoritative reports, schemes for revision of the French petroleum laws may not take shape before next spring, says a recent issue of the *New York Sun*. The proposal by M. Eynac for state control of importations and exportations of petroleum and petroleum product is regarded by many well-informed persons as embodying anything other than a liberal, open-door policy in connection with American oil interests.

If the Eynac proposal is favorably acted on by Parliament, which now is considered unlikely in view of the growing antipathy on the part of the public to a continuation of what is virtually a monopoly in the hands of the Royal Dutch Co., American oil interests and particularly the Standard Oil Co., which recently formed a French branch with Paul Cambon as president, will have to beg for a special permit before they can bring in even small quantities of crude oil for refining here, while the selling price of oil will always be subject to the control of a special department assigned to the Ministry of Public Works.

Notes from Trinidad, B. W. I.

From Our Special Correspondent

George R. Airth, managing director of the Anglo French Exploration Co., and Walter Maclachlan, chairman of the British Borneo Petroleum Syndicate, Ltd., arrived from London via New York Oct. 6 to attend a meeting of the directors of the Apex (Trinidad) Oilfields, Ltd., and to obtain a first-hand view of the company's operations. They were met by the local general manager, Colonel Hickling, and their geologist, Dr. Miller.

The gusher brought in by the Petroleum Development Co. on their new lease near Brighton has produced over 175,000 bbl. to date and is still producing at the rate of 1,500 bbl. per day.

A local press report states that Well No. 3 of the Apex Oilfields, Ltd., caught on fire on Nov. 5 through unknown causes. The derrick engine and drill equipment were quickly destroyed. The fire spread down the ravine on which the well was located and caused considerable damage to a cocoa plantation in the valley below.

On the afternoon of Nov. 21 Anaconda Copper Co., drilling in the Cat Creek field in central Montana in what is known as the West Dome, brought in a well having an estimated output of 1,000 bbl. Anaconda has acquired from ten to twelve thousand acres in this field and a second well is being drilled.

Warren County, Ky., Leads in New Work

From Our Special Correspondent

The result of developments in the Kentucky oil fields for the month of October shows that in new work under way Warren County takes the lead, followed by Allen, while it is a race between Lee and Johnson-Magoffin Counties for third place.

Drilling activity continues unabated in the Johnson County field, and recently a number of good producing wells were brought in. No. 1 Hayden Williams made 12 bbl. in four hours' pumping. This well is in the Weir sand. The Cumberland Petroleum Co.'s No. 2 on the Oliver Wheeler tract is estimated to be good for 30 bbl.

One of the largest wells in Simpson County was brought in by C. H. Upper on the George Slate lease. In addition to the regular sands found in that section, 15 ft. of light porous sand was encountered, giving forth a large quantity of oil. The bringing in of this well fully determines that the eastern part of Simpson County and the western part of Allen County will prove probably the largest and most consistent field in Kentucky, as the sands are uniform.

In Todd County, the Kentucky Producing Co., is starting a deep test near Elkton, planned to go 3,500 ft.

Mexican Wells Showing Decline

From Our Special Correspondent

The Transcontinental well on Lot 97 has been shut in entirely. It was showing emulsion and two-tenths of 1 per cent clear salt water. Thus the end of many of Mexico's largest wells is approaching rapidly. The new field in Zacamixtle will follow the same fate, as derricks spring up like mushrooms in this vicinity. An entirely new field will have to be found when this goes, as it is the last piece on this huge underground fold that has been supplying Mexico's oil for the past few years.

Over seventeen million barrels of oil were shipped from Mexico during the month of October; this figure being just a little over two hundred thousand barrels short of the record month, September, 1920.

The Metropolitan well No. 1 on Lot 135, Chinampa, was showing two-tenths of 1 per cent and the flow was pinched down. Their well on Lot 114 has been abandoned at a depth of 1,750 ft. also.

The Mexican Gulf well on Lot 95 has been shut in entirely as it has been showing emulsion for over a month now. Their two wells on Lot 251, Amatlan, have also been checked, as they were showing two-tenths of 1 per cent sediment.

Book Review

Industrial Housing — By Morris Knowles. 6½ x 9½; cloth; pp. 408; illustrated. Published by McGraw-Hill Book Co., Inc., New York. Price, \$5.

In the preparation of this book the author has drawn from an extensive experience with the housing activities of the Emergency Fleet Corporation, U. S. Shipping Board, of which he was chief engineer. The industrial housing idea, although practical to some extent, was, in the early stages, characterized "by incorrect social hypotheses and a complete lack of consideration of the problem." Also the suggestion of paternalism acted as a deterrent to the full progress of the movement. Later there were some notable examples of successful housing programs, but under the stimulation of a stringent need for industrial housing during the war, the movement grew rapidly and has now reached a high stage of development. The reader cannot fail to be impressed with the comprehensiveness of the author's treatment of his subject. Mr. Knowles states that not all of the features discussed are applicable to one locality, but that the consideration of them is advisable, and the mere providing of the house does not complete the industrial housing plan. There is necessary, also, "the appropriate planning of streets, blocks and lots; parks and recreation facilities; the utilities, such as drainage, sewerage, water supply, gas and electricity, transit and transportation, health and sanitation." A number of excellent examples of industrial housing projects and pertinent details connected thereto are given. Although there is but slight reference to mine "locations" or mining "camps," there is ample "food for thought" for the mine manager who has not provided an adequate and successful plan for the housing of his employees. D. E. A. C.

Mineralogy. An Introduction to the Study of Minerals and Crystals. By E. H. Kraus and W. F. Hunt. First edition; cloth; 6 x 9; pp. 561. McGraw-Hill Book Co., New York. Price, \$4.50.

Many books on this subject have been published, all of them inclined to be dry and uninteresting, but, however, of high scientific value. The authors of this book have taken pains to enliven it, to make it attractive enough to the reader so that, although he may not read it in preference to the latest *Saturday Evening Post*, he will at least not be repelled by the appearance of the text. To accomplish this, they have evidently worked with the enthusiastic co-operation of the photographer and the typographer. Photographs of crystal forms are shown instead of the conventional line cuts. A positive hemiortho-dome does not seem so forbidding when we can see an actual picture of it.

Photographs of prominent mineralogists, of equipment, and of natural minerals are generously scattered through the pages. We know that the piece of magnetite illustrated is magnetic, because half of the keys of the University of Michigan mineralogical laboratory are hanging on to it, to say nothing of a couple of worn-out safety-razor blades.

The first part of the book is devoted to crystallography and to equipment connected with that subject. Then comes a brief chapter on the formation and occurrence of minerals, followed by forty pages on qualitative blowpipe methods. Those without training with the blowpipe often will go to the trouble and expense of having a chemical analysis made, or merely make a guess at sight, when, by the use of the most simple blowpipe equipment, a sufficiently accurate qualitative analysis may be obtained. The most important blowpipe tests are given in this book. The remainder of the volume is devoted to descriptive mineralogy and tables for the determination of 150 minerals.

Professors Kraus and Hunt have produced a book which should have a wide appeal to men in the field as well as being valuable as a text for students beginning work in college, for which most of the matter has been used at Ann Arbor for several years. It has been ten years since the authors gave us a "B," or maybe it was a "C," in the course, and we still remember quite a few facts about the subject. It must have been well presented. E. H. R.

"The Limestone Deposits of New South Wales." By J. E. Carne and L. J. Jones, Mineral Resources No. 25, New South Wales Department of Mines, Geological Survey, Sydney, 1919, 6 x 9½ in., 411 pp., 67 illustrations, 31 maps.

This volume deals with the limestone deposits, and with the limestone, lime, cement, and marble industries of New South Wales. A historical review of the discovery and early development of the limestone deposits is followed by a discussion of the origin, composition, varieties, and uses of limestone, and a fairly complete treatment of the process of manufacture and uses of lime. Forty-six pages are devoted to a discussion of hydraulic cements, their properties, raw materials, processes of manufacture, and plant operation. In the general discussion of limestone, lime, and cement, voluminous reference is made to the literature on the subjects, particularly that of America, and thus a summary is presented of present available information. The discussion of marbles is accompanied by five well-executed colored plates of typical New South Wales marbles. Pages 131 to 352 comprise descriptions of the limestones and dolomites by counties in alphabetical order. These descriptions are supplemented by nearly 700 chemical analyses. In appendices I and II the gypsum and phosphate deposits are described. O. B.

Technical Papers

A Desert Guide Book—Water Supply Paper 490-A has just been issued by the U. S. Geological Survey, and is the most generally interesting one of the series which we have seen. It is entitled "Routes to Desert Watering Places in the Salton Sea Region, California." Part B is to be devoted to the district around Barstow; Part C to the area between Phoenix and the Colorado river, and Part D to the region around Ajo, but only Part A has yet been published. Much of the matter is in the form of an Automobile Blue Book. The maps are excellent, and enough descriptive matter about the area is given to provide Eastern authors with sufficient local color for several desert stories. The Salton Sea, as many of our readers know, is an artificial lake about thirty miles long and two or three hundred feet below sea level.

Oil Well Drilling—"Casing Troubles and Fishing Methods in Oil Wells", (Bulletin 182, Petroleum Technology 57), by Thomas Curtin, has been issued by the Bureau of Mines, Washington, D. C. (Price 15c. from the Superintendent of Documents, Washington, D. C.) In this paper the author has outlined the methods that have been evolved in the various oil fields for combating casing difficulties.

Workmen's Compensation Act—The subject of medical aid under the Workmen's Compensation Act is discussed in the *American Machinist* for Nov. 4, 1920 (three pages, price 25c. McGraw-Hill Co., N. Y.). The employer is generally conceded the right to name the physician. The workman must in general submit to a necessary operation if it does not endanger his life.

California Minerals—Bulletin No. 87, entitled "Commercial Minerals of California" has just been issued by the State Mining Bureau, Ferry Building, San Francisco, Cal. The bulletin is a compilation of descriptive data on metalliferous and non-metallic minerals. The industrial applications, properties and uses of the ores, distribution and association, common tests, and metallurgy are given in brief paragraphs. Not all of the minerals and ores described are commercially important in California.

U. S. Rights in Mexico—The National Association for the Protection of American Rights in Mexico, 347 5th Ave., New York, has published an eighteen-page pamphlet setting forth the points requiring adjustment in our relations with that country.

Colorado Mining—The Annual Report of the Colorado Bureau of Mines for 1919 has been issued and may be obtained by addressing the Bureau at the State Capitol, Denver, Col. It is a sixty-seven-page pamphlet, and includes a list of all the operating mines in the state, with the name and address of the operator and character of the product.

ECHOES FROM THE FRATERNITY

Mica Deposits of Madagascar Are Attracting Much Attention

Phlogopite of Good Grade in Large Slabs Plentiful in Southern Section—Deposits Accessible and Hundreds of Natives Now Employed

A correspondent of the London *Mining Journal* writes in part as follows:

"After the slump in the graphite market Madagascar, which easily reached and retained a premier place as a producer of that mineral, found it difficult to recover from the blow, and many a claim was abandoned, while others were prospected for other minerals, with the result that some interesting discoveries were made and attention was directed to their development.

"In southeastern Madagascar the occurrence of mica attracted particular attention, and while muscovite is practically absent, the deposits of phlogopite or amber mica have given some astounding results, and exportation on a large scale has begun, the month of July seeing the shipment of several hundred cases. In many instances the sizes are considerably above those actually found on the London market; the writer saw some slabs of 25 inches square without a stain or crack. The occurrence near a village called Ambatohabo is now giving employment to several hundred natives, and the depth reached is about ninety feet. There is no sign of the deposit giving out; on the other hand, fresh pockets and well-defined reefs are constantly met with.

"The abundance of the mineral, its perfect condition and easy cleavage have given rise to the making of fancy articles in mica, such as trays, cigar boxes, fans, and sailor hats entirely in mica which the natives sport occasionally in town. The latter, if improved on, should prove of some value for certain specified purposes.

"There can be no doubt that the importance of this region as a mica producer will maintain itself in the future, as every day from various places reports of fresh occurrences come to light, and no doubt a careful study of the geological features of the district will help considerably in proving the existence of other minerals either associated with occurrences of mica or lying in their vicinity.

"The central mountain backbone of the country terminates in this vicinity, where some of its highest peaks are situated. The transition from plain to mountain is very rapid, and the various formations are here easily approached and can be carefully studied without any particular difficulty. The forest vegetation which formerly covered them densely has practically all disappeared under the axe of the woodman or the fire of the old dwellers. As

soon as the primitive methods of extraction are abandoned in favor of a properly organized and up-to-date system of working, southeastern Madagascar alone will be able to supply all the world's wants in mica, and the wastage will disappear. As it is now the streets of this little town [Fort Dauphin] are often strewn with mica sheets of good size and commercially valuable.

War Memorial Given by Utah Copper and Bingham & Garfield Ry.

The Utah Copper Co. and the Bingham & Garfield Ry. Co. have presented a memorial bronze tablet to the employees of the two companies, commemorating the parts taken by 775 of their number in 1917-1918 in the Great War. The tablet was dedicated on Nov. 3, at the offices of R. C. Gemmell, general manager of the Utah Copper Co. in Salt Lake City, Utah. The office employees of the two companies in that city were present at the ceremonies.

Petroleum Engineering and Oil Geology Taught at M. I. T.

The Massachusetts Institute of Technology has recently established a course on oil and gas production, to supplement those courses on oil geology already established. Paul Paine, consulting petroleum engineer of Tulsa, Okla., and formerly production manager of the Gypsy Oil Co., has been appointed special lecturer on petroleum engineering and gives a course of thirty lectures on oil and gas production.

Other courses given are a general course on the geology of petroleum, a course on the valuation of oil properties, and a course on the construction and interpretation of oil maps. In the department of chemistry are given courses on oil and gas analysis and the distillation of oils.

Ontario Will Train Prospectors

The Minister of Mines has announced that early in the new year "Instruction Classes for Prospectors" will be established at the various mining centers in northern Ontario, where enough interest is shown to justify the undertaking. Dr. W. L. Goodwin, formerly Dean of the School of Mines at Kingston, Ontario, will be in charge. It is the intention to place at the various centers a competent instructor who will give an outline course in geology and mineralogy. Mineral collections will be provided, and an endeavor will be made to familiarize the prospector not only with the more common types of minerals, but also with such minerals as might reasonably be expected to be found in this country.

Treatment for Refractory Silver Ores To Be Sought

Canadian Research Council Appropriates Funds for Experimental Work—Mines Resumed Use of High-Grade Cyanide

The Canadian Advisory Council for Scientific and Industrial Research has made an appropriation for experimental work to devise a method of treatment for the refractory silver-lead-zinc ores which are to be found throughout British Columbia, but especially in the Kootenays. Horace Freeman, secretary of the British Columbia branch of the council, has been given charge of the work. It was Mr. Freeman who devised the process for the manufacture of low-grade cyanide indirectly from atmospheric nitrogen that is in use at Niagara Falls. Last summer the Hollinger and Dome mines, in the Porcupine district, purchased car-load lots of this cyanide and tried it for the extraction of gold from the ores of the respective mines.

So far as is known no report has been made, but the fact that the mines have reverted to the high-grade Scotch cyanide indicates that no worth-while saving was made over regular practice. This really was only to be expected. Pound for pound the value of cyanide as a gold solvent is directly proportional to the cyanogen content, and unless dollar's worth for dollar's worth the low-grade cyanide contained more cyanogen there would seem to be no possible reason for using it. Should the latter prove to be the case then, of course, everything would depend on the nature of the impurities and their influence on the solvent action of the cyanide. Mr. Freeman will commence his research on the British Columbia ores immediately.

Kinds of Briquettes Used by France

In the mining, metallurgical, and fuel literature of contemporary France one frequently meets with the term "agglomerés" as a form of fuel. An authoritative source issues the explanation that this seems to be "a general term for briquetted fuel, of all sizes and shapes. Common sizes used in France are: *briquettes*, weighing 6 to 9 kg., large rectangular brick-like blocks, usually made from washed coal and supposed to run 5 to 10 per cent ash; *briquettes perforées*, weighing about 900 g., and perforated; and *bowlets*, egg-shaped, and weighing 40 to 50 g."

This explanation will assist in understanding the table published in these columns Nov. 13, last, p. 958. It might be added that the lignite fuel of north central Europe is also commonly compressed into briquettes of about 50 g.

MEN YOU SHOULD KNOW ABOUT

Lester E. Grant is manager of the Braden Copper Co., succeeding S. S. Sorenson, who is now at the company's New York City office.

Prof. Herbert E. Gregory, of the Connecticut Geological Survey, has returned from Hawaii and is resuming his duties at Yale University.

S. Ford Eaton, engineer in charge of Dardanelles Mining Co. operations in the Chloride, Ariz., district, is in New York City on business for the company.

Max Barber, general superintendent on the Mesabi Range for the Cleveland-Cliffs Iron Mining Co., has returned to Hibbing, Minn., after a business trip to Ishpeming, Mich.

Forest Rutherford, consulting metallurgical engineer of New York City, has returned to New York after spending several months in Colorado on mine examinations and milling problems.

E. H. Gould, recently superintendent for the Co-operative Mining Co., at Lordsburg, N. M., is now assistant general superintendent of the Advance-Rumley Mfg. Co. at Battle Creek, Mich.

C. M. Weld, D. M. Liddell, and P. H. Lazenby have formed a partnership as consulting engineers and economists under the firm name Weld, Liddell & Lazenby, at 2 Rector St., New York City.

L. L. Wilcox, superintendent of the Republic Iron and Steel Co.'s mines at Hurley, Wis., and E. W. R. Butcher, of Duluth, chief engineer of the company, recently spent a few days in Negaunee, Mich., attending to business.

F. H. Newell, who recently resigned his position as head of the department of civil engineering in the University of Illinois, Urbana, Ill., is retained as consulting engineer for a Western project. Prof. I. O. Baker is acting head of the department built up by Dr. Newell.

H. A. Guess, managing director of the mining department of the American Smelting & Refining Co., and now head of the Premier Gold Mining Co., arrived at Prince Rupert, B. C., from New York recently to visit the latter property. He was accompanied on his trip by H. MacDonald, mine foreman.

Wm. Thomlinson, of New Denver, B. C., who was in charge of Canada's mineral exhibit at the Panama-Pacific International Exposition in San Francisco several years ago, early in November was in the Similkameen mining district of British Columbia collecting minerals and other economic substances for the Canada Department of Mines, Ottawa, Ontario, which is preparing a comprehensive mineral exhibit for display at the National Exposition of Chemical Industries, to be held in New York City during 1921.

It is of interest to note that after March 4, 1921, Congress will include five senators who are closely associated with mining. They are as follows: Senator F. R. Gooding of Idaho, who was for many years a mining contractor; Senator R. H. Cameron of Arizona is also interested in mining; Senator Tasker L. Oddie of Nevada is a mining engineer and was one of the first developers of the Tonopah mines; Senator Samuel D. Nicholson of Colorado is a gold and silver mine operator, and Senator J. W. Harrel of Oklahoma is interested in oil development.



H. S. MULLIKEN

Harry S. Mulliken, of San Antonio, Texas, has been appointed a metallurgical engineer in the Bureau of Mines, and assigned as special technical assistant to Director F. G. Cottrell. The creation of this position is an innovation. Mr. Mulliken will not report to any division chief but will have an important voice in the technical mining matters which come before the Bureau.

Mr. Mulliken, who is a native of Lexington, Mass., is a graduate of the Worcester Polytechnic Institute, Worcester, Mass. He began his industrial metallurgical work with the Chicago & Aurora Smelting & Refining Co. While with that company he specialized in the refining of silver and lead. Other positions he has held are: superintendent of the lead smelter at Pilot Bay, B. C.; assistant superintendent for the American Smelting & Refining Co., Perth Amboy, N. J.; superintendent of the Aguas Calientes and Monterrey smelters of American Smelting & Refining Co. in Mexico; general superintendent and plant manager of the Penoles company at Mapimi, Durango, Mexico; and in charge of all metallurgical operations of the American Metal Co. in Mexico. For the last several years he has been consulting engineer in metallurgy for the same company with offices at 61 Broadway, New York City.

B. M. Concklin, chief engineer of the Arthur Iron Mining Co., has returned to Hibbing, Minn., after a trip of several weeks in Montana.

S. R. Capps, who has been engaged in geologic work in European Turkey, is en route to the United States. He is expected to arrive late in December.

A. S. Agnew, general manager of the Rogers Brown Ore Co. and of the Mahoning Ore Co., has returned to Duluth, Minn., from his recent business trip to Hibbing, Minn.

E. K. Soper, geologist, of New York City, has gone to Trinidad, as manager of Trinidad-Tarouba Oil Development Co. His address will be P. O. Box 283, Port of Spain, Trinidad, B. W. I.

E. W. Shaw and a party of geologists including R. H. Sargent, G. L. Harrington, Edwin Kirk and C. P. Ross are expected to reach New York City on Dec. 10, returning from a geologic survey made in eastern Bolivia.

SOCIETY MEETINGS ANNOUNCED

American Society of Mechanical Engineers holds its annual meeting Dec. 7 to 10, at Engineering Societies Building, W. 39th St., New York City, in conjunction with its Fuels Section.

Montana State Assembly of American Association of Engineers meets on Dec. 11, in Butte, Mont. The keynote of the meeting will be "Engineers for Engineering Jobs." The president, W. J. McMahon, announces that there will come up for endorsement by the assembly, a petition to the governor, and others responsible, requesting that the offices of state engineer, mine inspector, forester, and similar places be filled by engineers.

The American Association for the Advancement of Science holds its annual winter meeting this year at Chicago, Ill., during the week Dec. 27 to Jan. 1. At the same time and place meet a number of related or affiliated societies, including the American Physical Society (Dec. 28-31), Geological Society of America (Dec. 31-Jan. 2), and the American Metric Association. Prof. B. J. Livingston, Johns Hopkins University, Baltimore, Md., is permanent secretary of the A. A. A. S., and on request will furnish information concerning programs and accommodations.

OBITUARY

The body of Robert H. Remington, drowned while engaged in work for the U. S. Geological Survey, has been recovered and has been sent to Watertown, N. Y., for burial.

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

Columbia Section of A. I. M. E. Meets at Kellogg, Idaho

Northwest Engineers Visit Bunker Hill Plant—Meeting Pronounced Most Successful Ever Held

The annual meeting of the Columbia Section of the American Institute of Mining and Metallurgical Engineers was held at Kellogg, Idaho, on Nov. 19 and 20. The afternoon of the first day was devoted to an inspection of the Bunker Hill smelter and concentrating mill. In the evening a banquet was served by the Bunker Hill & Sullivan company and the business men of Kellogg, at which were seated 147 guests, a large number of business men and others connected with mining outside the technical class being present from all parts of the Coeur d'Alene district. Following the banquet Stanly A. Easton, manager of the Bunker Hill & Sullivan company, delivered a brief address of welcome on behalf of his company and the people of Kellogg. The meeting was then formally opened by James F. McCarthy, manager of Hecla Mining Co., president of the Columbia section. James M. Porter, of Spokane, dean of Northwest mining engineers, responded to the address of welcome. The following formal papers were read and discussed:

"The Federal Income Tax and Mine Valuation," by W. Earl Greenough, of Spokane; "Precipitation of Smelter Fumes in Series Treatment at the Bunker Hill Smelter," by J. P. Schuttenhelm, of the Bunker Hill staff, Kellogg; "Hydraulic Classification and Table Riffing at the Bunker Hill Concentrator," by G. Y. Garber, of the Bunker Hill staff, Kellogg; "Considerations in Relation to Flotation," by Thomas M. Owens, assistant manager of the Federal Mining & Smelting Co., Wallace; "Mechanical Shoveling in the Bunker Hill Mine," by William McDougall, superintendent; "Electrical Drying of Flotation Concentrates," by W. C. Clark, of the Bunker Hill staff, Kellogg; and "Treatment of Zinc-Lead-Silver Ores of the Coeur d'Alene District," by W. G. Woolf, of the Bunker Hill staff, Kellogg.

After the reading of these papers the following officers were elected for the ensuing year: President, Ivan De Lashmutt, of Spokane, manager of the Standard Silver-Lead Mining Co. at Silverton, B. C.; vice-president, Paul S. Couldrey, of Rossland, B. C., manager of Le Roi No. 2 mine; secretary, L. K. Armstrong, of Spokane. This closed

WEEKLY RÉSUMÉ

The Cananea Consolidated Copper Co., of Cananea, Sonora, Mexico, the operating company for the Greene Cananea Copper Co., has announced its intention to shut down its mines, mill and smelter on Dec. 15 owing to present economic conditions. In order to aid producers in Mexico the Mexican government, it is stated, is about to issue a more favorable tariff on metal exports. According to word from Melbourne, the Electrolytic Zinc Co. of Australia is issuing 1,500,000 new £1 shares. In this country zinc producers continue their policy of curtailment owing to market conditions. As far as copper is concerned the list of smaller companies that are shutting down is steadily lengthening. A number of operators in the Kentucky fluorspar district have also been forced to suspend. Iron ore shipments by water from the Lake Superior district are practically completed; estimates of the 1920 output are now somewhat below those of a month ago. From Washington it is announced that the new experiment station of the U. S. Bureau of Mines at Reno, Nev., will open Jan. 20.

the formal business of the meeting. The next day was devoted to visiting the Morning mine at Mullan, the Hecla and the Hercules mines at Burke, and the Tamarack on Nine Mile. The meeting was one of the best ever held by the Columbia Section.

Cananea Con. Copper To Suspend on Dec. 15

Mines, Mill and Smelter To Shut Down—Action Forced by Present Economic Conditions

The mines, smelter and concentrator of the Cananea Consolidated Copper Co. at Cananea, Sonora, Mexico, will close down indefinitely on Dec. 15 because of present economic conditions, according to official statements. The company will continue to operate practically all the public utilities in Cananea and to furnish light and power for this purpose. The mines will be kept unwatered and some development work may be done. This company is the operating company for the Greene Cananea Copper Co. Increased costs of supplies and labor together with the present market situation as well as the increased cost of shipping bullion are responsible for the shutdown. Cananea is about forty miles from the border.

Lake Shipments Practically Completed for Season

Recent Estimates of Year's Tonnage Lower Than Those of Month Ago—1921 Ore Prices Awaited With Interest

The movement of iron ore from the Lake Superior district for 1920 has about come to a close and very little will be sent down the Lakes during December. It is figured that the total tonnage for the year will be in the neighborhood of 56,000,000, about 2,000,000 tons less than the estimates of a month ago. Cold weather and storms on the Lakes interfered with shipments during November and schedules could not be maintained. Considerable time was lost because of ore freezing in the cars and much time was consumed in thawing operations. Most vessel owners do not care to have their boats on the Lakes in December and the insurance on most of the boats expires on Nov. 30, so it is certain that there will be little transporting of iron ore by water during the remainder of the year. About the only ore that will not be stocked when raised to surface will be that which goes from the Mesabi Range to the plant of the Minnesota Steel Co. and that from the Michigan ranges which goes to charcoal iron furnaces in northern Michigan and northern Wisconsin. Most of the pit mines have already suspended operations for the year.

There is considerable uneasiness through the Lake Superior district regarding the iron ore business, but it is not expected that there will be any new developments until the 1921 prices are announced about the first of the year. When the reports were received that some of the copper companies had reduced wages, laid off many employees and put the surface men on part time, the miners on the iron ranges commenced to talk about the iron ore outlook. The only men laid off to date are those employed in the open pit mines, but they are always released at this season of the year. Wages are higher than ever before and up to a short time ago there was a scarcity of men for underground work. Of late, however, many have returned from the manufacturing centers, particularly Detroit and vicinity, and there is little employment to be had. Some of the operators do not look for a cut in the price of iron ore, putting forth the argument that they were hard hit this fall by the increases in rail and Lake freights.

It is believed by some, however, that if the demand for iron and steel products does not hold up it is likely that the iron ore business will have to suffer, in which event wages would have to be lowered and some mines forced to curtail or to close.

Surveys Started for Railroad to Flin Flon

Manitoba Government Probably Will Ask Syndicate First To Guarantee Erection of Smelter

Surveys have been started for a railway running from the Pas to the Flin Flon property in northern Manitoba, a distance of 85 miles. It is probable, however, that before the government will decide on the actual construction of the road guarantees for the building of a smelter will be demanded from the Flin Flon syndicate. The present option on the property expires next March, and while the syndicate would, no doubt, refuse to take over the property unless they were assured of a railroad, mutual guarantees would settle this difficulty.

Such a railroad, in addition to serving the Flin Flon property, would open up a territory of large mineral possibilities. There is still a considerable tonnage of ore in the Mandy mine which could be treated by a smelter on the ground. In addition to this there are a large number of gold properties within a few miles of the Flin Flon.

Lake Ore Boats Suffer Mishap

Two Lake ore carriers were badly damaged recently. The "J. H. Sheadle" of Cleveland-Cliffs Iron Co.'s fleet, a 500-ft. freighter, was driven on the rocks by wind and current while backing away from the Presque Isle ore dock and sank in 24 ft. of water. The other boat to suffer mishap was the "D. M. Clemson," a 600-ft. boat of the Pittsburgh line, which ran aground two miles off Jackson Park, Chicago, on the night of Nov. 24. This freighter was carrying 13,000 tons of iron ore from Duluth to Gary, Ind.

To Establish Sick Benefit Fund for Cobalt Employees

Arrangements are being made to establish a sick benefit fund for employees of mining companies at Cobalt, Ont., the administration of which will be in the hands of the committee representing the Central Council of Workmen and the Timiskaming Mine Managers' Association. The men are to contribute 75c. monthly, the companies paying an amount equal to that contributed by their employees. The benefits of \$2.75 per day will be paid to claimants who are ill seven days or more over a period of thirteen weeks, and in case of more protracted illness the beneficiary will receive half the specified amount for the next thirteen weeks.

Chile Copper produced 9,420,000 lb. copper in October, against 9,496,000 in September.

Closing Month Finds Leadville Operations Dull

Abnormal Conditions Hit Camp Hard—Projects of Promise Fail To Materialize

The last month of 1920 finds the Leadville district operating on a scale lower than ever before in its history despite the outlook that seemed so bright early in the year and in the latter months of 1919. Early in January announcement was made that a million-dollar corporation, the C. & H. Mining Co., had been organized to develop the Graham Park section. It was expected that this company would prove a heavy producer but owing to the adverse conditions this has not been the case. Following the consolidation of the Leadville Zinc Co. and the Western Zinc Concentrating Co., the new corporation, the Western Zinc Oxide Co., announced the installation of furnaces of a new and improved type which would exactly double the production of the plant, but owing to the failure of eastern markets the new unit has stood idle for several months. The National Mining & Development Co., financed by Chicago men and holding control of large areas throughout the district, announced their arrival into the district and hinted at the erection of a \$25,000 molybdenum mill, a railroad into the Iowa Gulch territory and other development projects. The extent of their operations, however, has included only the driving of the main bore of the Big Chicago tunnel in Iowa Gulch by a small force of men with no shipments resulting. With the coming of more prosperous times, they maintain, their prophecy of a mill and a railroad will become a reality.

It was also expected that the Climax Molybdenum Co., forced to close by post-war conditions, would resume normal operations but the failure of conditions to right themselves has kept the property idle. Numerous other properties prepared to resume work in the spring but only a few of these are still in operation at present. The most consistent shippers of the district have been the Yak, Down Town, Garbutt, Ibez, Dinero, Hilltop, Chrysolite, Fanny Rawlins, and Cramer & Co., while the Griffin and other properties in the Sugar Loaf section have succeeded in maintaining a fair tonnage during most of the past year.

On the Ibez a strike reported to be the richest made in the district for many years was announced in February by Austrian lessees working on No. 2 shaft. The ore is said to run as high as \$10,000 per ton and shipments of the high-grade gold have continued steadily.

The Prospect Mountain project, a plan for boring into the unscratched areas of the Canterbury section, has been continually postponed owing to the inability to secure capital for financing the proposition. At present the Chamber of Commerce of Leadville is considering the matter of forming a home mining company with activities centered on this project.

Northport Smelting Co. Loses Lone Pine-Surprise Suit

Action Brought To Quiet Title to Last Chance Claim at Republic Dismissed at Spokane

The suit of the Northport Smelting & Refining Co., of Northport, Wash., against the Lone Pine-Surprise Consolidated Mining Co. has been dismissed by Judge Rudkin in the Federal Court at Spokane. It was brought to quiet title, for an injunction and for an accounting to obtain \$100,000 for ore removed. The property involved was a segment of a vein or lode, bearing gold and silver, within the surface boundaries of the Last Chance claim at Republic, Wash., occupied by the defendant.

"The Northport company, as owner of the Lone Pine claim, claimed extralateral rights in ore beneath the Last Chance claim," it was explained by Fred S. Duggan, an attorney for the defendant, in the *Spokesman-Review* recently. "It was averred that the ore was in a vein having its apex in the Lone Pine.

"The decision of the court is that the Lone Pine claim has no extralateral right in the direction of the Last Chance claim for the reason that the discovery vein of the Lone Pine crosses both of its side lines. This was one of the main points in the controversy, and the decision sustains the Last Chance's contention on that point."

Hanna Furnace Co. Organized

The Pennsylvania Iron & Coal Co., Detroit Iron & Steel Co. and the United Iron & Steel Co., have been organized into one company under the name of the Hanna Furnace Co. The new organization also has lease interests in other furnace companies. Besides the holdings of the furnace companies, the Hanna Furnace Co. has acquired a 37-per cent interest in the Hanna Ore Mining Co. and a 100-per cent interest in the Hollister Mining Co. The latter company operates several iron mines on the Menominee Range in Michigan. The Hanna Ore Co. operates many large iron ore properties in Minnesota.

Recent Production Reports

Cie due Boleo, in Baja California, produced 617,120 lb. copper in October.

Calumet & Hecla produced 7,943,502 in October, as follows: Ahmeek, 1,759,100; Allouez, 0; C. & H., 4,596,959; Centennial, 0; Isle Royale, 831,700; La Salle, 14,413; Osceola, 627,264; Superior, 38,066; and White Pine, 76,000. September production was 7,288,214.

Butte & Superior produced 7,000,000 lb. zinc in concentrates, and 193,000 oz. of silver in October compared with 7,800,000 lb. and 140,000 oz., respectively, in August of this year.

New Cornelia's copper production was 3,450,000 lb. in October and 3,314,000 lb. in September, compared with 3,878,000 lb. in October a year ago.

Calumet & Arizona produced in October 2,484,000 lb. of copper, as against 3,038,000 lb. in September and 4,244,000 a year ago.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Investigation of Drill Steel Undertaken

Bureau of Mines Co-operating With New Jersey Zinc Co. in Studying Causes of Breakage

The Bureau of Mines is taking up actively an investigation of drill steel. Many users of drill steel feel that the improvements in that product have not kept pace with the improvements in drilling machines. The matter has been the subject of recent conferences between Dr. F. G. Cottrell, the director of the Bureau of Mines, D. A. Lyon, supervisor of experiment stations, and Bureau specialists with representatives of various types of mining enterprises. The testimony of users in the districts where the rock is hard is wholly to the effect that the failure of steel has become a very serious problem, due to the loss of time on the part of high-priced labor.

B. F. Tillson, of the New Jersey Zinc Co., has made a special study of the causes of breakage in drill steel and will co-operate with the Bureau of Mines in the study of the problem. Mr. Tillson's investigations lead him to believe that the blows of the drill hammer set up vibrations comparable to sound waves and that nodes are caused by the concentration of these waves at certain points in the drill. This leads to prompt fracture. When a flaw or sand hole comes within the area of concentrated wave effect, the failure of the drill takes place almost immediately.

The Bureau's specialists, who are to be assigned to this problem, will be sent to the manufacturing plants to discuss the matter with officials there. A collection is to be made of broken steel so that the breaks may be studied.

Over Half of Railroad Tonnage Product of Mines

Fifty-six per cent of the tonnage handled on the larger railroads of the country during the quarter ended June 30 consisted of products of mines. Class 1 railroads are those having annual operating revenue in excess of \$1,000,000. They carry more than 90 per cent of all freight transported. Figures just compiled by the Interstate Commerce Commission show the following tonnages for products of mines:

	Tons
Anthracite coal.....	19,300,597
Bituminous coal.....	83,152,797
Coke.....	6,032,255
Iron ore.....	24,183,287
Other ores and concentrates.....	6,355,047
Base bullion and matte.....	144,060
Clay, gravel, sand and stone.....	25,967,455
Crude petroleum.....	1,600,870
Asphaltum.....	335,672
Salt.....	832,403
Other products mined.....	1,722,822
Total.....	169,627,265

War Mineral Awards

Awards totaling \$18,032.45 were recommended during the week ended Nov. 20 by the War Minerals Relief Commission. The details of the recommendations are as follows:

Walter M. Long, tungsten, \$1,687.93, 62 per cent; estate of H. and William Rich, pyrites, \$3,461.27, 40 per cent; A. H. Layton, chrome, \$886.58, 50 per cent; Akin & Stilwell, chrome, \$474.50, 65 per cent; J. G. Murphy, manganese, \$5,896, 39 per cent; Tungsten Development Co., tungsten, \$4,766.42, 76 per cent; Leadville District Mining & Milling Co., manganese, \$456.75, 12 per cent; T. H. Williams, tungsten, \$424, 60 per cent.

The award in the claim of the estate of H. and William Rich was recommended by Senator Shafroth only. Commissioners Moore and Pomeroy recommended the disallowance of the claim because the losses could not be traced to Government stimulation.

In addition to the above awards the payment of \$746 on the chrome claim of Noel and Johnson which had been disallowed was recommended.

At the close of business on Nov. 13, \$2,640,802.15 had been expended or recommended for award by the War Minerals Relief Commission. This leaves \$5,859,197.87 of the original appropriation unexpended. The administrative expenses of the Commission to that date totaled \$322,646.82. Claims were filed under the War Minerals Relief Act for a total of \$16,655,481.94. This was the aggregate of 1,203 claims. Action has been taken on 1,104 of these claims but awards were recommended on only 267. The amount involved in the 99 claims still under consideration is \$1,172,302.13.

During the week ended Nov. 13, awards totaling \$104,499.31 were recommended. They were as follows (the name of the claimant, the mineral, the amount recommended, and its percentage relationship to the amount claimed are shown): W. H. Shewan, tungsten, \$13,759.38, 35 per cent; F. M. Doak, manganese, \$14,023.56, 71 per cent; Crimora Manganese Corporation, manganese, \$76,616.37, 16 per cent; Charles E. Wilcox, chrome, \$100, 14 per cent.

Additional amounts were recommended in the following claims which had been acted upon previously: George and William Pedro, \$1,253.35; Lehigh Valley Manganese Co., \$2,369.22.

Reno Station to Open Jan. 20

The experiment station of the U. S. Bureau of Mines at Reno, Nev., will be opened formally on Jan. 20. The opening is to be the occasion for fitting ceremonies.

Problems of Zinc Industry Receiving Attention

Improved Methods of Treatment Sought With View to Lowering Cost of Production

A series of conferences has been held by Bureau of Mines officials in several centers of the zinc mining industry in the Middle West. The idea has been to learn more about the problems which are facing this industry. It develops that there is a widely held opinion that the most helpful thing that can be done at this time would be the development of cheaper reagents for use in flotation. Recent experiments have shown that the cost of ammonia and sodium sulphite equals the value of the recovery. In the Illinois-Wisconsin district the concentrate averages 33 per cent zinc. With a smelting cost around \$30 the chances of profitable operation are small at present prices.

Some operators in the Illinois-Wisconsin district believe magnetic separation could be utilized to greater advantage and would like to see the Bureau of Mines undertake experiments to that end. The opinion was expressed at one of the conferences that magnetic separation could be made after a dead roast, utilizing the sulphur for sulphuric acid. A middling product, running as high as 14 per cent zinc, could be expected, which might be used for oxide making. On a basis of \$6 to \$7 per ton for oxidizing the middling product this method figures \$3.75 better than the margin on 33 per cent zinc concentrate.

Experiments in the production of electrolytic zinc and in making standard brasses are also being urged. It has been suggested that under the new Water Power Act hydro-electric power could be developed which could be utilized to advantage in the making of electrolytic zinc. Sentiment was in favor of the electro-thermic process.

The electro-thermic smelting of zinc ore could not be undertaken, it was admitted, with power costing two cents per kilowatt. It is believed, however, that hydro-electric power can be produced for one-half cent per kilowatt. It is thought that this would enable the saving of at least \$3 a ton over the retort process.

In the Kansas, Missouri and Oklahoma districts means must be found, it was declared, for the recovery of ore left as pillars. As much as 20 per cent of the original ore in the mine is contained in these pillars. It is believed that other support can be provided and these pillars removed with a profit. All concerned in that district, however, are anxious that concentrated attention be given to underground haulage.

NEWS BY MINING DISTRICTS

SPECIAL LONDON LETTER

Surprising Assays Reported at Globe & Phoenix—Russo-Asiatic Shareholders in Luck—Broken Hill Strike Over

By W. A. DOMAN

London, Nov. 16.—Work having been resumed at the coal mines a slight feeling of something akin to confidence is manifest in the financial and industrial spheres. This is noticeable in the appeals made to the public for millions sterling for new working capital. Matters, however, are not proceeding so smoothly as could be wished owing to the Russian military situation and the further depreciation in the French franc. Both of these disturbances have a reflex action on mining business as shares are continually coming on offer, with results disastrous to prices. Especially is this the case with those descriptions that enjoy—"enjoy" is scarcely the correct word, perhaps, at the moment—an international market. The incipient upward movement in South African gold mining shares has received a check, though the gold produced in the Transvaal last month was estimated as sold at £5 17s. 6d. per fine oz. This compares with £5 15s. for September, and £5 12s. 6d. for August. The total output of 662,472 oz. is poor, and is the lowest since February last, when 625,380 oz. was obtained. Working expenses have risen, and it is quite clear that apart from the gold premium many mines would be compelled to shut down as profits would vanish. Profits are not declared in any standard form, and it is consequently not easy to contrast results obtained by one company with those by another. Native labor seems to be a perennial trouble. A fresh outbreak of influenza is reported, while it is suggested that the Kaffirs are less inclined than formerly to follow any underground occupation.

Whether Fortune's wheel is making a favorable turn for the Globe & Phoenix mine in Rhodesia is still not quite clear, but some rather high assays over fair stretches of ground, at depth, are reported. Few people are able to comprehend the position seeing that a mining engineer of repute a few months ago had virtually written "Finis" to the prospects of discovering further profitable ore in the mine. The 5s. shares are now quoted at 20s. 6d.

Shareholders in the old Russo-Asiatic Corporation have had a *bonne bouche*. When the company went into liquidation and the Russo-Asiatic Consolidated was formed the Inland Revenue authorities demanded £147,458 as excess profits duty. This matter has been fought in a very strenuous manner, and after months of argument the company has won its case. The distribution of assets can consequently now proceed, and for every Russo-Asiatic Corporation share previously held 5½ Russo-

Asiatic Consolidated shares will be given.

News has come to hand from Melbourne that the strike of miners on the Barrier Range has terminated, after being in existence since May, 1919. The cost to the Broken Hill mines and the miners is estimated at approximately £12,000,000. Work is being resumed, but owing to the fall in the price of the metals there can hardly be a return to the former scale of profits. Just at the moment the Colony cannot buy shares on the London market as the balance of trade is against Australia and the government has prohibited the export of gold. This, by the way, does not apply to the production of the gold mines, but to the stock of metal held by the banks.

Holders of diamond shares were rather perturbed a few weeks ago by reports that German scientists had discovered a method of fabricating diamonds. The Hamburg firm of Nobels has tested the invention and rejected it, which is the result generally expected.

AUSTRALIA

Electrolytic Zinc Co. Issues 1,500,000 Shares Carrying 8 Per Cent

Melbourne, Oct. 25.—The Electrolytic Zinc Co. of Australia, Ltd., is issuing 1,500,000 £1 cumulative participating preference shares carrying 8 per cent. Of this number 900,000 will be available to share-holders of the companies constituting the original "proprietary" company, 150,000 to the shareholders of the Mount Read & Rosebery Mines Ltd., and the Mount Lyell Mining & Ry. Co. Ltd., and 50,000 to the staffs of the various companies. The remaining 400,000 preference shares are held in reserve. The authorized capital of the new company will be £3,000,000 comprising 1,500,000 preference and 1,500,000 ordinary shares. Of the ordinary shares 1,100,000 have been issued to the following companies as payment for the investment: Amalgamated Zinc (De Bary's) Ltd., 300,000; North Broken Hill Ltd., 150,000; Broken Hill South Ltd., 150,000; Zinc Corporation Ltd., 150,000; and Mount Read & Rosebery Mines Ltd., 350,000. The shares issued to Mount Read & Rosebery Mines Ltd. are in consideration of the company's leases and assets, and they are "deferred" as to any dividend payable before July 31, 1925, but thereafter will rank with the other ordinary shares.

The present issue is being made to provide funds for the completion of the company's works at Risdon, Tasmania. The enlarged plant is estimated to produce 100 tons electrolytic zinc per day together with substantial tonnages of various by-products. It is anticipated that the first half of the plant will be ready before the end of 1921 and the whole of the plant twelve months later. The following from the

report of the general manager, H. W. Gepp, is of general interest:

"The site of the works at Risdon (near Hobart) is from every point of view ideal, and being situated on one of the finest deep sea water ports in Australia insures to the company ability to draw raw material for this and other industries from any part of Australia, or, indeed, from any part of the world. The company's wharf now in course of erection, and which will be 60 ft. wide and 1,000 ft. long, will be available for use within six months from date. There is 30 ft. of water at low tide at this wharf, and no dredging of any kind is required in the channel between the works and the Southern Ocean—thirty miles to the southward.

"Good progress is being made with the construction of the first half of the 100 tons a day plant. A large portion of the new cell room is practically completed, and work has been started on the erection of a new leaching building and other necessary divisions of buildings and plant. The unit will, it is anticipated, be in operation before the end of 1921, by which time a minimum of 15,000 horsepower will, under the contract with the Tasmanian Government, be made available. By the end of 1922 the whole of the plant is expected to be in operation, utilizing 30,000 horsepower and producing 100 tons of zinc daily with corresponding quantities of the various by-products and also considerable amounts of rolled zinc, zinc dust, etc.

"In England today the cost of labor is more than 100 per cent higher than pre-war, and the increase in the price of coal is considerably more than 100 per cent. Producing and operating costs the world over have increased enormously. As these factors must be reflected for many years to come in the selling price of zinc, it is my opinion that £30 per ton London is a conservative and safe price upon which to base estimates of profits.

"Accepting this price £30 with corresponding prices for other zinc products and by-products, and basing the price of raw material on the cost of zinc concentrates obtained from the Broken Hill companies, I estimate that the net profits of the company, after making all necessary provisions for depreciation and amortization, will be £413,000 per annum."

CANADA

Ontario

Power Situation Little Changed—Small Surplus of Labor Reported

Cobalt—The power situation in Northern Ontario still remains about the same. During the last few weeks there has only been a small amount of moisture, and although this has proved a great benefit to the power company, there has not been sufficient yet to jus-

tify the hope that the mines will be able to operate during the winter. Fortunately, however, the weather still remains mild. Kirkland Lake camp is supplied from the Cobalt power companies. Porcupine is in a little better position than Cobalt, but the condition there is also serious. This shortage of power, together with a considerable influx of labor has provided sufficient men and gives a small surplus of labor for the first time in four years.

Cobalt—Ore shipments in October from Cobalt mines over the T. & N. O. Ry. totaled 1,739 tons of 2,000 lb. Shippers were as follows: Coniagas, 96; Dominion Reduction, 77; Hudson Bay, 32; Kerr Lake, 31; La Rose, 44; Mining Corporation, 520; McKinley-Darragh, 184; Nipissing, 555; O'Brien, 32; H. F. Strong, 30; and Temiskaming, 140. These shipments went to the following plants: Deloro S. & R., 1,391; Coniagas Reduction, 161; Ontario S. & R., 30; Pueblo plant A. S. & R., 65; and Perth Amboy plant A. S. & R., 93.

Porcupine—The McIntyre Consolidated has done considerable drifting on the new vein discovered on the 1,375-ft. level. The silver content is irregular, one section of the vein 60 ft. in length showing high values, while it is lean in other places. The 1,500 level is being opened up and operations have so far confirmed the reports of diamond drill results.

It is proposed to sell 100,000 treasury shares of the Schumacher to finance the resumption of operation in the spring.

Kirkland Lake—The Lake Shore during October treated 1,570 tons of ore with a recovery of \$47,077, an average of \$29.98 per ton, the highest in the history of the mine. The mill ran 89.11 per cent of possible running time, some loss of time being due to power interruptions.

Copper Cliff—The International Nickel Co. of Canada, Ltd., is building a 60-ton experimental mill here for concentrating low-grade copper-nickel sulphide ore. It is expected to be in operation next spring. H. E. T. Haultain, professor of mining engineering at the University of Toronto, has been engaged in the capacity of consulting engineer.

British Columbia

Trail—Ore shipments from the Consolidated smelter during the week ended Nov. 21 totaled 10,664 tons coming from shippers given in the following table:

Mine	Location	Gross Tons
Bluebell.....	Riondel	179
Bunyan.....	Lake Windermere	30
Canada Copper	Allenby	107
Emerald.....	Salmo	33
Helldriver.....	Lake Windermere	36
Horn Silver...	Similkameen	39
Josie.....	Rossland	164
Knob Hill.....	Republic	54
North Star....	Kimberley	150
Providence....	Greenwood	40
Ptarmigan....	Lake Windermere	4
Rambler.....	Caribou	42
Velvet.....	Velvet	23
White Water..	Retallack	30
Company mines		9,733

MEXICO

New Tariff on Metal Exports To Aid Producers

City of Mexico—The Secretary of the Treasury announces that a new tariff on metal exports will be promulgated the coming week in order to assist the mining industry in general, but more particularly silver bearing properties. The government's decision to make haste, was brought about by the shut down of the Velardeña Mining Co., of Durango. This was preceded by the shutting down of the mines at Matehuala, some in the El Oro district and a number of less important companies. In speaking of the new tariff the secretary said:

"It is difficult to arrive at a just tax on ores at this time, and no general law can be applied. All of the mining properties are not in the same category. Some of them are working exclusively on low-grade ores, some on low and high-grade and others are confining themselves to high-grade shipping ores. My department has been making a careful study of individual cases with the idea in view of meeting the urgent demands of the miners and at the same time conserving the interests of the government. Owing to the urgency of the situation a new tariff will be presented within the next few days."

In addition to the continued depression of silver, the conditions as to copper and zinc have been slumping at an alarming rate and threaten to effect the operation of many of the important concerns, especially in the northern part of Mexico.

The market situation, taken with the coal shortage, due to the continued strikes in the northern coal fields of Mexico, has cast a gloom over mining interests. During the second week in November seventy-nine important mines were obliged to close for lack of fuel and if the strike is not settled by the end of the month it is more than probable that there will be a practical complete tie-up of the northern mines.

At the end of October taxes were being paid on 28,618 distinct properties covering a surface of about 900,000 acres. Many properties have been abandoned in the past sixty days because of refusal on the part of owners to stand for back taxes accumulated during the riotous days of the revolutionary period.

Durango

Officers of Monterrey Steel Co. Inspect Iron Mountain Property at Durango

Durango—Adolfo Prieto, president and one of the controlling stockholders of the Cia. Fundidora de Fierro y Acero de Monterrey, México, William G. Moler, representative of the same company in the United States, and Miller, their counsel, arrived in Durango recently on a special train. Upon the report of their chief engineer here, Manuel Rangell, they proceeded to make an examination of the property owned

by the Callahan Estate on the Iron Mountain (Cerro Mercado), north of the city of Durango. A deal was closed whereby the Callahan Estate, represented by its executors, J. B. Rowns, James Callahan and Gowen, transfers to the Cia. Fundidora de Fierro y Acero de Monterrey all of its holdings in the Iron Mountain, consisting of mineral rights on approximately 300 acres of ground, and about 150 acres of land adjoining the mountain suitable for the erection of buildings and improvements. The Cia. Fundidora had formerly acquired about eighteen pertenencias on the mountain, known as "Bracho & Creel" group.

Mr. Prieto, who has been in the directorship of his company since 1908, with a whip-hand in the management of the same, has outlined his program as follows: First of all they will have to study the mountain thoroughly by making a complete sampling thereof, using drills for the purpose of ascertaining the mean percentage of phosphorus in the ores; should this grade be less than 1½ per cent the Bessemer process could not be employed and they will have to find out the best kind of treatment. The grade of iron (60 per cent as a minimum) has been found satisfactory; the problem of treatment involved is due to the silica and phosphorus content. The company has a staff of engineers in Austria, Germany and France studying the treatment process fit for ores too low grade in phosphorus.

The present system of working the deposit will be greatly improved, and as soon as the treatment problem is solved they will study the most convenient place for the erection of a smelter. This Cia. Fundidora has also acquired some big iron deposits located in Hercules, near Laguma de Jaco, in the Sierra de las Cruces, about 120 kilometers north of Sierra Mojada mining camp, State of Coahuila. As soon as the National Railroads finish the Cuatro Ciénegas line to Sierra Mojada, the Cia. Fundidora will build a branch to the Hercules iron mines. Mr. Prieto will proceed to Mexico City to close the Hercules deal.

Sinaloa

Fuerte M. & S. Co. Preparing to Blow In Smelter

Culiacan—In the Fuerte district of Sinaloa the Fuerte Mining & Smelting Co. is preparing to blow in its smelter and will be making a high-grade copper matte about Jan. 1. The Fuerte company is the company operating the mines of the Choix Consolidated Mining Co. A. M. McDermott is general manager.

The Potrero Mining Co. has its new power plant installed and is progressing with its new shaft. This is in the Mocerito district.

The Palmarito Leasing Co., also in the Mocerito district, is crushing about 80 tons daily in its 20-stamp mill and in spite of the low silver price is making both ends meet.



SURFACE WORKINGS AND HEADFRAME, OLD EUREKA MINING CO.,
SUTTER CREEK, CAL.

CALIFORNIA

Harvard Mine at Sonora Sold—Carson Hill's New Stamp Unit Ready—Suit Against Mammoth Copper Transferred to Federal Court

Sonora—The old Harvard mine has been sold to John Ferguson, of Berkeley. Until a few years ago this mine was in steady operation. However, labor conditions grew so bad that the mine was forced to shut down, and after having remained idle for three years the mill was dismantled and moved to the Angels Deep mine at Angels Camp. At a meeting of the stockholders in Boston it was voted to sell the Harvard holdings for \$5,000. The vote represented 18,871 shares of the company stock and a majority of the total shares.

The transfer includes besides the Harvard mine property several adjoining claims and mine rights, among which are the Jamestown claim on Whiskey Hill, the Consolidated Gold & Silver Mining Co.'s claim, the Preston & Garrison claim, Capp's & Mussel claim, including a 10-stamp mill, the McCann quartz mine, the Vulture, Donovan & Clark quartz mine, the McKinley quartz mine, the Erin-Go-Bragh quartz, the Cloudman quartz claim, and the Sabrante quartz mine and all machinery and equipment of all the claims controlled by the Harvard company. Ferguson will not work the property. It is reported that he has closed the deal for other interests who will reopen the famous old producer.

Angels Camp—The construction of a new 10-stamp unit at the big mill of the Carson Hill Gold Mining Co. has been practically completed and the battery will go into commission in about two weeks. The addition will increase the capacity of the mill to approximately 15,000 tons per month, according to advices from the property. During October 10,500 tons of ore was treated at the mill.

In the issue of November 20 the Rainer Mining Co. is erroneously referred to as owning the property now being unwatered on Bald Hill near Angels Camp. This mine belongs to the Victor Land & Mineral Co. with

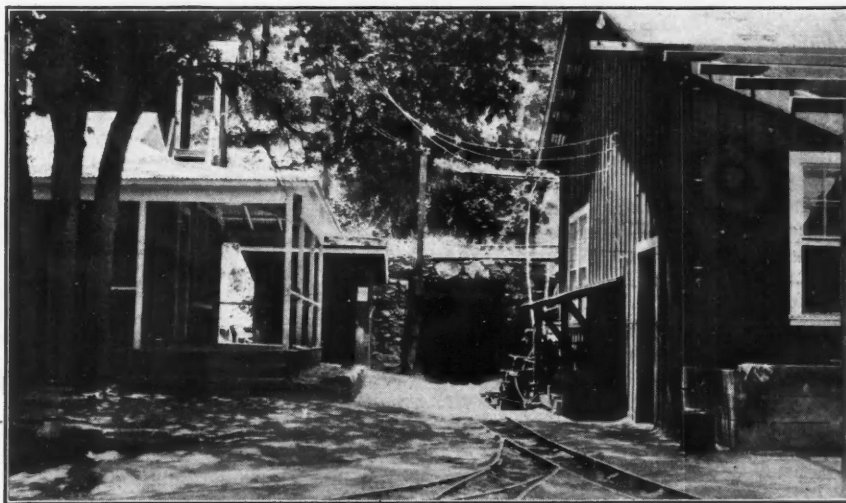
offices at 512 Commercial Bldg., St. Louis, Mo.

Placerville—The Wiedebusch gold mine, near Georgetown, has been purchased by Edward Spencer, of Vallejo, who with associates has been operating the property under lease. A 5-stamp mill was installed. The ore is of fair grade with the vein showing indications of persisting to good depth. The new owners are planning further development.

Sutter Creek—At Central Eureka mining operations are rapidly approaching normal, now that the power regulation is withdrawn, and labor conditions have improved.

Kennett—The suit filed against the Mammoth Copper Co. by the Shasta Copper Exploration Co. has been transferred to the Federal Court by order of the Superior Court of Shasta County. Both companies claim ownership of valuable copper claims in the Kennett field.

Randolph Flat—The South Star mine, which was recently re-opened by A. W. Johnson, is giving encouraging signs and the shaft is down only seventy-five feet. There are three men employed and Mr. Johnson believes that more will soon be employed.



MINE OFFICE, ADIT AND COMPRESSOR HOUSE AT MORGAN MINE, CARSON HILL GOLD MINES, INC., CARSON HILL, CAL.

NEVADA

Conditions Improving in Tonopah District—Arrowhead Company Gets New Equipment

Tonopah—Reported bullion shipments from mills of the Tonopah district, representing operations for the first half of November, indicate a gross production of the district for the month of about \$550,000 in gold and silver. The latest shipments are: Tonopah Belmont \$91,960; West End \$57,585; and Tonopah Extension \$48,500. Shipments from the Tonopah Mining and Mac-Namara have not been reported as yet.

Conditions in the district are good. Labor is not as scarce as in previous months and as a whole is more reasonable. Living conditions are good, due principally to the existence of "The Miners Mercantile Co.," a corporation organized and financed by companies of the Tonopah and Divide districts to reduce living costs, which sells practically all necessaries at cost. The method of operation, including all books of account, is open for inspection to a committee of the mine workers, and the few complaints made are seriously considered by the management.

The larger mines, including the Tonopah Belmont, West End, Tonopah Extension and Tonopah Mining, report normal and satisfactory development and ore production, with no new discoveries of importance.

In the Rescue Eula, in the southeast portion of the Tonopah district, a very promising ore shoot has been cut on the 1,100 level. This is thought to be a downward continuation of the vein as developed on the upper levels. Drifting is being done to the east and west, the west face being low while in the east face there is exposed 5 ft. of ore averaging \$50 per ton.

Divide—As the management of the Tonopah Divide had predicted, no ore values were encountered when cross-cutting the vein on the 800 and 1,000 levels. Drifting on the hanging wall, to the southeast, has been started on both these levels with the expectation of driving several hundred feet before

reaching the ore shoot as projected from the levels above. The only other development performed during the last week was on the 165 level, drift 101 being driven ahead 30 ft. and raise 107 32 ft. with no change of importance.

At the Kernick Divide, where work is being done from the 900 level (which corresponds approximately to the 1,300 level of the Tonopah Divide mine), no special changes in conditions or formation are reported. The crosscut being driven toward the Hasbrouck is out 60 ft. from the shaft and the crosscut is out 55 ft.

Arrowhead—Regular development is being accomplished in several properties in this district. New surface machinery for the main Arrowhead company has arrived in Tonopah and is being transferred to the mine by motor truck. The new equipment includes a hoist, a 40-ft. steel headframe, and a blower. In this property shaft sinking and drifting to the west are being done, and conditions are reported favorable.

Candelaria—Underground work has been suspended for the winter, excepting for sampling and mapping of the Lucky Hill workings. More than 8,000 samples have been taken in the Mt. Diablo, Argentum and Holmes mines, proving several hundred thousand tons of mill ore. Designs are being prepared for a large mill, according to C. D. Kaeding, manager.

Virginia City—The North End mines, namely, the Con. Virginia, Ophir, Mexican, Union and Sierra Nevada, will reduce wages from \$6 to \$5 on Jan. 1. The South End mines have paid only \$5 and all report an abundant supply of good labor. The Con. Virginia is producing rich ore from the recently discovered orebody below the 2,150-ft. level. A drift north from the sub-level at 2,200 ft. has advanced 140 ft., in rich ore and in a distance of 24 ft. it produced 67 tons, assaying \$553 per ton. The Mexican mill, operated by the North-end group, is treating 100 tons daily, assaying from \$15 to \$50 per ton. Storage bins contain 1,000 tons of high-grade ore, which is mixed in milling with ore from stopes on the 2,050, 1,950 and 1,650-ft. levels. At the south end of the lode the United Comstock, embracing a dozen of the old bonanzas, has advanced its haulage tunnel over 100 ft. underground, besides building 100 ft. of snow shed over the open grading. The large compressor house and shops are completed and 8 faces from old shafts are being driven to the survey line of the tunnel, in the foot wall of the lode. The tunnel will be 10,000 ft. long and 8 by 8 ft. in the clear. A spur line has been extended to the millsite, and work will begin at once on the 2,000-ton cyanide mill. This enterprise is controlled by Bulkeley Wells, representing Harry Payne Whitney and associates. Roy A. Hardy is engineer in charge.

Jarbridge—Options on three groups of claims in the district have been secured by the Tonopah Mining Co. but it is

unlikely that any new work will be started before spring.

Pioche—Ore shipments from the Pioche district for the week ended Nov. 18 were as follows: Prince Con., 1,355 tons; Virginia Louise, 660; Combined Metals, 240; Bristol Silver Mines, 150; Black Metals, 105, and Bristol Walker Lease, 45; total 2,555.

Notification of the much discussed change in freight rates on Pioche ores has been received by the larger shippers. The new schedule is based upon the smelter returns to the mine or owner before deducting transportation charges, which amount is divided by the gross weight of the ore as found at destination. The new rates are as follows:

Ore Not Exceeding in Value	Old Rate	New Rate
\$6.50	\$2.75	\$2.20
7.50	2.75	2.75
8.50	3.50	2.80

For ore exceeding \$8.50 in value the new rate is the same as the old. Three per cent war tax must be added to the total freight.

This new tariff will shortly be published, as request for short notice publication has already been made to the Interstate Commerce Commission. Immediately on completion of publication the new rates will become effective.

ARIZONA

Producers in Johnson District Forced To Close—Gila Copper Sulphide Suspends

Johnson—The Arizona United and all other producing properties of this district have been forced to close down, being unable to produce copper at the present price. The Johnson Development Copper Co. continue development work on the eighth level. Lessees on the Arizona-Texas have repaired the compressor and are drifting to cut the orebody on the third level.

Dragoon—The Cochise Marble & Granite Co. has been incorporated to take over the sixty claims owned by L. R. Ligier, on which marble of all colors can be found in large quantities. This property has been tied up by litigation for several years.

Bisbee—Shattuck-Arizona is reported to have laid off 100 men on Nov. 23. It is also said that mining operations will be suspended Jan. 1.

Phoenix—The Arizona Corporation Commission has granted the application of the Ray Electric & Telephone Co. to establish a rate of 2.75c. per kw.-hr. for industrial uses. The case came up on complaint from the Gila Copper Sulphide Co., which previously had been receiving power at 2c. from the American Smelting & Refining Co.'s Hayden smelter.

Arizona shippers are opposing an application made by the railroads to the State Corporation Commission for new demurrage charges of \$3 a day after 48 hours, \$6 a day for the next three days and \$10 a day thereafter. These

rates are more than double those now in force.

Christmas—All mining operations have been suspended here by the Gila Copper Sulphide Co., which has been furnishing about 250 tons daily of concentrating ore to the Hyden smelter for several years. With the present price of copper and slack demand, no profit could be had through operation.

Duncan—Creditors representing an indebtedness of \$35,000 have petitioned the Grant County, N. M., court for a receivership for the Duncan Mining & Milling Co., which has been working the Mount Royal property in the Steeple Rock district. Bonds to the amount of \$100,000 on the property were issued to bankers in east Texas. The representative of these parties has been operating the property recently. It is claimed that the bondholders intend to foreclose and thus block payment for supplies sold the company. This is a gold property, the ores being treated satisfactorily by the cyanide process. The mill, however, was operated but a short time.

COLORADO

Indiana-Colorado To Erect Mill at Lake City

Idaho Springs—The Denver tunnel is being cleaned out and retimbered, preparatory to resumption of development work. The tunnel has been advanced 1,800 ft., and will be continued as soon as new equipment is installed.

Cripple Creek—The Rittenhouse, International, and Lexington properties on Gold Hill, have been acquired by the Moonlight Gold Mining Co., recently organized by Hildreth Frost, C. W. Hays, and J. S. Anderson. The Rittenhouse shaft has been sunk to a depth of 700 ft. Electric hoisting equipment will be installed.

Ouray—The Loyal Mining & Milling Co. will resume operations at the Mickey Breen property. Development work is in progress under the supervision of E. G. Holden. A new power line will be built to the property either this winter or early in the spring. The company is planning the installation of a new mill. Thomas P. Mitchell is manager.

Lake City—The Indiana-Colorado Mining & Milling Co. is developing and operating the Golconda property, and has opened some high-grade ore. The company will erect a 200-ton mill, the machinery for which has been delivered on the ground.

Cripple Creek—The Modoc Con. Mining Co. is installing a new electric hoist, capable of hoisting from a depth of 2,000 ft. The new equipment will be ready for operation on Dec. 1. The cost of the hoist was \$35,000.

Leadville—Joseph T. Terry, holder of patents on a selective flotation process for treating low-grade complex ores, is preparing to install his process at the old Leadville District mill here. Satisfactory tests have been made on such ores, it is said.

MONTANA

North Butte Curtails Further—A. S. & R. To Cut Wages at East Helena

Butte—North Butte, which has been operating on a 70 per cent basis, has made a further cut in production and will hold its output within a half million pounds of copper monthly.

John Gillie, manager of Anaconda's mines, has announced that no further reduction in output is to be made for the present.

The quarterly report of Barnes-King for the period ending with September shows a net loss of \$17,795.54. The directors passed the third quarter dividend.

The American Smelting & Refining Co., which recently cut wages 50c. a day at its Tacoma, Wash., plant, will shortly reduce wages at its East Helena plant.

ALABAMA

Second Manganese Ore Shipment Due at Mobile from Brazil

Birmingham—Sixty-two hundred tons of manganese ore from Brazil was due at Mobile Nov. 29, on the S. S. Bantu, and will be loaded on barges en route to the Birmingham district via the Warrior River. The ore is being brought up by the Tennessee Coal, Iron & R.R. Co., a subsidiary of the Steel Corporation, and is the second shipment of manganese ore received from Brazil in the last three months. The other shipment was handled from Mobile half by river and the other half by rail, but the shipment just arriving is to be brought up the river on barges operated by the government.

Independent ore producers of the Birmingham district are feeling the big slump in the pig iron market, the closing down of furnaces cutting off many contracts. Even those mining companies which a few weeks ago were happy over the fact that contracts had been made for stipulated tonnages instead of selling on tonnages alone and for immediate delivery are now feeling the effects of the general depression.

Y. A. Dyer is interested in a small brown ore property at Cave Springs, Ga. The product is being hauled in auto trucks to one of the charcoal furnaces of the Birmingham district.

MINNESOTA

Mesabi Range

Six State Leased Mines Suspend Shipping—Morrow Mine Reopened

Chisholm—The Morrow mine has been reopened by the Kingston Mining Co. This property was opened by the Sellwood interests in 1902 and over 100,000 tons of ore has been shipped. A new shaft has been sunk and all ore from drifting is being stockpiled.

The M. A. Hanna Ore Co. plans to deepen the Alexandria shaft and to cut a new station 76 ft. below the present station. There will be 2,600 ft. of drifting in rock at this level which has been selected as being below the ore. This will allow the mining of all ore on

the Alexandria's forties and the south Snyder forty.

Buhl—The No. 300 electrically operated shovel at the Wabigon pit of the M. A. Hanna Ore Co., which is being operated with a drag line, removed 40,000 cu.yd. of stripping in its first month's work. It is equipped with a 5-yd. bucket and it is anticipated that under ordinary circumstances it will remove 60,000 cu.yd. per month working two ten hour shifts per day.

Nashwauk—The central repair shop of the Cleveland-Cliffs Iron Co.'s properties is practically complete. The structure is of brick with rolling steel doors and steel frame windows and has a floor space of 11,613 sq.ft., which is divided between three shops, a machine, forge and blacksmith and a carpenter shop. All heavy or special work will be done at this new plant.

Hibbing—The state mine inspector's report for the week ended Nov. 20 shows that six state leased mines have suspended ore shipping.

Small shipments comparatively are recorded as only a total of 64,359 tons was shipped. The Missabe Mountain pit, usually the largest state shipper, reported only 19,200 tons shipped during the week.

MICHIGAN

Gogebic Range

Steel Corporation Mines Stop Shipping for Season

Ironwood—The mines of the U. S. Steel Corporation on the Gogebic Range have definitely stopped shipping for the season. The total tonnage shipped during the season was about 2,036,000, an increase of about 22 per cent over the previous season, when the company's shipments totaled about 1,663,000 tons.

The Steel & Tube Co. of America are still shipping, several cargoes being loaded the week of Nov. 27. They have, however, begun to reduce their working forces. A few hundred men have been laid off at their Anvil-Palms and Newport mines. A number of shop men and timekeepers have also been laid off.

The Wakefield Iron Co. has completed its shipping program for the year at the Wico pit, having forwarded about 980,000 tons, a big increase over last year's shipments. Most of the other mines on the range have stopped shipping, and some have reduced forces.

With the close of the shipping season No. 10 shaft of the Tilden mine was temporarily shut down on Nov. 22. The old wooden shafthouse is being torn down and the steel frame taken from "A" shaft of the Aurora mine is being erected. This practically stops production.

Marquette Range

May Reopen Breitung-Hematite Property at Negaunee

Ishpeming—The Truscon Steel Co., of Youngstown, Ohio, has completed a new warehouse here for the Cleveland-Cliffs Iron Co. The building is 60 ft. by 200 ft. in size and will be used for

storing heavy mining supplies. Part of the old warehouse has been turned over to the electrical department.

Negaunee—The Marquette Ore Co. has suspended mining at the Mary Charlotte mine for a week while repairs are being made to the shaft. It is reported that the same company is shortly to reopen the Breitung-Hematite property.

Menominee Range

Cardiff Surface Plant To Be Completed This Month

Iron River—It is expected that the surface improvements at the Cardiff mine will be completed in December. These include a new steel headframe, change house, engine house, boiler house and a few smaller buildings. The shaft, which is bottomed at 560 ft., has been concreted. The timbered shaft was found inadequate because of water, but the pumps have handled very little since concreting was completed. The mine is owned by the Wickwire Mining Co., which also has the Homer, adjacent. The surface equipment at the two properties is much alike. A concrete tunnel connects the engine house, change house and the shaft, and all steam and air lines and electric wiring go through the tunnel. Power is secured from the Peninsular Power Co. The engine house contains a 1,300-ft. I.-R. and two Nordberg electric hoists.

KENTUCKY

Many Fluorspar Mines Shut Down Owing to Lessened Demand

Marion—Owing to slackened demand, many of the Kentucky fluorspar mines have suspended operations during the last month. The only large producers now running are the Franklin mine of the Fairview Fluorspar & Lead Corporation, the Mary Belle mine of the Kentucky Fluorspar Co., the Tabb mine of the West Kentucky Ore Co., the Lucile mine of the Guggenheim Mining Co., the Haffaw mine of the Aluminum Ore Co., and the Blue & Marble mine of the Keystone Fluorspar Co. There has been no tendency toward lowering of prices, operators simply shutting down to await more settled conditions.

The Aluminum Ore Co. have lately made considerable improvement at their Haffaw mine near Mexico, the latest being the addition of a large generator.

An experiment, the outcome of which has been awaited in this district with considerable interest, has just been brought to an apparently successful conclusion at the Big Four mine of Avery H. Reed. In order to handle the drainage of his mine more economically than by means of pumps, Mr. Reed has installed a four-inch air lift; the surplus air from his compressor now handles all of the water which formerly kept two 2-in. pumps busy, without in any way affecting the operation of drills, and with almost no expense. The successful result of this innovation will probably lead to the adoption of the same methods by other mines of the district.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N Y.	St. L.	St. L.
25	.....	.....	.....	.....	.....	.....
26	13.50@13.75	33.00	35.00@35.50	5.40	5.40	5.75
27	13.50	33.00	34.75@35.00	5.40	5.40	5.70
29	13.25@13.50	32.00	33.00@33.50	5.15	5.15	5.70
30	13.25	31.75	33.00@33.25	5.00	5.00	5.55
Dec. 1	13.25	32.00	33.00@33.50	5.00	5.00	5.55

*These prices correspond to the following quotations for copper, "delivered": 13.75 @ 14, 13.75, 13.50 @ 13.75, 13.50, and 13.50c.

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.

Monthly Average Prices for November:

Copper:	
New York Electrolytic.....	14.257
London Standard.....	84.807
London Electrolytic.....	94.614
Lead:	
New York.....	6.159
St. Louis.....	6.127
London.....	32.489
Silver:	
New York, foreign.....	77.734
New York, domestic.....	99.500
London.....	50.952
Sterling Exchange.....	342.333
Zinc:	
St. Louis.....	6.247
London.....	35.028
Tin:	
99 per cent.....	35.667
Straits.....	36.854
London.....	241.080
Antimony.....	6.109
Quicksilver.....	58.417

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3 M	Spot	3 M	Spot	3 M
	Spot	3 M							
25	78 1/4	79	90	229 1/4	229 1/2	28 1/4	29 1/4	32 3/4	34 1/4
26	78	78 1/4	90	221 1/4	225	28	28 3/8	32 1/4	33 1/4
27	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	77 1/4	77 3/4	87	208 3/4	212 1/2	25 1/4	25 3/4	29 1/4	31
30	75 1/4	75 3/4	84	207 1/4	212	25	26	29 3/8	31 1/4
Dec. 1	76 1/2	77 1/4	85	208 3/4	213 3/4	26 1/4	27	29 3/4	31 1/2

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

Nov.	Sterling Exchange	Silver			Nov.	Sterling Exchange	Silver		
		New York, Domestic Origin	New York, Foreign Origin	London			New York, Domestic Origin	New York, Foreign Origin	London
25	Holiday	Holiday	Holiday	47 1/4	29	348	99 1/2	71 3/4	46 3/8
26	347 1/2	99 1/2	75 1/2	48 3/8	30	347 1/2	99 1/2	68 3/8	43 3/8
27	348	99 1/2	76	49 3/8	Dec. 1	347 3/4	99 1/2	69 3/4	44 3/8

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.

Metal Markets

New York, Dec. 1, 1920

The meager selling at declining prices which has characterized trading in the last few weeks has continued, and no hope for an improvement is offered before the new year. Buying is only hand-to-mouth on the part of consumers, and speculative demand is absent.

A comparison of present prices with the average for 1913, the last full year before the war, indicates that, with costs now far higher than at that time, the prices of copper, tin, and zinc are near the bottom. The first figure given is the 1913 average and the second the current price: Electrolytic copper, lb., 15.27c., 13.25c.; Straits tin, lb., 44.25c.,

33.25c.; zinc, lb., 5.50c., 5.55c.; lead, lb., 4.37c., 5.00c.; iron, basic, ton, \$15.57, \$36.96; silver, oz., 59.79c., \$1 (domestic), 69 3/4c. (foreign). Prices can hardly be expected to go much lower for copper and tin, although the large stocks of the former will have a bad influence. Zinc production is being rapidly curtailed, so the present price is probably near the bottom. Lead has been held up by under-production, but with the present decreased demand, is rapidly falling into line with the other metals. It has not much further to go to reach the 1913 prices, but has acquired considerable momentum. Iron would seem to be due for a big drop. Artificial conditions, of course, enter into the silver market with the Pittman act in force.

Copper

Large producers report that they are not willing to sell for less than 14c. delivered, and a small amount of scattered business was done early in the week at that figure. Others have been willing to shade this price considerably, and a little business was done, U. S. Steel being among the buyers.

At present prices, curtailments, shut-downs, and wage reductions can be expected in constantly increasing numbers. As reported elsewhere, Cananea has closed down; wages have been reduced at Tacoma; and Inspiration has further curtailed production. These are only the opening guns. No resumption of activity at many of these properties can be expected until not only the demand improves, but the surplus stocks of copper metal are largely dissipated. Then the copper industry will be in excellent position for a long prosperous period.

With this week we are increasing the differential between the price f.o.b. refinery and delivered to consumer's plant, from 15 to 25 points. This is more nearly in accord with present conditions, due largely to increased freight rates.

Lead

On Tuesday, Nov. 30, the A. S. & R. reduced its official price of lead, New York and St. Louis, from 6 to 5 1/2c. The move was anticipated, as the outside market was well under the former price.

Those who follow the market closely feel that with the present statistical condition of lead, the metal is worth 5c. a pound and unlikely to go lower, unless the London price falls sufficiently to make importation profitable. Current London quotations are equivalent to 5.50@5.75. New York, so a con-

siderable fall in London would be necessary before this condition would exist. Many producers would stock lead rather than sell should prices drop further.

Mexican lead is now being sold here, as it is cheaper to pay the duty than to ship to Europe. A deduction from the New York price, equivalent to the freight and selling expense, is made by the government to arrive at the Mexican price, on which the 25 per cent duty is levied.

Zinc

The market in St. Louis is firmer today, and unless selling pressure appears from a new quarter, further price reductions may not be expected. Demand is confined to galvanizers.

No demand for forward delivery exists.

Tin

Conditions are unchanged from last week, and only small lots have been purchased.

Straits tin for future delivery: Nov. 26th, 36.50@37c.; 27th, 36@36.50c.; 29th, 34@34.50c.; 30th, 34.50@35c.; Dec. 1st, 35@35.50c.

Arrivals of tin in long tons: Nov. 24th, Straits, 400; China, 40.

Silver

The market has showed continued weakness, although there has been a slight improvement today. Yesterday's figure for foreign bullion is a new low. China is the dominant factor in the market, with India a potential support at low prices.

Mexican Dollars: Nov. 26th, 57½; 27th, 58½; 29th, 54½; 30th, 52½; Dec. 1st, 53½.

Gold

Gold in London: Nov. 25th, 117s.; 26th, 117s. 7d.; 29th, 117s. 1d.; 30th, 117s. 6d.; Dec. 1st, 117s. 5d.

Foreign Exchange

On Tuesday, Nov. 30, francs were 6.065c.; lire, 3.66c. and marks, 1.425c. New York funds in Montreal, 13½ per cent premium.

Other Metals

Aluminum—For 50-ton lots: ingot, 99 per cent and purer, 33c.; 98@99 per cent, 32c. Outside sales reported at lower prices than quoted above.

Antimony—Chinese and Japanese brands, 5¼@5½c.; market very quiet; W.C.C. brand, 8¼@8½c. per lb. Cobkerson's "C" grade, 12½@13c. Chinese needle antimony, lump, nominal at 5c. per lb. Standard powdered needle antimony (200 mesh), 10c. per lb. Market dull.

White antimony oxide, Chinese, guaranteed 99 per cent Sb₂O₃, wholesale lots, 10c.

Bismuth—\$2.40 per lb. 500-lb. lots, and \$2.42 per lb., 100-lb. lots.

Cadmium—Nominal, \$1.40 per lb. Market steady.

Cobalt—Metal, \$6 per lb.; black oxide, \$4. per lb.; sulphate, \$1.60.

Iridium—Nominal, \$350@400 per oz.

Magnesium—Crude, 99 per cent or over pure, \$1.75 per lb. for 100-lb. lots and over, f.o.b. Niagara Falls.

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

Nickel—Ingot, 43c.; shot, 43c.; electrolytic, 45c., f.o.b. Bayonne, N. J.

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

Osmium—Open market, \$70@80 per troy oz.

Palladium—\$75 per oz. Dull.

Platinum—Firm at \$75 per oz., nominal.

Quicksilver—Market quiet; \$50@60 per 75-lb. flask. San Francisco wires \$53@55. Weak.

Rhodium—\$200@225 per troy oz.

Ruthenium—\$175@200 per troy oz.

Selenium—Black powdered, amorphous, 99.5 per cent pure, \$2@2.25 per lb.

Thallium Metal—Ingot, 99 per cent pure, \$20 per lb.

Tungsten Metal—\$35@60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Guaranteed 50 per cent Cr₂O₃ foreign ore with a maximum of 6 per cent silica, 55@60c. per unit, New York. California concentrates, 50 per cent Cr₂O₃ and upward, 60@65c.

Manganese Ore—45@50c. per unit, seaport; chemical ore (MnO₂), \$65@70 per gross ton, lump; \$75@80 per net ton, powdered.

Molybdenum Ore—85 per cent MoS₂, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 45c. per lb. in ton lots.

Titanium Ores—Ilmenite, 52 per cent TiO₂, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO₂, 15c. per lb. for ore, with concessions on large lots or running contracts.

Tungsten Ore—Scheelite, 60 per cent WO₃ and over, per unit of WO₃, \$5, f.o.b. mines; wolframite, 60 per cent WO₃ and over, per unit of WO₃, \$4.25@4.50, in New York.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U₃O₈ and 5 per cent V₂O₅ sells for \$1.50 per lb. of U₃O₈ and 75c. per lb. of V₂O₅; ore containing 2 per cent U₃O₈ and 5 per cent V₂O₅ sells for \$2.25 and 75c. per lb., respectively; higher U₃O₈ and V₂O₅ content commands proportionately higher prices.

Vanadium Ore—\$1.50 per lb. of V₂O₅ (guaranteed minimum of 11 per cent V₂O₅), New York.

Zircon—Washed, iron free, 5c. per lb.

Zirkite—According to conditions, \$80@90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at \$1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 27—Zinc blende, per ton, high, \$45.35; basis 60 per cent zinc, premium, \$33.50; Prime Western settling, \$45@35, buying, \$35@32.50; fines and slimes, \$30@27.50; calamine, basis 40 per cent zinc, \$35@32.

¹Furnished by Foote Mineral Co., Philadelphia, Pa.

Average settling prices: Blende, \$43.07; calamine, \$36; all zinc ores, \$42.97.

Lead, high, \$111.75; basis 80 per cent lead, settling, \$110@55; buying, \$55; average settling price, \$84.34 per ton.

Shipments for the week: Blende, 6,918; calamine, 98; lead, 1,738 tons. Value, all ores the week, \$448,030.

Tuesday will end the contracts of a number of purchases of zinc made on \$45@40 basis, and lead \$110 basis, with perhaps nearly all deliveries on these contracts in at the end of next week.

With offerings today leaning heavily downward on zinc, the mines are closing indefinitely as fast as they can arrange business details.

Platteville, Wis., Nov. 27—No market quotations are available for lead and zinc ore. Shipments for the week: Blende, 161; lead, 45 tons. Shipments for the year: Blende, 58,973; calamine, 2,534; lead, 4,473; sulphur ore, 1,342 tons. Shipped during the week to separating plants, 2,724 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, \$2,000@3,000; No. 2, \$1,400@1,700; spinning fibres, \$400@800; magnesia and compressed sheet fibres, \$325@500; shingle stock, \$110@150; paper stock, \$60@75; cement stock, \$17.50@30; floats, \$8.50@15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as Canadian royalty export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, \$10@12 per net ton; ground (white) \$24@30 in bags, carload lots; (off-color) \$22@26 in bags, carload lots; all f.o.b. Kings Creek, S. C. Crude, 88 to 94 per cent, \$23; ground (white), \$45; ground (off color) \$30@32 per net ton, less than carload lots, f.o.b. New York. Crude, first grade, \$10 per ton, f.o.b. cars, Missouri; floated, \$28 per ton in bbls.; \$26.50 per ton in 100-lb. bags; extra charge for bags, f.o.b. St. Louis.

Chalk—English, extra light, 5@5½c.; light, 5@6c.; dense, 4½@5c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, \$8@12; washed, \$12@15; powdered, \$18@22; bags extra, per net ton, f.o.b. mines, Georgia; crude, \$8@12; ground, \$15@40, f.o.b. Virginia points. Domestic lump, \$10@20; powdered, \$25@30; imported lump, \$25@35; powdered, \$30@35, f.o.b. New York.

Feldspar—Crude, \$8@14 per gross ton, f.o.b. Maryland and North Carolina points; \$7.50@10, f.o.b. Maine; ground, \$27@30, car lots, f.o.b. Baltimore; ground, \$17@21, f.o.b. North Carolina points; \$17@21 per ton, No. 1 ground, f.o.b. New York State; \$21@23 per ton, ground, f.o.b. Maine. Crude spar very scarce.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, \$22.50 per ton, f.o.b. Illinois mines, and \$25.50, f.o.b. Kentucky; ground, suitable for acid, chem-

ical or enameling purposes, \$60; lump, \$17, f.o.b. Tonuco, N. M. In Canada 85 per cent calcium fluoride sells for \$20 per ton f.o.b. Madoc; output limited. Canadian price generally \$18 (Canadian currency) per ton, f.o.b. mines; market inactive.

Fuller's Earth—\$18 per ton carload lots, f.o.b. New York.

Graphite—The 90 per cent crucible grade is held in Alabama for 9c. per lb. and 85 per cent grade is practically unobtainable, prices being 7@9c.

Gypsum—Plaster of paris in carload lots sells for \$4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, \$3.50@\$4.50; calcined stucco, \$9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Dolomite, 1@2 man size, \$1.60@\$1.65; 2@8 in., \$1.55@\$1.65 per net ton, f.o.b. Plymouth Meeting, Pa.; fluxing, \$1.65@\$1.75 per net ton, f.o.b. Howellville, Pa.

Magnesite, Calcined—High-grade caustic calcined, lump form, \$35@\$40 per ton, carload lots, f.o.b. California points. In Chicago district, \$57.70; Atlantic seaboard, \$61@\$63.

Dead-Burned—\$38 per net ton, Chewelah, Wash.; \$58@\$64, Chester, Pa. Austrian grade, \$55@\$60 per ton, f.o.b. Baltimore. (Magnesite brick—See Refractories.)

Mica—India block mica slightly stained, per lb.: No. 6, 50c.; No. 5, \$1.20@\$1.40; No. 4, \$2@\$3; No. 3, \$4.25@\$6; No. 2, \$5.50@\$7; No. 1, \$8. Clear block: No. 6, 55c.; No. 5, \$2; No. 4, \$3.50; No. 3, \$5, No. 2, \$6.50; No. 1, \$8; A1, \$10; extra large, \$25, all f.o.b. New York; ground, \$150 per ton, Philadelphia. Domestic, uncut, f.o.b. Franklin, N. C., as follows: Scrap, \$45@\$50 per ton; punch, 10c. per lb.; circle, 15@25c.; 1½ x 2 in., 75c.; 2 x 2 in., \$1.15; 2 x 3 in., \$1.65; 3 x 3 in., \$2.10; 3 x 4 in., \$2.50; 3 x 5 in., \$2.75; 3 x 6 in., \$3.75; ground 165 mesh, \$150@\$170 per ton; ground roofing mica, \$60; mica washers, 75c. @ \$2 per lb.; 1½-in. disks, No. 1, \$1.60 per lb.; No. 2, \$1.30. The foregoing domestic prices obtain also in the Chicago district.

Monazite—Minimum of 6 per cent thorium oxide, \$30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, \$13; 75 per cent, \$11.50; 75@74 per cent, \$11; 70 per cent, \$8.35; 68 per cent, \$7.85; 68@66 per cent, \$7.60. Finely ground Tennessee rock sells for \$8.50 per net ton for 13 per cent phosphorus content, agricultural application; for acid-making, 14 per cent, \$9; both prices f.o.b. Centerville, Tenn.

Pumice Stone—Imported, lump, 4@50c. per lb.; domestic lump, 6c.; ground, 4@7c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 17c.; Spanish lump, 14@16c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Quartz—(Acid tower) fist to head, \$10; 1½ to 2 in., \$14; rice, \$17, all net ton, f.o.b. Baltimore; lump, carload lots,

\$5@\$7.50 net ton, f.o.b. North Carolina mines.

Sand (Glass)—Dry glass sand, \$4 per net ton, f.o.b. cars Mapleton, Pa. Sand, f.o.b. Ottawa, Ill., is \$3 per ton; \$2.50 on annual contracts. Sand at Klondike, Gray Summit and Pacific, all in Missouri, is \$2.50 on contract; some outside sales have been made at \$4. St. Louis, open market, at \$3.50; contract price on large quantities, \$2.50; on small quantities, \$3.

Sulphur—\$18 per ton for domestic; \$18@\$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, \$12@\$22 per ton; roofing grades, \$9.50@\$15; rubber grades, \$12@\$18, all f.o.b. Vermont. California talc, \$20@\$45, talcum powder grade. Southern talc, powdered, carload lots, \$12@\$15 per ton; less than carload, \$25, f.o.b. cars; freight to New York \$5.25 per ton, carload lots; less than carload lots, \$9.25. Imported, \$60@\$70; Canadian, \$20@\$40 per ton.

Mineral Products

Arsenic—White arsenic, 13@14c. per lb.; sulphide, powdered, 16@17c. per lb. in carload lots.

Sodium Nitrate—\$3 per cwt., ex vessel, Atlantic ports. Market quiet.

Sodium Sulphate—For 95 per cent material, \$22 per ton, f.o.b. mines, Idaho and Arizona, spot and six months' contract.

Potassium Sulphate—Domestic, \$225@\$250 per net ton, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrocobalt—For 15 to 18 per cent material, \$200@\$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocobalt—Per lb., \$12@\$15.

Ferrocrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 17@18c. per lb. of chromium contained; 4 to 6 per cent carbon, 16@17c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, \$150, freight allowed; \$145, f.o.b. seaboard bases; English, \$135@\$140, c.i.f. Atlantic seaports. Spiegel-eisen, 18@20 per cent, \$60@\$65, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, \$2.25@\$2.50 per lb. of contained metal, f.o.b. works.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, \$60@\$65; 50 per cent, \$80@\$85; 75 per cent, \$160.

Ferrotungsten—Domestic, 70 to 80 per cent W, 65@75c. per lb. of contained tungsten, f.o.b. works. Foreign, 65c.

Ferro-uranium—35 to 50 per cent U, \$7 per lb. of U contained, f.o.b. works.

Ferrovanadium—Basis 30 to 40 per cent, \$6.50@\$7.50 per lb. of V contained, according to silicon content, f.o.b. works.

Metal Products

Copper Sheets—Current New York

Furnished by Foote Mineral Co., Philadelphia, Pa.

price, 23½c. per lb.; wire, 18c. Even lower quotations are heard.

Lead Sheets—Full lead sheets, 9½c.; cut lead sheets, 9¼c. in quantity, mill lots.

Nickel Silver—Unchanged at 35½c. per lb. for 18 per cent nickel.

Yellow Metal—Dimension sheets, 22¼c.; sheathing, 22¼c.; rods, ½ to 3 in., 19¼c.

Zinc Sheets—\$11.50 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter; zinc plates, 10¼c. per lb.

Refractories

Bauxite Brick—56 per cent alumina, \$160 per 1,000, f.o.b. Pittsburgh.

Chrome Cement—40@45 per cent Cr₂O₃, \$55@\$60 per net ton, and \$65 in sacks, carload lots, f.o.b. eastern shipping points.

Fire Brick—First quality, 9-in. shapes, \$55@\$60 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, \$45@\$50.

Magnesite Brick—9-in. straights, \$110 per net ton; 9-in. arches, wedges and keys, \$120; soaps and splits, \$130.

Silica Brick—9-in., per 1,000: Chicago district, \$65@\$70; Birmingham, Ala., \$56@\$61; Mount Union, Pa., \$55@\$60.

Iron Trade Review

Pittsburgh, Nov. 30, 1920

Last Friday several large independent mills, which had previously been quoting 3c. on bars, shapes and plates, came down to the Steel Corporation prices of 2.35c. for bars, 2.45c. for shapes and 2.65c. for plates. Previously 3c. had been shaded by some mills on particularly desirable orders and by a few Western mills on all business. Yesterday a large independent maker of wire products came down to the Steel Corporation prices.

Finished-steel prices are now quotable as follows: Bars, 2.35c.; shapes, 2.45c.; plates, 2.65c.; tin plate, \$7 per base box; steel pipe, 57½ to 54 per cent basing discount; blue annealed sheets, 3.55@4.05c.; black sheets, 4.35@4.85c.; galvanized sheets, 5.70@6.20c.; plain wire, 3.25c.; wire nails, \$3.25.

Independent mill operations have continued to decline, though the Steel Corporation fully maintains its production and seems well provided with orders for several months.

Pig Iron—Foundry iron is down \$2 to \$37, Valley, bessemer and basic remaining nominally at \$37.50 and \$35, respectively, Valley, with \$1.96 freight to Pittsburgh.

Semi-finished Steel—The first sale of semi-finished steel at the Corporation price, 6,000 tons of sheet bars at \$47, Pittsburgh, has not been followed by others. Billets are nominally \$50 and sheet bars \$55.

Charcoal and Coke

Charcoal—Willow, 7c. per lb. in bbls.; hardwood, 6c. per lb., in 250-lb. bbls.

Connellsville—Furnace, \$10@\$12; foundry, \$8@\$10.

METAL STATISTICS

Monthly Average Prices of Metals

Silver						
	New York			London		
	1918	1919	1920	1918	1919	1920
January	88.702	101.125	132.827	44.356	48.438	79.846
February	85.716	101.125	131.295	42.792	48.027	85.005
March	88.082	101.125	125.551	43.620	48.171	74.194
April	95.346	101.125	119.779	47.215	48.886	68.848
May	99.505	107.135	102.585	48.980	52.104	60.010
June	99.500	110.430	90.957	48.875	53.896	51.096
July	99.625	106.394	91.971	48.813	54.133	53.736
August	100.292	111.370	96.168	49.077	58.835	59.875
September	101.125	114.540	93.75	49.500	61.668	93.6.5
October	101.125	119.192	83.481	49.500	64.049	54.97
November	101.125	127.924	77.734	48.969	70.065	50.952
December	101.125	131.976		48.492	76.432	
Year	96.772	111.122		41.516	57.059	

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		Standard		London		Electrolytic	
	1919	1920	1919	1920	1919	1920	1919	1920
January	(a)	18.918	92.238	118.095	106.619	123.238		
February	16.763	18.569	78.700	120.188	95.700	126.950		
March	14.856	18.331	76.821	109.533	82.071	118.348		
April	15.246	18.660	77.300	103.025	82.200	111.500		
May	15.864	18.484	77.767	96.750	81.227	109.200		
June	17.610	18.065	83.062	87.864	85.900	101.909		
July	21.604	18.76	99.576	90.148	103.046	106.455		
August	22.319	18.346	97.300	93.935	106.429	111.143		
September	21.755	18.444	100.767	6.381		11.05		
October	21.534	15.934	103.418	93.3.7				
November	19.758	14.257	98.894	84.807		94.614		
December	18.295		103.708					
Year	18.691		90.796					

(a) No market.

Lead

	New York		St. Louis		London	
	1919	1920	1919	1920	1919	1920
January	5.432	8.561	5.316	8.300	37.227	47.095
February	5.057	8.814	4.784	8.601	28.675	50.256
March	5.226	9.145	4.992	8.894	27.952	46.054
April	4.982	8.902	4.722	8.618	24.888	39.225
May	5.018	8.576	4.773	8.352	23.852	38.488
June	5.340	8.323	5.070	8.169	22.544	34.330
July	5.626	8.338	5.408	8.283	23.457	34.960
August	5.798	8.687	5.583	8.725	24.750	36.304
September	6.108	8.177	5.853	8.160	25.330	35.452
October	6.487	7.0	6.249	7.0.3	28.473	3.0
November	6.808	6.159	6.649	6.127	34.731	32.489
December	7.231		6.955		41.202	
Year	5.759		5.530		28.590	

Tin

	New York				London	
	1919		1920		1919	1920
	99%	Straits	99%	Straits		
January	67.702		61.596		248.557	376.512
February	66.801		58.466	59.932	223.963	395.750
March	67.934		61.037	61.926	236.843	369.489
April	72.500		61.120	62.115	225.275	345.450
May	72.500		53.230	55.100	234.398	294.813
June	71.240		46.125	48.327	238.263	250.614
July	68.000		45.798	49.154	253.272	261.886
August	57.226		43.856	47.620	273.625	274.048
September	54.482		41.940	44.4.5	280.102	270.1.0
October	54.377				279.239	
November	53.307		35.667	36.854	283.556	24.080
December	53.870				314.113	
Year	63.328				257.601	

Zinc

	New York		St. Louis		London	
	1919	1920	1919	1920	1919	1920
January	7.272	9.483	6.922	9.133	56.045	58.643
February	6.623	9.058	6.273	8.708	46.150	61.338
March	6.500	8.881	6.150	8.531	38.500	53.467
April	6.465	8.534	6.114	8.184	36.118	47.388
May	6.429	7.938	6.079	7.588	35.477	45.088
June	6.901	7.815	6.551	7.465	36.763	41.193
July	7.873	8.070	7.523	7.720	41.815	41.886
August	7.789	8.185	7.439	7.835	39.338	41.220
September	7.510	7.717	7.160	7.661	40.955	39.690
October	7.823		7.473		43.630	2.7.7
November	8.177		7.827	6.247	46.588	35.028
December	8.700		8.350		53.101	
Year	7.338		6.988		42.879	

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

Pig Iron, Pittsburgh

	Bessemer †		Basic †		No. 2 Foundry	
	1919	1920	1919	1920	1919	1920
January	\$33.60	\$40.47	\$31.40	\$39.88	\$32.40	\$39.86
February	33.60	42.95	31.40	42.61	32.40	43.40
March	32.54	43.40	31.40	42.90	29.12	43.40
April	29.35	43.72	27.15	44.22	28.15	43.90
May	29.35	44.00	27.15	44.88	28.15	45.36
June	29.35	44.89	27.15	45.41	28.15	46.40
July	29.35	47.21	27.15	47.42	28.15	46.56
August	29.35	48.90	27.15	49.88	28.15	49.35
September	29.35	50.46	27.15	50.46	28.15	51.96
October	29.35	49.21	27.15	44.38	28.30	48.58
November	31.60		31.56		32.16	
December	36.57		35.32		36.86	
Year	\$31.11		\$29.26		\$28.35	

† As reported by W. P. Snyder & Co.

Antimony, New York; July, 7.500c., August, 7.177c., September, 7.113c., October, 7.0c., November, 6.1c.

Quicksilver, New York; July, \$90.333, August, \$85.355, September, \$75.000, October, \$67.200, November, \$58.417.

Monthly Copper Production

The crude-copper content of blister copper of the principal producers, in pounds, for July-October, 1920, follows:

MONTHLY CRUDE COPPER PRODUCTION, 1920

	July	August	September (a)	October
Alaska shipments	5,797,645	5,762,551	1,635,677	4,984,219
Arizona:				
Arizona Copper	3,000,000	3,000,000	3,000,000	2,800,000
Calumet & Arizona	4,232,000	5,200,000	4,292,000	3,802,000
Cons. Ariz. Smelting	750,000	975,000	950,000	865,000
Inspiration	6,500,000	7,200,000	6,500,000	7,000,000
Magma	865,774	556,760	663,219	750,814
Miami	4,549,298	4,630,725	4,549,140	4,582,293
New Cornelia	3,522,000	3,842,000	3,314,000	3,450,000
Old Dominion	2,640,000	2,802,000	1,957,000	2,912,000
Phelps Dodge	5,955,000	5,875,000	6,381,000	5,309,000
Shattuck Arizona	166,938	194,003	166,513	206,772
Ray	4,500,000	4,505,000	4,502,000	3,990,800
United Verde	5,085,140	5,125,000	4,837,000	5,858,000
United Verde Extension	3,304,878	5,805,568	3,327,644	3,864,756
Michigan:				
Calumet & Hecla	8,312,025	7,520,107	7,278,215	7,945,502
Other Lake Superior	6,200,000	6,000,000	6,000,000	6,000,000
Montana:				
Anaconda	11,700,000	11,800,000	11,100,000	11,000,000
East Butte	1,537,880	1,566,800	1,634,260	1,500,000
Nevada:				
Nevada Cons.	4,650,000	4,650,000	4,650,000	3,850,000
New Mexico:				
Chino	4,360,932	4,000,140	5,161,894	3,933,435
Utah:				
Utah Copper	8,500,000	4,820,000	8,420,000	8,000,000
Eastern Smelters	1,600,000	1,600,000	1,600,000	1,600,000
Total reported	97,729,510	101,430,654	91,919,262	94,204,591
Others, estimated	12,000,000	15,000,000	13,000,000	10,900,000
Total United States	109,729,510	116,430,654	104,919,262	105,104,591
Imports: Ore and concentrates, etc.	3,937,824	11,040,057	10,132,777	
Imports in blister, etc.	26,553,600	20,320,824	20,428,866	
Grand total	140,220,934	147,791,535	135,480,905	
British Columbia:				
Granby Cons.	2,400,000	2,471,200	2,239,174	2,293,500
Mexico:				
Boleo	781,613	618,390	440,720	617,200
Cananea	3,500,000	3,500,000	3,500,000	3,500,000
Phelps Dodge Mexican properties	2,402,000	2,490,000	1,617,000	1,817,000
Other foreign:				
Cerro de Pasco	3,652,000	4,440,000	4,360,000	4,698,000
Chile	9,904,000	10,640,000	9,496,000	9,420,000
Katanga	5,637,822	4,615,176	None	2,697,696
Backus & Johnston	1,458,000	1,580,000	1,500,000	1,740,000

Total reported 97,729,510 101,430,654 91,919,262 94,204,591
Others, estimated 12,000,000 15,000,000 13,000,000 10,900,000

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Other foreign: Cerro de Pasco 3,652,000 4,440,000 4,360,000 4,698,000
Chile 9,904,000 10,640,000 9,496,000 9,420,000
Katanga 5,637,822 4,615,176 None 2,697,696
Backus & Johnston 1,458,000 1,580,000 1,500,000 1,740,000

Domestic copper production for 1918, 1919, and part of 1920 follows:

	1918	1919	1920
January	165,431,568	135,733,511	121,903,744
February	160,011,364	111,649,512	117,450,000
March	185,525,168	102,040,460	120,309,316
April	163,207,096	98,808,998	116,078,871
May	181,070,350	92,652,975	114,964,207
June	166,723,599	95,856,570	116,107,856
July	159,329,031	100,369,247	109,729,510
August	165,550,799	107,994,040	116,430,654
September	157,992,487	108,703,075	(a) 104,919,262
October	168,638,775	115,143,143	105,104,591
November	159,217,588	117,289,735	
December	161,801,916	102,997,633	

(a) Revised

MINING STOCKS
Week Ended November 27, 1920

Table listing mining stocks with columns for Stock, Exch., High, Low, Last, Last Div. Includes sections for COPPER, LEAD, and ZINC.

Table listing mining stocks with columns for Stock, Exch., High, Low, Last, Last Div. Includes sections for GOLD, SILVER, GOLD AND SILVER, SILVER-LEAD, and NICKEL-COPPER.

*Cents per share. †Bid or asked. ‡Quotations missing. Q Quarterly. SA, Semi-annually. BM, bimonthly. R, irregular. I, Initial. X, includes extra.

